Thomas Jacobi
VP Operating Systems and Practices

21 May 2010

Ms. Jo Strang
Associate Administrator for
Railroad Safety / Chief Safety Officer
Federal Railroad Administration
1200 New Jersey Avenue, S.E.
Washington, DC 20003

RE: Positive Train Control Implementation Plan – Version 1.1
Public Version

Dear Ms. Strang,

Enclosed please find the Public Version of Union Pacific's PTC Implementation Plan ("PTCIP"), revised per comments provided by FRA staff on Version 1 of the plan submitted on 16 April 2010. This revised PTCIP is being submitted in accordance with 49CFR236.1009(a). The PTCIP describes Union Pacific's plan for deployment and operation of a Positive Train Control system in accordance with Section 104 of Public Law 110-432 (now codified as 49 USC §20157) and 49CFR236 Subpart I.

Please note that certain requirements of the above regulations are subject of a Petition for Reconsideration and/or possible appellate review, the results of which could affect the PTCIP. For example, this PTCIP is based on Toxic- or Poison-By-Inhalation (TIH/PIH) traffic volumes for calendar year 2008 as is required under §236.1005, but this matter is subject to dispute. In submitting this PTCIP, Union Pacific reserves all rights under current and future legal proceedings related to the 2008 baseline and other matters pertaining to PTC.

The plan set forth in this PTCIP is based on overcoming a set of challenges which Union Pacific has attempted to mitigate to the highest possible degree. Risks includes technical, performance, system coverage, quality, interoperability and other matters, some of which are not fully within Union Pacific's control. We have therefore crafted a detailed program to minimize risk, with a goal of timely completion in accordance with the Congressionally-mandated deadline of 31 December 2015 for completing installation of PTC on required lines.

The volume of operational and technical data collected in support of this plan, both internally and externally, is unprecedented. Union Pacific has worked in good faith to ensure its accuracy, but recognizes that exceptions may be found. Union Pacific will continue to review plan data and, in conjunction with FRA, work promptly to correct any material errors and amend this plan if required.

Thomas Jacobi
VP Operating Systems and Practices

The primary contact during review of this PTCIP submission is:

Gregory M. Richardson
General Director – Train Control Systems
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Omaha, NE 68179

As mentioned above, this is the Public Version of Union Pacific's submission. As such, it is redacted to delete confidential information including trade secrets, commercial and/or financial information within the meaning of 5 USC §552 and/or 18 USC 1905, and/or Safety Analysis Records subject to 49 USC 20118. In addition, the Public Version does not include information which constitutes Sensitive Security Information controlled under 49 CFR 1520.

Please contact Mr. Richardson or the undersigned if you have any questions regarding this submission.

Thank you for your attention to this matter.

Respectfully Submitted,

Thomas F. Jacobi

Positive Train Control Implementation Plan (PTCIP)

Public Version

Version 1.1

05/21/2010

Submitted in fulfillment of 49 CFR Part 236, Subpart I, § 236.1011

REVISION HISTORY

Date	Version	Description	Author
04/16/2010	1	Initial Plan	UP
05/21/2010	1.1	Revision Per FRA Comments on Version 1	UP

Table of Contents

1 Introduction 1-1

1.1 OVERVIEW 1-1
1.1.1 Organizational Relationships 1-1
1.1.2 Request for Amendment of a PTCIP [§ 236.1009(a)(2)(ii)] 1-2
1.2 GOALS AND OBJECTIVES 1-3
1.2.1 Quality and Safety 1-3
1.2.2 PTC System Coverage 1-3
1.2.3 Progressive Risk-Based Deployment 1-4
1.2.4 Interoperability 1-4
1.2.5 Regulatory Compliance 1-4
1.2.6 Cab Signal System Discontinuance 1-4
1.3 SUCCESS CRITERIA 1-5
1.3.1 Long Term Goal Metrics 1-5
1.3.2 Intermediate Goal Metrics 1-6
1.4 APPLICABILITY 1-7
1.5 DOCUMENT OVERVIEW 1-7
1.6 ACRONYMS AND DEFINITIONS 1-8

2 Applicable Documents 2-1

3 Technology [§ 236.1011(a)(1)] 3-1

4 Compliance [§ 236.1011(a)(2)] 4-1

4.1 PTC DEVELOPMENT PLAN 4-1
4.2 PTC SAFETY PLAN AND *PTC SYSTEM CERTIFICATION* 4-1
4.3 PROJECT AND PLAN RISKS 4-1

5 Interoperability [§ 236.1011(a)(3)] 5-1

5.1 RAILROAD AGREEMENT PROVISIONS RELEVANT TO INTEROPERABILITY [§ 236.1011(A)(3)(I)] 5-1
5.1.1 Interoperable Train Control Agreement 5-1
5.1.2 Letter of Understanding 5-2
5.2 TECHNOLOGY APPLICABLE TO INTEROPERABILITY [§ 236.1011(A)(3)(II)] 5-2
5.2.1 Technical Interoperability 5-2
5.2.2 Semantic Interoperability 5-4
5.2.3 Organizational Interoperability 5-5
5.3 OBSTACLES TO INTEROPERABILITY [§ 236.1011(A)(3)(III)] 5-5

6 Installation Risk Analysis [§ 236.1011(a)(4)] 6-1

7 Deployment Sequence and Schedule [§ 236.1011(a)(5)] 7-2

7.1 PLAN FACTORS 7-2
7.1.1 Line Segment Risk 7-2
7.1.2 Pilot Territories 7-4
7.1.3 Labor Agreements 7-4
7.1.4 Existing Line Segment Infrastructure 7-6
7.1.5 Corridor Continuity 7-6
7.1.6 Commitments to Local Agencies 7-6
7.2 PTC INSTALLATION SEQUENCE AND SCHEDULE 7-7

8 Rolling Stock [§ 236.1011(a)(6)] 8-1

8.1 ROLLING STOCK TO BE EQUIPPED [§ 236.1011(A)(6)(I)] 8-1
8.1.1 Historic Locomotive Fleet 8-2
8.2 SCHEDULE [§ 236.1011(A)(6)(II)] 8-2
8.3 GOALS FOR INCREMENTAL PTC OPERATIONS [§ 236.1011 (A)(6)(III)] 8-2
8.4 TENANT RAILROADS [§ 236.1011(A)(6)(IV)] 8-4

9 Wayside Devices [§ 236.1011(a)(7)] 9-1

9.1 CONTROL POINT / INTERLOCKING LOCATIONS 9-2
9.2 INTERMEDIATE SIGNAL LOCATIONS 9-2
9.3 MONITORED SWITCHES 9-2
9.4 PTC WAYSIDE EQUIPMENT INSTALLATION SCHEDULE 9-2

10 Designating Track as Main Line or Non-Main Line [§ 236.1011(a)(8)] 10-1

10.1 INDUSTRIAL LEADS AND BUSINESS TRACKS 10-8

11 Exceptions to Risk-Based Prioritization [§ 236.1011(a)(9)] 11-1

12 Strategy For Full PTC System Deployment [§ 236.1011(b)] 12-1

13 Main Line Track Exclusion Addendum [§ 236.1019] 13-1

13.1 DESOTO SUBDIVISION 13-1
13.2 GREEN RIVER SUBDIVISION 13-1

Table of Figures

Figure 1: Union Pacific Route Map 1-7
Figure 2: Union Pacific BRS Work Zones 7-5
Figure 3: Map of PTC Installation Phases 7-11

Table of Tables

Table 1: Identified Risks to Completion of Implementation by 31 December 2015 4-3
Table 2: Agency Agreements and Affected Line Segments 7-6
Table 3: Schedule for PTC System Implementation 7-7
Table 4: Locomotive Models Targeted for PTC Installation 8-1
Table 5: PTC Fleet Equipping Plan By Year 8-2
Table 6: Goals for Incremental PTC Operations 8-3
Table 7: Tenant Carriers Not Submitting PTCIP 8-4
Table 8: Schedule of PTC Wayside Devices Installation (Sorted by Line Segment) 9-2
Table 9: Schedule of PTC Wayside Devices Installation (Sorted by Work Complete Date) 9-7
Table 10: Line Segments and Their Status as *PTC Main Line* 10-1
Table 11: Industrial Leads 10-9

1 Introduction

1.1 Overview

This document describes Union Pacific's plan for implementation of Positive Train Control (PTC) technology on its line segments where such installation is mandated by the provisions of the Rail Safety Improvement Act of 2008 (RSIA 08) and 49 CFR 236 Subpart I. Its content is constructed in accordance with §236.1011. This plan document includes the following:

- Reference to a PTC Development Plan, filed in accordance with §236.1009 and §236.1013, which describes the particular PTC technology that Union Pacific is developing and plans to deploy on its lines, how that technology provides the statutory and regulatory functionality, and how it provides for interoperability;
- Identification of all line segments which meet the regulatory definition of *PTC Main Line* in accordance with §236.1003, and on which Union Pacific will either install and operate PTC technology or seek exclusion from the PTC baseline;
- The operational, traffic, and route characteristics of each of those line segments;
- An analysis of the risk present on each line segment, based on the line segment characteristics; and
- The sequence and schedule on which Union Pacific will install and commission PTC on applicable line segments, developed in consideration of the risk analysis and in such a manner as to address areas of greater risk before lesser risk.

Union Pacific notes that the plan contained herein describes a project of unprecedented scope, further magnified given the requirement to complete all technology development, installation work, and commissioning of PTC operation on all required line segments on or before 31 December 2015. A project of this scope carries with it attendant technical, cost, and schedule risks of the same magnitude.

1.1.1 Organizational Relationships

To manage and provide direction for the Positive Train Control (PTC) program, Union Pacific created the position of *Vice President - Operating Systems and Practices* that reports to Union Pacific's executive leadership team. This position has the authority and overall responsibility to coordinate all departmental functions within the railroad to insure full development, implementation and operation of PTC within the required time frame. A high-level commitment from senior management has insured the desired cooperation and sense of urgency within the organization to provide any and all resources necessary to complete this important project. Affected areas/departments include Information Technologies, Telecom Services, Engineering, Transportation, Dispatching, Passenger Operations, Network Planning, Operating Practices, Safety, Mechanical, Supply, Finance, and Corporate Relations. Individuals from each affected area of the company have been identified and monthly sessions to review PTC-related goals, target dates and accomplishments are held. Additionally, the Vice President - Operating Systems and Practices gives regular updates to the Chairman's Operating Committee on the progress of the project, securing additional resources and/or direction as necessary.

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

The PTC Implementation Plan is a living document which describes Union Pacific's plan for deployment and operation of a Positive Train Control system in accordance with § 20157 of Public Law 110-432 and 49 CFR 236 Subpart I. The PTC Implementation Plan must be maintained for the life of the PTC System and accurately describe the current PTC deployment or deployment schedule for those line segments and rail lines where PTC is required. The Vice President Operating Systems & Practices is responsible for Union Pacific Railroad's PTC Implementation Plan.

The Vice President Operating Systems & Practices shall be promptly notified of anticipated changes in freight service, passenger service, traffic volumes and/or TIH/PIH routing which may affect the approved PTC Implementation Plan. Changes may include increases or decreases in service levels. The Vice President Operating Systems & Practices or his/her designated representative(s) shall determine whether or not the proposed service changes would require submittal of a Request for Amendment to the Federal Railroad Administration for approval prior to implementing the service changes.

Proposals to amend Union Pacific's PTC approved Implementation Plan shall be submitted to the Vice President Operating Systems & Practices or his/her designated representative(s) for review and approval or disapproval. Depending on the complexity and impact of the proposed amendment, the Vice President Operating Systems & Practices may formally charter a committee comprised of railroad employees who are qualified by training and/or experience to perform system safety engineering tasks to review and make recommendations on the proposal to amend the PTC IP. The Vice President Operating Systems & Practices or his/her designated representative(s) may also informally consult with FRA prior to submittal of a Request for Amendment (RFA).

A Request for Amendment (RFA) must be promptly submitted under the signature of the Vice President Operating Systems & Practices or his/her designated representative to the Federal Railroad Administration for prior approval if Union Pacific intends to modify its approved PTC Implementation Plan or a change in operating conditions would required the modification of its approved PTC Implementation Plan. Material modifications to an approved PTC IP include:

- Initiation of a new passenger or freight service which would require the installation and operation of a PTC system;
- Adding a line segment or rail line to an approved PTCIP where changes in operating conditions would require the deployment and operation of a PTC system;
- Removing or excluding a line segment or rail line from an approved PTCIP where changes in operating conditions would no longer require the deployment and operation of a PTC system;
- Decreasing the limits of an existing PTC system on a particular line segment or rail line where changes in operating conditions would no longer require the deployment and operation of a PTC system;
- A material modification to a signal or train control system as defined in §236.1021; or
- Discontinuance of an existing PTC system.

The PTC Development Plan, PTC Implementation Plan and PTC Safety Plan shall be maintained in an electronic format on a secure Union Pacific server. The Vice President Operating Systems & Practices shall designate one or more experienced railroad personal as custodians of these documents and they shall be responsible for the management of these documents which shall include, but not be limited to version control and distribution of the documents. A copy of the approved version of the PTCDP, PTCIP and PTCSP shall be available for review by Union Pacific employees on a secure Union Pacific server. Paper copies of these documents may be maintained for archival purposes.

Material modifications which affect an approved PTC Development Plan, PTC Type Approval, PTC Safety Plan or *PTC System Certification* also require submittal of an RFA under the signature of the Vice President Operating Systems & Practices or his/her designated representative.

1.2 Goals and Objectives

The primary goal for the deployment of PTC technologies on Union Pacific's network is to enhance safety, with particular focus on the prevention of train-to-train collisions, overspeed derailments, incursions into established work zone limits, and movement of trains through improperly-positioned switches. Enhancements to safety will be achieved as a PTC vital overlay system is progressively deployed across all portions of the Union Pacific network for which PTC deployment is required by 49 CFR §236.1005(b), with all required portions of the Union Pacific network to be fully equipped, operational, and interoperable with all tenant railroads by 31 December 2015. Goals and objectives relating to various aspects of PTC deployment are described in additional detail below.

1.2.1 Quality and Safety

Deployment of PTC technologies will be conducted in full compliance with all applicable Federal regulations, 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 PTCSP, as required by 49 CFR §236.1015, will be followed, and as a part of this, Union Pacific will ensure that all vendors from whom PTC technologies are to be acquired will have an acceptable quality assurance program for both design and manufacturing processes. The "systems" approach that will be employed by Union Pacific will also help ensure safe and reliable functionality and interaction between the wayside, on-board, and office components of the PTC system, with the communications component of the system providing the hardware and software elements that interface with and provide the required connectivity between the other PTC system components. This holistic view will be necessary, as it is anticipated that products from multiple vendors will be integrated into the PTC system design.

1.2.2 PTC System Coverage

Union Pacific defined its network of approximately 26,100 main track route miles as 260 line segments for the purpose of analysis for required PTC system coverage. Of these 260 line segments, 179 meet the requirements for PTC applicability per §236.1005(b), constituting

approximately 21,500 route miles. Subject to FRA's disposition of request for exclusion of certain line segments from the PTC baseline, Union Pacific plans to install and commission PTC on approximately 19,500 route miles. Of the 19,500 route miles to be equipped, approximately 6100 route miles accommodated passenger operations in 2008. Implementing PTC on line segments where passenger traffic and/or TIH/PIH traffic exceeding the *de minimis* level is present will provide added protection in these areas perceived to be of higher risk, as specifically required by Congress in §20157(a)(1) of RSIA08. The reduction in risk achieved through the implementation of PTC on tracks where passenger traffic and TIH/PIH traffic are present will provide added protection to railroad crew members, railroad equipment, and the general public by preventing accidents involving all types of traffic (i.e., other non-TIH/PIH hazardous freight and non-hazardous freight); not just passenger traffic and TIH/PIH traffic. This is aligned with Congress' goal of reducing the number and rates of accidents, incidents, injuries, and fatalities involving railroads, as identified in Section 102 of RSIA08.

1.2.3 Progressive Risk-Based Deployment

The progressive deployment of PTC technologies across Union Pacific's line segments will take place in a manner such that, to the extent practical, the PTC system will be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk. Union Pacific will also achieve progressive implementation of onboard systems and deployment of PTC-equipped locomotives such that the safety benefits of PTC are achieved through incremental growth in the percentage of equipped controlling locomotives operating on PTC lines.

1.2.4 Interoperability

The PTC system will provide for interoperability between Union Pacific and all tenant railroads, as technical, semantic, and organizational interoperability will be achieved to enhance the ability of Union Pacific and its tenants to operate together safely. Interoperability between Union Pacific and its tenants will be achieved through product testing, industry partnership, common technology, and standard implementation. Union Pacific and its tenants will work closely together throughout the PTC deployment process to ensure that all aspects of interoperability are fully addressed, and this partnership will be on-going as the railroads proceed to operate on these equipped portions of the Union Pacific network into the foreseeable future.

1.2.5 Regulatory Compliance

In order to meet the 31 December 2015 deadline mandated by Congress for installation of PTC on required lines, Union Pacific has developed this PTCIP in accordance with § 236.1011. A PTC Development Plan (PTCDP), developed in accordance with § 236.1013, was previously submitted to FRA on 24 March 2010. It is Union Pacific's goal to obtain FRA *PTC System Certification* by the third quarter, 2012 and to complete deployment of PTC on all required portions of its network before 31 December 2015.

1.2.6 Cab Signal System Discontinuance

Union Pacific intends to supplant the operation of its existing cab signal systems with PTC on its lines currently so equipped. Union Pacific's planned PTC solution, the Vital Electronic Train Management System ®, is targeted to provide levels of functionality and safety that exceeds those provided by either the 4-aspect continuously-coded Automatic Cab Signal or 2-aspect

Automatic Train Control systems currently in operation. Upon approval of its PTC Safety Plan and receipt of *PTC System Certification* in accordance with 49 CFR 236.1015, Union Pacific intends to apply for discontinuance of cab signals in accordance with 49 CFR 235 on those lines where PTC is operative. Union Pacific also intends to seek discontinuance of its intermittent Automatic Train Stop (ATS) systems.

1.3 Success Criteria

This section of the PTCIP calls out the metrics that will be applied to gauge the successful long term and intermediate implementation goals. For clarification, when referred to in this section, long term goals shall refer to Union Pacific's implementation milestones from a system point of view. Intermediate goals shall refer to Union Pacific's implementation milestones from a line segment point of view.

1.3.1 Long Term Goal Metrics

To gauge long term goals, Union Pacific shall use the following metrics for System PTC implementation and locomotive installation. A definition of long term goals for PTCSP submittal and *PTC System Certification* are also included. The remaining metrics will be on a line segment basis and are described in Section 1.3.2.

1.3.1.1 System PTC Implementation

Implementation of PTC on a line segment will be considered complete when revenue-service PTC operations commence on that line segment. Union Pacific sets forth the following yearly metrics for the number of line segments on which it shall have commissioned PTC operations, subject to FRA's disposition of request for exclusion of certain line segments from the PTC baseline:

- 2012: ~300 route-miles have been completed (1.4% of network route-miles)
- 2013: ~9650 route-miles have been completed (37% of network route-miles)
- 2014: ~14,100 route-miles have been completed (54% of network route-miles)
- 2015: ~19,500 route-miles have been completed (75% of network route-miles)

1.3.1.2 Locomotive Installation

Since Union Pacific does not assign its locomotives on a per-line segment basis, it is appropriate to consider the equipping of rolling stock with PTC as a long term goal. Union Pacific's sets forth the goals identified in Table 5 for equipping its locomotive fleet with PTC.

1.3.1.3 PTCSP Submitted

As put forth in §236.1015, Union Pacific is required to submit a PTCSP in order to obtain PTC System Certificate. This long term goal shall be considered complete once the PTCSP has been submitted to the FRA.

1.3.1.4 *PTC System Certification* Received

§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 Union Pacific receives the *PTC System Certification*, the configuration shall be considered operational.

1.3.2 Intermediate Goal Metrics

Intermediate goals shall refer to those deployment or implementation milestones that can best be used on a line segment to line segment basis. When all of the intermediate goals associated with a line segment have been completed, that line segment shall be considered cutover to PTC operations.

1.3.2.1 Wayside Infrastructure Installation Completed

Wayside infrastructure installation for a line segment shall be completed when the track infrastructure, signaling components, and communications system components have been installed and tested for proper functionality. Union Pacific's sets forth the goals identified in Table 9 for completing installation of PTC wayside infrastructure.

1.3.2.2 Track Database Validated

There are two intermediate goals on each subdivision that are related to the track data utilized by the PTC system. The track database, including GIS data, shall be considered validated for a subdivision when the following are completed:

- Track Survey Completed
- Track Database Validated & Verified

1.3.2.3 Field Testing Completed

Field testing shall be conform with §236.1015 (d) (10) and be considered complete when the following has been completed.

- Host Railroad PTC Operation successfully tested
- Interoperable PTC Functionality successfully tested

1.3.2.4 Training Completed

Training shall be considered completed once following training tasks have been accomplished, allowing commission of PTC on a line segment:

- Field and office maintenance personnel, as described in §236.1041(a)(1), for the line segment have completed training in accordance with §§236.1039 through 236.1045.
- Dispatchers, as described in §236.1041 (a)(2), for the line segment have completed training in accordance with §§236.1039 through 236.1045.
- Train or engine crews, as described in §236.1041 (a)(3), for the line segment have completed training in accordance with §§236.1039 through 236.1045.
- Roadway workers, as described in §236.1041 (a)(4), for the line segment have completed training in accordance with §§236.1039 through 236.1045.
- Direct supervisors, as described in §236.1041 (a)(5), for the line segment have completed training in accordance with §§236.1039 through 236.1045.
- Contractors and sub-contractors, engaged in the installation, maintenance, testing or repair of PTC systems on a line segment, have completed training in accordance with §§236.1039 through 236.1045.

1.4 Applicability

Union Pacific operates a railroad network encompassing approximately 26,100 route miles in 23 states, as depicted in Figure 1.

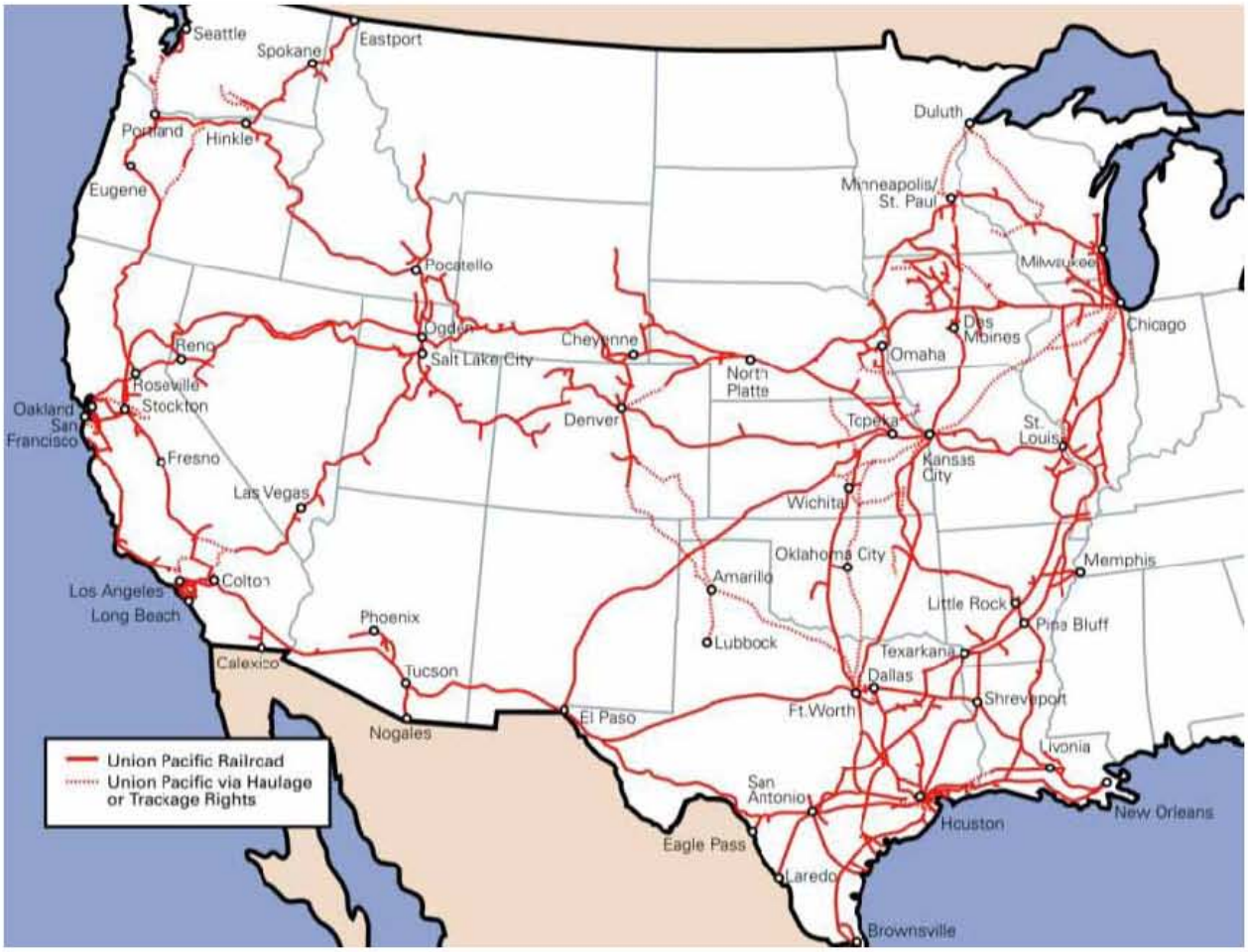

Figure 1: Union Pacific Route Map

Table 10 identifies each of Union Pacific's line segments and its status as PTC *Main Line*. Annual passenger and freight traffic densities (2008) and presence of TIH/PIH traffic (2008) are identified in Appendix B.

1.5 Document Overview

Union Pacific's Positive Train Control Implementation Plan document complies to the extent practical with the content and format specified in a template provided by FRA in August of 2009. The document is organized as follows:

- Section 1 describes the general objectives, applicability, and scope of this PTCIP.
- Section 2 lists applicable documents that are referenced in this PTCIP.
- Section 3 describes the functional requirements that the proposed PTC system must meet as required by § 236.1011(a)(1).
- Section 4 describes how Union Pacific intends to obtain *PTC System Certification* in compliance with §236.1009(d) and the risks to same as required by §236.1011(a)(2).

- Section 5 describes how Union Pacific will provide for PTC interoperability with other railroads as required by §236.1011(a)(3).
- Section 6 describes the risk analysis utilized to define 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, schedule, and decision basis for the line segments to be equipped, including risk and other factors in addition to or in lieu of risk, which were utilized, as required by §236.1011(a)(5).
- Section 8 identifies the rolling stock that will be equipped with the PTC technology, as required by §236.1011(a)(6) and defines a schedule for same. Additionally, annual goals for PTC operations through 31 December 2015 are identified in this section as required by §236.1006(b)(1).
- Section 9 identifies the type and number of PTC wayside devices required for each line segment and the schedule to complete the installations, as required by §236.1011(a)(7).
- Section 10 identifies which track segments Union Pacific designates as *main line* and non-*main line* track, as required by §236.1011(a)(8).
- Section 11 identifies and describe Union Pacific's basis for determining that the risk-based prioritization in Section 6 was not practical, as required by §236.1011(a)(9).
- Section 12 describes the strategy 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.
- Section 13 contains the Main Line Track Exclusion Addendum (MTEA) as required by §236.1019.
- Appendices A and B contain information supporting the content and understanding of this PTCIP.

1.6 Acronyms and Definitions

The following is a list of some abbreviations and acronyms that may be used in the PTCIP:

Acronym	Meaning
AAR	Association of American Railroads
ATS	Automatic Train Stop
BRS	Brotherhood of Railway Signalmen
CAD	Computer-Aided Dispatching System
CCS	Continuously-Coded Cab Signals
CFR	Code of Federal Regulation
CSXT	CSX Transportation
CTC	Centralized Traffic Control
ETMS	Electronic Train Management System®
FRA	Federal Railroad Administration
GPS	Global Positioning System
ITC	Interoperable Train Control
MGT	Million Gross Tons
MHZ	Megahertz
MTEA	Main Line Track Exclusion Addendum

Acronym	Meaning
NPI	Notice of Product Intent
NS	Norfolk Southern
PIH	Poison by Inhalation Hazard
PPA	PTC-Preventable Accident
PTC	Positive Train Control
PTCDP	Positive Train Control Development Plan
PTCIP	Positive Train Control Implementation Plan
PTCSP	Positive Train Control Safety Plan
RFA	Request For Amendment
RSAC	Railroad Safety Advisory Committee
TIH	Toxic Inhalation Hazard
UP	Union Pacific
U.S.C.	United States Code
V&V	Verification and Validation
WRE	Wabtec Railway Electronics

The following is a list of definitions of terms that may be used in the PTCIP:

Class I railroad	A railroad which in the last year for which revenues were reported exceeded the threshold established under regulations of the Surface Transportation Board (49 CFR part 1201.1-1 (2008)).
Host railroad	A railroad that has effective operating control over a segment of track.
Interoperability	The ability of a controlling locomotive to communicate with and respond to the PTC railroad's positive train control system, including uninterrupted movements over property boundaries.
Main line	Except as provided in § 236.1019 or where all trains are limited to restricted speed within a yard or terminal area or on auxiliary or industry tracks, a segment or route of railroad tracks: (1) Of a Class I railroad, as documented in current timetables filed by the Class I railroad with the FRA under § 217.7 of this title, over which 5,000,000 or more gross tons of railroad traffic is transported annually; or (2) Used for regularly scheduled intercity or commuter rail passenger service, as defined in 49 U.S.C. 24102, or both. Tourist, scenic, historic, or excursion operations as defined in part 238 of this chapter are not considered intercity or commuter passenger service for purposes of this part.
Main line track exclusion addendum	The document further described in § 236.1019.
NPI	Notice of Product Intent as further described in § 236.1013.
PTC	Positive Train Control as further described in § 236.1005.
PTCDP	PTC Development Plan as further described in § 236.1013.

PTCIP	PTC Implementation Plan as required under 49 U.S.C. § 20157 and further described in § 236.1011.
PTC railroad	Each Class I railroad and each entity providing regularly scheduled intercity or commuter rail passenger transportation required to implement and operate a PTC system.
PTCSP	PTC Safety Plan as further described in § 236.1015
PTC System Certification	Certification as required under 49 U.S.C. § 20157 and further described in §§ 236.1009 and 236.1015.
Request For Amendment	A request for an amendment of a plan or system made by a PTC railroad in accordance with § 236.1021.
Segment of track	Any part of the railroad where a train operates.
Tenant railroad	A railroad, other than a host railroad, operating on track upon which a PTC system is required.
Track segment	Segment of track

2 Applicable Documents

Note: For dated references, only the edition cited applies. For undated references, the latest edition of the reference document applies, including amendments.

1. Federal Railroad Administration, US Department of Transportation. 49 CFR Parts 229, 234, 235 et al. *Positive Train Control Systems; Final Rule*. Docket No. FRA-2008-0132, Notice No. 3. January 15, 2010.
2. Union Pacific/Norfolk Southern/CSX Transportation/Wabtec Railway Electronics, *Vital Electronic Train Management System Positive Train Control Development Plan*, DOT Docket FRA-2010-0061.
3. Federal Railroad Administration, US Department of Transportation. *Risk Prioritization Methodology for PTC System Implementation*, January 7, 2010.

3 Technology [§ 236.1011(a)(1)]

As required by 49 CFR §236.1011(a)(1) the PTCIP will describe the functional requirements that the proposed PTC system must meet. A complete description of the V-ETMS® functionality is provided in the *Vital Electronic Train Management System (V-ETMS®) Positive Train Control Development Plan* [2]. The PTCDP describes how V-ETMS® satisfies the mandated requirements for PTC systems as outlined in §236.1005. On 24 March 2010, the PTC Development Plan ("PTCDP") prepared by Wabtec Railway Electronics ("WRE"), Union Pacific Railroad ("UPRR"), Norfolk Southern Railway ("NS"), and CSX Transportation ("CSXT") was submitted to the FRA for review and approval. The PTCDP was jointly submitted for FRA Type Approval as set forth under 49 CFR Part 236, Subpart I §236.1009(b) and included documentation as required by §236.1013.

The *Vital Electronic Train Management System (V-ETMS®) Positive Train Control Development Plan* [2] 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. 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 implementable 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 track ownership.

An overview of the V-ETMS system, its primary functions, the architecture of the PTC system(s) 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:

PTCDP Section 3, V-ETMS Description, 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 49 CFR 236 Subpart I §236.1013(a)(1). Please reference the following subsections within Section 3:

- 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

PTCDP Section 4, PTC Architecture, which describes how V-ETMS architecture satisfies safety requirements as required by 49 CFR 236 Subpart I §236.1013(a)(4). Please reference the

following subsections within Section 4 of the *Vital Electronic Train Management System (V-ETMS®) Positive Train Control Development Plan* [2]:

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

The Concept of Operations, contained in Appendix A of the PTCDP, is provided as required by §236.1013(a)(3). This portion 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 *Vital Electronic Train Management System (V-ETMS®) Positive Train Control Development Plan* [2], Appendix A, 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 crossings

5.4 Train Movement
5.4.1 Movement Authority Provided by Mandatory Directive
5.4.2 Wayside Signals
5.4.3 Cab Signals
5.4.4 Reverse Movement
5.4.5 Switching Mode
5.4.6 Entry to V-ETMS Territory
5.4.7 Exit from V-ETMS Territory
5.4.8 Yard Limits
5.11 Warning and Enforcement
5.11.2 Predictive Warning and Enforcement

5.11.3 Restrictive Speed Enforcement

Related to train to train collisions as a requirement of the Subpart, is the provision for railroads to address rail-to-rail crossings-at-grade. In all cases where PTC equipped lines are involved, an interlocking signal arrangement developed in accordance with subparts A through G of part 236 will be in place. V-ETMS is designed to prevent train to train collisions where interlocking signals are in place as described in the V-ETMS PTCDP Sections 5.4.2 Wayside Signals and 5.4.3 Cab Signals. The method to be used by Union Pacific for protecting non-PTC routes at rail-to-rail crossing-at-grade will be dependent on the speed and the specific field conditions of each location, availability of alternate technologies to provide positive stop enforcement, and the presence of PTC equipped locomotives operating on the non-PTC routes.

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

5.4.8 Yard Limits
5.5 Speed Limits and Restrictions
5.5.1 Permanent Speed Restrictions
5.5.2 Temporary Speed Restrictions
5.5.3 Track Authority Speed Restrictions
5.5.4 Consist or Lading Speed Restriction
5.11 Warning and Enforcement
5.11.1 Reactive (Overspeed) Warning and Enforcement
5.11.2 Predictive Warning and Enforcement
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 49 CFR part 214

5.6 Work Zones
5.11 Warning and Enforcement
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 §235.1005(e).

5.10 Route Integrity Protection
5.10.1 Monitored Hand-Operated Switches
5.10.2 Switches in Signaled Territory
5.11 Warning and Enforcement
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;

5.4 Train Movement

5.4.2 Wayside Signals
5.4.3 Cab Signals
5.10.2 Switches in Signaled Territory
5.10.3 Other Monitored Devices
5.11 Warning and Enforcement
5.11.1 Reactive (Overspeed) Warning and Enforcement
5.11.2 Predictive Warning and Enforcement
5.11.3 Restrictive Speed 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; {Applies to high speed passenger lines}

5.4.2 Wayside Signals
5.10.3 Other Monitored Devices
5.11 Warning and Enforcement
5.11.2 Predictive Warning and Enforcement

(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;

5.7 Malfunctioning Highway Grade Crossing Warning Systems
5.11 Warning and Enforcement
5.11.2 Predictive Warning and Enforcement

(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;

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

5.4.2 Wayside Signals
5.10.3 Other Monitored Devices
5.11 Warning and Enforcement
5.11.2 Predictive Warning and Enforcement

(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

5.4.2 Wayside Signals
5.10.3 Other Monitored Devices
5.11 Warning and Enforcement
5.11.2 Predictive Warning and Enforcement

(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.

5.5.1 Permanent Speed Restrictions
5.11 Warning and Enforcement
5.11.1 Reactive (Overspeed) Warning and Enforcement

4 Compliance [§ 236.1011(a)(2)]

Union Pacific's plan for compliance with the procedural requirements of §236.1009(d) is described below.

4.1 PTC Development Plan

Union Pacific, in conjunction with Norfolk Southern, CSX Transportation, and Wabtec Railway Electronics, developed and submitted a PTC Development Plan in the form of the *Vital Electronic Train Management System (V-ETMS®) Positive Train Control Development Plan* [2]. This submittal constitutes Union Pacific's application for Type Approval of a PTC system in accordance with §236.1013. The technology and concept of operations included in that plan, without variance, accurately represent Union Pacific's plan for deployment and operation of interoperable PTC technology. Union Pacific intends to work with its PTC system suppliers to ensure that system design remains compliant with Appendix C to 49 CFR 236. Upon receipt of Type Approval, efforts will progress to support application for *PTC System Certification* in the form of the PTC Safety Plan.

4.2 PTC Safety Plan and *PTC System Certification*

Union Pacific plans to construct an application for *PTC System Certification* in the form of a PTC Safety Plan (PTCSP). The PTCSP will include the following items:

- Artifacts to support evidence of compliance with Appendix C of 49 CFR 236;
- Test results verifying PTC system statutory and regulatory compliance;
- Test results verifying interoperability;
- All other artifacts and materials required by §236.1015.

Tests in support of collection of results supporting Union Pacific's initial PTC Safety Plan submittal will be conducted on those line segments designated in the pilot phase of the overall program (see Section 7.1.2). Union Pacific plans to collaborate on the compilation of test results demonstrating interoperability with other railroads referencing the granted Type Approval and with which interoperability is required. Union Pacific's goal is to submit its PTCSP in the 4th quarter of 2011 and receive *PTC System Certification* no later than the 3rd quarter of 2012. Subsequent to receipt of *PTC System Certification*, tests will be conducted along each line segment on which PTC is to be commissioned, albeit of scope different than those conducted in support of PTCSP submittal. The planned scope of PTC commissioning tests will be described in Union Pacific's PTCSP.

4.3 Project and Plan Risks

Union Pacific has implemented a risk management process to identify, mitigate, and monitor 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 Union Pacific's PTC deployment;
- predicts the consequences associated with risks;
- implements risk mitigation strategies;
- monitors risk status; and

- establishes contingency plans.

Table 1 lists identified risks to Union Pacific's completion and delivery of PTC installation on or prior to 31 December 2015, its associated goal/objective category, the predicted consequences of the risk should it occur, Union Pacific's mitigation/containment strategy, and contingency plans.

Table 1: Identified Risks to Completion of Implementation by 31 December 2015

Risk ID	Objective/Goal Category	Risk Description	Predicted Consequences	Risk Mitigation	Contingency Plan
1	*Performance:* Enhance system safety, with particular focus on the prevention of train-to-train collisions, over-speed derailments, incursions into established work zone limits, and movement of trains through improperly-positioned switches.	PTC system does not enhance system safety: • Does not prevent train to train collisions • Does not prevent overspeed derailments • Does not prevent incursions into established work zone limits • Does not prevent movement of trains through improperly positioned switches • Creates additional safety hazards that reduce system safety • An acceptable level of safety is not maintained in the development, functionality, architecture, installation, implementation, inspection, testing, operation, maintenance, repair, and modification of the PTC technologies to be deployed.	• PTC system cannot be deployed without modification of system behavior. • PTC system cannot be deployed without re-assessment of achieved safety levels. • Deployed PTC system cannot obtain FRA Certification • Schedule delay	• Follow system development methodology that captures PTC system requirements and provides traceability of those requirements throughout the system life cycle. • Rigorous safety program at all levels of system development. Methodologies and activities as required by 49 CFR §236.1015 will be followed in the PTCSP.	Existing method of operation will be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted.

Table 1: Identified Risks to Completion of Implementation by 31 December 2015

Risk ID	Objective/Goal Category	Risk Description	Predicted Consequences	Risk Mitigation	Contingency Plan
2	*Coverage:* Enhancements to system safety will be achieved as a PTC vital overlay system is progressively deployed across all portions of the Union Pacific network for which PTC deployment is required by 49 CFR §236.1005(b)	PTC system progressive installation is delayed because of • PTC equipment availability • Availability of trained installers • Ineffective coordination of installation plans result in interference between installation crews where infrastructure is complex and/or working space is limited. • Installation procedures become protracted • Acts of nature	• PTC system will not be installed across all portions of the Union Pacific network for which PTC deployment is required by 49 CFR §236.1005(b) • Full benefit of safety enhancements will not be realized by required date • Union Pacific may incur Civil Penalties.	• Develop detailed plans for equipping rolling stock, wayside, and office with required PTC equipment. • Develop detailed training and personnel plans. • Work closely with vendors and other railroads in close geographic proximity to minimize risk associated with installation procedures and schedule. • Establish schedule performance metrics to measure PTC deployment progress. Monitor metrics to identify any potential schedule delays. Take action to avert potential schedule delays.	Existing method of operation will be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted.

Table 1: Identified Risks to Completion of Implementation by 31 December 2015					
Risk ID	**Objective/Goal Category**	**Risk Description**	**Predicted Consequences**	**Risk Mitigation**	**Contingency Plan**
3	*Coverage:* All required portions of the network to be fully equipped, operational, and interoperable with all tenant railroads by December 31, 2015.	All required portions of the network are not fully equipped, operational, and interoperable with all tenant roads by December 31, 2015. • Unable to maintain equipage schedule • Delay in initiating PTC operations • Difficulty and/or delay in establishing required interoperability agreements with tenant railroads. • Difficulty and/or delay in achieving required levels of technical interoperability	• PTC system will not be installed across all portions of the Union Pacific network for which PTC deployment is required by 49 CFR §236.1005(b) • Full benefit of safety enhancements will not be realized by required date • Union Pacific may incur Civil Penalties	• See Risk Mitigation Strategy for risk #2 above. • Establish clear understanding of technical requirements and schedule for interoperability with each tenant road. • Establish performance metrics to measure tenant progress toward equipping rolling stock with interoperable PTC equipment.	Existing method of operation will be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted.

Table 1: Identified Risks to Completion of Implementation by 31 December 2015					
Risk ID	**Objective/Goal Category**	**Risk Description**	**Predicted Consequences**	**Risk Mitigation**	**Contingency Plan**
4	*Performance & Quality:* PTC deployment will meet the *PTC System Certification* performance requirements in CFR §236.1015.	• The methodologies and activities as required by 49 CFR §236.1015 are not applied consistently for the PTCSP. • Gaps in the V&V process are uncovered that impact the validity of testing results; or, at worst, the design of the system.	• PTC may not function as required to meet performance requirements. • PTC system may not enhance safety levels. • PTC system cannot be deployed without modification of system behavior. • PTC system cannot be deployed without re-assessment of achieved safety levels. • Deployed PTC system cannot obtain FRA Certification • Schedule delay	• The methodologies and activities as required by 49 CFR §236.1015 will be followed for the PTCSP. • Union Pacific will ensure that all vendors from whom PTC technologies are to be acquired will have an acceptable quality assurance program for both design and manufacturing processes. • Testing and documentation process audits are conducted periodically with vendors	Existing method of operation will be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted.

Table 1: Identified Risks to Completion of Implementation by 31 December 2015					
Risk ID	**Objective/Goal Category**	**Risk Description**	**Predicted Consequences**	**Risk Mitigation**	**Contingency Plan**
5	*Technical:* Interoperability between Union Pacific and its tenants will be achieved.	Interoperability between Union Pacific and its tenants is not achieved. • Unsuccessful in deploying interoperable radio and messaging technology • Semantic incompatibility between railroads.	• PTC system will not be installed across all portions of the Union Pacific network for which PTC deployment is required by 49 CFR §236.1005(b) • Full benefit of safety enhancements will not be realized by required date • Union Pacific may incur Civil Penalties	• Establish organizational structure to facilitate communication and coordination between host and tenant roads • Union Pacific participates in industry organizations to establish PTS system standards to achieve interoperability by working collaboratively on requirements definition, system/component design, and product testing to deploy interoperable, common technology. • Testing will ensure that implementations conform to industry standards. • Interoperability testing will be conducted.	Existing method of operation will be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted.

Table 1: Identified Risks to Completion of Implementation by 31 December 2015

Risk ID	Objective/Goal Category	Risk Description	Predicted Consequences	Risk Mitigation	Contingency Plan
6	*Performance, Coverage Quality,& Technical:* Union Pacific will maintain acceptable levels of operation on subdivisions operating under PTC.	Union Pacific incurs unacceptable train delays resulting from PTC operation • PTC implementation and/or system design introduces inefficiencies o wireless communication-related delays o Inefficient train operation resulting from braking algorithm • Reduction in efficiency resulting from running unequipped trains through PTC equipped territory because (a) Locomotives operating with PTC equipment installed but with equipment outages (b) trains not PTC-equipped. • Reduction in efficiency of personnel o Ineffective human factors design for PTC equipment o Ineffective and/or insufficient training of personnel	• Railroad incurs unacceptable train delays as a result of PTC • PTC deployment is delayed until productivity issues are resolved	• Reliability program initiated to monitor, report, and improve reliability of equipment. • Identify and reach agreement with additional potential tenants for equipping with PTC equipment. • Monitor effectiveness of training – quality improvement program in place. • System development effort focusing on high technical risk areas to identify and mitigate potential system design and implementation-related contributions to decreased productivity.	Existing method of operation will be maintained during/after PTC installation until acceptable levels of operation have been achieved.

* This list of risks is intended to capture the risks at a high level, and is not intended to be an all-inclusive list.. Union Pacific maintains a risk management process through which additional risks may be identified and existing risks may be closed as PTC installation progresses. Assigned risk numbers are relative and do not reflect risk probability or the severity of the risk consequences.

5 Interoperability [§ 236.1011(a)(3)]

This section describes how Union Pacific's PTC implementation will provide for interoperability between itself and all tenant railroads operating on line segments required to be equipped with a PTC system per Part 236 Subpart I.

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

5.1.1 Interoperable Train Control Agreement

An Interoperable Train Control (ITC) collaboration agreement was executed by and amongst several railroads wishing 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.

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

- Norfolk Southern Railway Company
- CSX Transportation, Inc.
- BNSF Railway Company

5.1.2 Letter of Understanding

Union Pacific has additionally exchanged a *Letter of Understanding* with each of its passenger and freight tenant carriers who are required to install and operate PTC on its track, but who have not to date become party to the ITC collaboration agreement. The letter establishes agreement between Union Pacific and its 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.

Union Pacific has executed the *Letter of Understanding* and is coordinating implementation of an interoperable PTC system in accordance with the interoperability requirements stated in the ITC collaboration agreement with the following tenant railroads:

- Canadian Pacific Railway Company
- Canadian National Railway Company
- Kansas City Southern Railway Company
- Terminal Railroad Association of St. Louis
- Kansas City Terminal Railway
- National Railroad Passenger Corporation (Amtrak)
- Southern California Regional Railroad Authority (Metrolink)
- Altamont Commuter Express
- Utah Transit Authority
- Commuter Rail Division of the Regional Transportation Authority, a division of the Northern Illinois Regional Commuter Railroad Corporation (Metra)
- Peninsula Corridor Joint Powers Board (Caltrain)
- Capitol Corridor Joint Powers Board
- Dallas Area Rapid Transit

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

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

5.2.1 Technical Interoperability

Technical interoperability is achieved through the common use of documented 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.

Union Pacific achieves interoperable PTC operations on with its tenant and host railroads which operate PTC systems in one of three technical methods described below.

5.2.1.1 Native Interoperability

Union Pacific and its interoperability partner both install and operate the Vital Electronic Train Management® (V-ETMS) or interoperable Electronic Train Management System (ETMS®) on their respective locomotives, office, and wayside. V-ETMS and interoperable ETMS provide for full functionality for any equipped locomotive, regardless or ownership, with any office or wayside correspondingly equipped. Interoperability is achieved through native operation of V-ETMS/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 the common application behavior of the V-ETMS/ETMS product specification. V-ETMS/ETMS encompass the methods of operation and rules of both Union Pacific and its interoperability partners and accommodates any differences in the data provided by back office systems. V-ETMS/ETMS and its operations are fully described in the *Vital Electronic Management System Positive Train Control Development Plan* (PTCDP) [2], submitted to FRA on 24 March 2010. Railroads with which Union Pacific will conduct interoperable PTC operations in this manner are as follows:

- Norfolk Southern Railway Company
- CSX Transportation, Inc.
- BNSF Railway Company
- Canadian Pacific Railway Company
- Canadian National Railway Company
- Kansas City Southern Railway Company
- Terminal Railroad Association of St. Louis
- Kansas City Terminal Railway
- National Railroad Passenger Corporation (Amtrak)
- Southern California Regional Railroad Authority (Metrolink)
- Altamont Commuter Express
- Utah Transit Authority
- Commuter Rail Division of the Regional Transportation Authority, a division of the Northern Illinois Regional Commuter Railroad Corporation (Metra)
- Capitol Corridor Joint Powers Board
- Dallas Area Rapid Transit

5.2.1.2 Functional Interoperability

Union Pacific's interoperability partner has stated that it intends to specify and contract for the development of a PTC system which will be functionally interoperable with Union Pacific's V-ETMS. In this interoperability approach, the onboard PTC apparatus installed on the respective locomotives of Union Pacific and its interoperability partner will each be responsive to the PTC apparatus installed in the office and on the wayside of each property. Union Pacific notes the following risks with this approach:

- The scope of effort required to establish interoperability between disparate systems operated by Union Pacific and its interoperability partner will exceed that required to establish interoperability amongst the balance of the industry. Once interoperability is initially established between the two disparate systems, it must then be maintained for the life of each system, even as each evolves independently. Furthermore, such an effort is unprecedented for vital safety systems as complex as PTC.
- The difference in development timelines will present a challenge as the respective project timelines for requirements definition, development, and testing for each system will not be synchronized. Furthermore, Union Pacific may not unilaterally make requirement or design changes to its interoperable system; as those decisions will impact interoperability amongst the balance of the industry.
- The scope of the safety analysis for Union Pacific and its interoperability partner is effectively tripled as each permutation of onboard and office/wayside apparatus interaction must be analyzed.
- A fallback strategy should interoperability between the two systems fail to be achieved whereby the locomotives of Union Pacific and its interoperability partner are dually-equipped with the respective onboard apparatus of each system is not practical. The size of Union Pacific's run-through locomotive fleet and current power management practices would require that in inordinate number of its locomotives be dual-equipped. Alternatively, establishment of a smaller captive fleet and the associated logistics of lead locomotive addition and subtraction could negatively impact operations for both Union Pacific and its interoperability partner.

Each of these risks may impact the "*…sequence and schedule in which track segments will be equipped…*" in order to "*…address areas of greater risk to the public and railroad employees before areas of lesser risk…*" described in the respective PTC Implementation Plans of Union Pacific and its interoperability partner.

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

- Peninsula Corridor Joint Powers Board or "Caltrain", Communications-Based Overlay Signal System (CBOSS)

5.2.1.3 Unequipped Operation

Some of Union Pacific's non-Class I freight tenants may operate their unequipped locomotives on Union Pacific PTC lines where FRA regulations allow. Although no technical form of interoperability is required or exists, such operations will be conducted as prescribed in 49 CFR 236.1029 and will require procedural coordination amongst Union Pacific and its interchange partner. Those non-Class I freight tenants who will operate their locomotives on Union Pacific PTC line segments are identified in Section 8.4.

5.2.2 Semantic Interoperability

Semantic interoperability is achieved through the common use of documented system behavioral specifications. In the current ITC architecture, 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.

5.2.3 Organizational Interoperability

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 in perpetuity to provide configuration management and ensure that interoperability is maintained as the interoperable PTC system(s) are enhanced. ITC and AAR teams also work to establish organizational interoperability in the areas of interchange and infrastructure sharing. Finally, Union Pacific has designated the Director – Operating Systems as a liaison to ensure organizational communications on PTC interoperability matters with each of its tenant railroads.

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

No specific obstacles to interoperability have been identified other than those risks identified in Sections 4.3 and 5.2.1.2 of this document.

6 Installation Risk Analysis [§ 236.1011(a)(4)]

The risk prioritization model used by Union Pacific is based heavily on the sample methodology provided by the Federal Railroad Administration (FRA) in the *Risk Prioritization Methodology for PTC System Implementation* [3]. This is a basic weighted score approach in which a number of risk factors were assigned integer scores, corresponding with level of risk, ranging from 0 (lowest risk) up to 5 (highest risk) for each of the Union Pacific line segments 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. Equation 1 below shows how, for *n* risk factors, a relative risk score was generated for each line segment by multiplying the integer score assigned to the line segment for a given factor (FR_i) by the weight assigned to that factor (FW_i), and summing the products of the *n* risk factors. The resulting calculation is not predictive of the actual accident risk at any particular location, but rather provides an overview of the relative levels of risk among various routes.

$$\sum_{i=1}^{n} FR_i FW_i$$

Equation 1: Risk Score for Line segment

In order to perform the above calculation, Union Pacific performed the following activities:

1. Identify risk factors to be included in the risk prioritization model;
2. Estimate risk factor weights (FW_i);
3. Define the risk factor levels (from 0 to 5) that would be used to assign scores to the line segments for each risk factor; and
4. Assign integer scores (FR_i) to each line segment using the criteria defined above.

A complete description of the activities listed above is provided in Appendix A of this PTCIP.

7 Deployment Sequence and Schedule [§ 236.1011(a)(5)]

Union Pacific's plan for implementation of PTC is based on consideration of six general factors:

- Line segment risk, based on traffic, operational, and route characteristics;
- Pilot project line segments;
- Labor agreement considerations;
- State of existing infrastructure on line segment;
- Continuity of installation along long-haul corridors; and
- Commitments to federal, state, or local agencies.

Consideration of factors in addition to line segment risk is required in order to develop a plan that best utilizes Union Pacific resources in order to maximize the benefit of PTC operations prior to 31 December 2015 and to ensure the earliest possible completion of PTC implementation. The result of consideration of these factors is a plan which describes PTC installation in a pilot phase, plus five priority-based phases (1-5).

In the pilot phase, Union Pacific will establish a test bed where *PTC System Certification* activities may be conducted (see Section 7.1.2). Each of the subsequent Phases 1 - 5 addresses PTC installation priority in such a manner as to address areas of greater risk before those of lesser risk. Line segments with the highest volumes of commuter passenger operations and/or TIH/PIH traffic are generally prevalent in Phase 1. Phase 2 and 3 line segments consist of those in the highest-risk long-haul corridors, while Phases 4 and 5 complete PTC installation along those line segments with ever-decreasing risk levels.

A detailed description of each of the plan factors appears in Section 7.1 below. The sequence and schedule on Union Pacific will commission revenue-service PTC operations is described in Section 7.2.

7.1 Plan Factors

Union Pacific considered each of the factors described in this section in the development of its sequence and schedule for PTC system installation.

7.1.1 Line Segment Risk

Union Pacific calculated the existing risk on each of its line segments which are subject to PTC applicability per the definition of *PTC Main Line* (§236.1003) and included in the regulations for *lines required to be equipped* (§236.1005[b][1]). This risk score was the *primary* factor considered in development of the installation plan and formed the basis from which all other plan factors were considered. A risk score was calculated for each line segment in accordance with the process described in Section 6 and Appendix A of this PTCIP. Line segment characteristics and other items affecting risk are described in this section.

7.1.1.1 Line Segment Traffic, Operational, and Route Characteristics [§ 236.1011(a)(5)]

Line segment characteristics and corresponding risk scores calculated for each line segment that meets the *PTC Main Line* (§236.1003) definition (from Table 10) appear in Appendix B of this PTCIP.

7.1.1.2 Planned Modifications Affecting Risk [§236.1011(a)(5)(ii)]

Union Pacific has identified planned material modifications in two areas which affect risk. These planned modifications include retirement of Cab Signals and passenger operations exceeding 79 MPH.

7.1.1.2.1 Retirement of Cab Signals

Pursuant to 49CFR235 and 49CFR236 Subpart I, Union Pacific intends to make application for discontinuance of the Intermittent Automatic Train Stop system in use on its Harvard and Kenosha Subdivisions subsequent to receipt of *PTC System Certification*. Subject to FRA's disposition of the application, the ATS system would be removed from service only when PTC has been commissioned on the affected line segments and all locomotives operating over those line segments have been equipped.

Pursuant to 49CFR235 and 49CFR236 Subpart I, Union Pacific intends to make application for discontinuance of the 2-Aspect Automatic Train Control system in use on its Geneva, Clinton, and Boone subdivisions upon receipt of *PTC System Certification*. Subject to FRA's disposition of the application, the 2-Aspect ATC system would be removed from service only when PTC has been commissioned on the affected line segments and all locomotives operating over those line segments have been equipped.

Pursuant to 49CFR235 and 49CFR236 Subpart I, Union Pacific intends to make application for discontinuance of the 4-Aspect Automatic Cab Signal system in use on several of its subdivisions. Subject to FRA's disposition of the application, the 4-Aspect ACS system would be removed from service only when PTC has been commissioned on the affected line segments and all locomotives operating over those line segments have been equipped.

7.1.1.2.2 High-Speed Passenger Operations

Union Pacific, Amtrak and the state of Illinois are planning to upgrade portions of the Joliet and Springfield Subdivisions to support passenger and commuter rail operations at speeds up to 110 MPH between Chicago and St. Louis. A number of other passenger and commuter lines have expressed interest in high speed rail operations. FRA participation in this endeavor is critical to the success of this project and high speed rail in the United States. Union Pacific requests that FRA indicate at its earliest convenience its expectations regarding requirements for certification of its PTC system for such operations.

7.1.1.2.3 Infrastructure Improvements

Union Pacific has not at this time identified any specific infrastructure improvements that would materially or adversely impact risk. An RFA will be submitted to the Federal Railroad Administration for approval prior to any material modifications to existing rail infrastructure or new rail line construction that would require the deployment of a PTC system.

7.1.2 Pilot Territories

Union Pacific has identified several territories on which it will pilot the installation and operation of its PTC system. The purpose of the pilot installations is to provide a test bed on which system testing and PTC certification activities may be conducted, as well as provide a basis in experience for finalization of installation and training plans. Pilot territories are intended to encompass the range of Union Pacific methods of operation and mix of train traffic and densities to the extent practical. Union Pacific's pilot territories and respective methods of operation under which PTC will be tested are as follows:

- Traffic Control with cab signals: South Morrill Subdivision between O'Fallons, NE and Horse Creek, NE;
- Traffic Control without cab signals: Powder River Subdivision between Horse Creek, NE and Shawnee Junction, WY; and
- Track Warrant Control: Spokane Subdivision between Spokane, WA and Eastport, ID.

Characteristics of these line segments are identified in Appendix B.

Several signaled interlocking locations exist on the Spokane subdivision, which will allow the testing of TWC operation in signaled territory. Should this configuration provide an insufficient basis for testing, the north end of Union Pacific's Ayer subdivision, which is operated as TWC/ABS and adjacent to the Spokane subdivision, could be included in the pilot territories. Non-signaled Yard Limits are also present in the Spokane subdivision.

Line segments on which Union Pacific's 2-aspect ATC or ATS systems are deployed are not specifically included in the pilot territories since PTC will not be integrated with either of these systems and the fact that Union Pacific intends to apply for their discontinuance in conjunction with full implementation of PTC (see Section 7.1.1.2.1).

Subsequent to receipt of *PTC System Certification*, tests will be conducted along each line segment on which PTC is to be commissioned, albeit of scope different than those conducted in support of PTCSP submittal. The planned scope of PTC commissioning tests will be described in Union Pacific's PTCSP.

7.1.3 Labor Agreements

Union Pacific, like the other Class I's, maintains seniority districts for Brotherhood of Railway Signalmen (BRS) employees, who will be involved with the installation of the Wayside Interface Units on the switches, interlockers and signals on the required routes. These seniority districts, or "BRS zones" are restrictive, in that employees worked on a zone gang outside of their zone are paid at a "penalty rate" of time and one-half for all hours worked. Union Pacific's five BRS zones are shown in Figure 2.

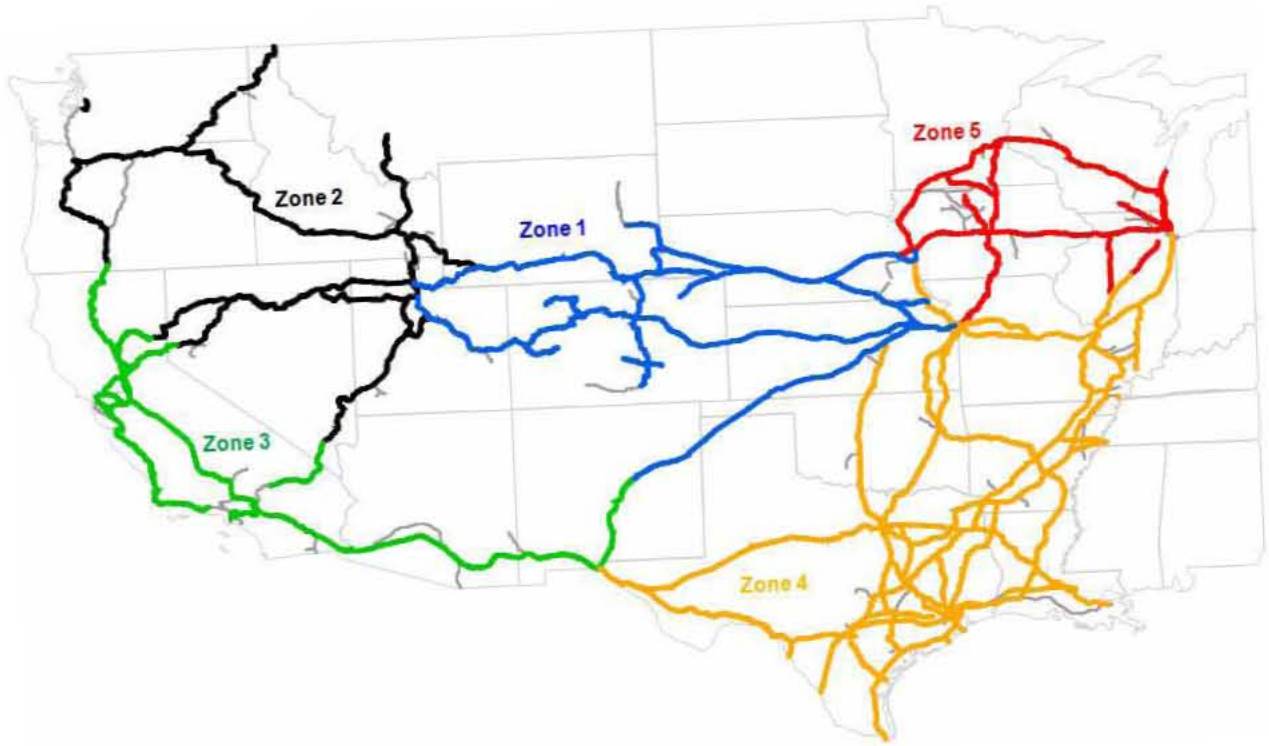

Figure 2: Union Pacific BRS Work Zones

The number of employees in each zone varies based on signaled routes, grade crossings and interlocker volumes but are fairly proportional to the infrastructure that they are required to maintain. As an example, the Central Corridor which extends from Chicago to the Pacific Northwest crosses three BRS zones: 5, 1 and 2. Routes in zones 5 and 1 have recently been upgraded from Current of Traffic to CTC and the work required for PTC wayside installation pales in scope to what needs to take place within work zone 2, where pole line and relays are prevalent. Union Pacific will work continuously on the corridors in the respective zones, and installation of PTC on routes in zones 5 and 1 should be completed before work in zone 2. Resources from those zones 5 and 1 may begin work on routes in other parts of their zone, but the forces from zone 2 will not be redeployed until the corridor is complete.

Union Pacific's PTC implementation will progress in a five-pronged approach with implementation proceeding in sequential order of priority within each zone. Installation will address line segment risk from a higher to lower level in priority order within each zone. However, in order to minimize the mobilization of work forces from one zone to another without securing any PTC benefit, exceptions to strict priority ordering across all zones may exist. For clarification purposes this would mean that Union Pacific may be working to complete all of the Phase 1 segments in one zone while in another zone, work may be proceeding on either a priority two or three route as installation on priority one and or two segments may have been completed in that zone. Union Pacific has very few corridors that consist of line segments of one priority for installation and none of them are in just one zone.

7.1.4 Existing Line Segment Infrastructure

The scope of the PTC installation effort on any particular line segment is affected by the state of the wayside infrastructure existing on that segment, and is not equal amongst all line segments. In particular, the presence of pole line and older relay-based signal systems on a line segment increases the scope of the installation effort. Union Pacific has for some time maintained a program to retire older pole line and relay systems on its signaled lines and replace them with modernized signal equipment. In order to harden and greatly improve the reliability of the underlying wayside infrastructure prior to PTC installation, which will translate into higher PTC system operational reliability, Union Pacific has re-prioritized and increased the scope of its pole line elimination program to accommodate schedule and priorities for implementation of PTC. Union Pacific estimates it must upgrade the wayside infrastructure on several thousand track miles in preparation for PTC installation. Some of these routes include line segments with installation priority one, but infrastructure improvement work may not be completed until 2013. As a result, there will be other lower-priority lines where PTC will be installed on the wayside before all of the higher-priority to provide an opportunity to complete system-wide implementation on or before 31 December 2015. Union Pacific will file application with the FRA when changes resulting from a line segment infrastructure improvement project require such a filing in accordance with 49CFR235.

7.1.5 Corridor Continuity

Line segments that make up any of Union Pacific's long-haul corridors were sometimes grouped for the purpose of establishing installation priority. Once the work commences on a particular corridor, the intent is to complete PTC installation across all line segments of the corridor to maximize labor efficiency and PTC continuity along traffic corridors. Implementation of PTC along corridors will proceed from the end of the corridor consisting of line segments with highest risk scores (as driven by passenger and/or TIH/PIH traffic) toward the end consisting of line segments with lower risk scores. Union Pacific believes this approach will maximize the number of trains and route-miles under which PTC operations are conducted prior to 31 December 2015 and provides an incremental safety benefit over the entire corridor.

7.1.6 Commitments to Local Agencies

Union Pacific has established agreements to prioritize installation of PTC on its routes utilized by certain passenger agencies. Agreements to date has resulted in very little deviation from the risk-based schedule as the line segments involved were classified into the highest installation priority group as a result of the risk analysis due to the volumes of passenger traffic. Table 2 identifies the agencies with which Union Pacific has established agreements and the affected line segments.

Table 2: Agency Agreements and Affected Line Segments

Agency	Affected Line Segments
Southern California Regional Railroad Authority (Metrolink)	• Los Angeles Subdivision • Santa Barbara Subdivision
Illinois Department of Transportation (IDOT)	• Joliet Subdivision • Springfield Subdivision

7.2 PTC Installation Sequence and Schedule

Union Pacific's plan for implementation of PTC on its lines where required, in consideration of the regulatory completion date of 31 December 2015 and all plan factors described in Section 7.1, appears in Table 3.

The combination of volume of line segments to be equipped with PTC within a particular work zone, the scope of prerequisite pole line elimination work, and corridor continuity planning has resulted in the scheduling of PTC implementation on a very few Phase/Priority 2 line segments as late as CY 2014. Such line segments are those with the lowest risk scores (as driven by passenger and/or TIH/PIH traffic) at the far end of a corridor within a work zone from where implementation is planned to begin.

Union Pacific intends to seek exclusion of certain of its line segments from the PTC baseline in accordance with §236.1005(b)(4). Where such exclusion is sought, the regulation under which Union Pacific intends to seek exclusion is cited in the table:

- §236.1005(b)(4)(i) – Line segments where cessation of TIH/PIH traffic or loss of *PTC Main Line* status has occurred;
- §236.1005(b)(4)(ii) – Line segments with *de minimis* TIH/PIH traffic;
- §236.1019(c)(3) – Line segments for which limited operations exception has been granted as a result of Main Track Exclusion Addendum filed jointly with passenger carrier.

Union Pacific intends to provide supporting risk analyses at a future date for each exclusion sought under and in accordance with §236.1005(b)(4) once the FRA's Risk Evaluation Task Force has completed definition of the methodology for such analyses.

Table 3: Schedule for PTC System Implementation

Line Segment	From MP	To MP	Exclusion Sought	Phase/ Priority	BRS Zone	Year PTC Commissioned
ADAMS SUB	202	314		4	5	2013
ALBERT LEA SUB	193	352		3	5	2014
ALEXANDRIA SUB	115	190		3	4	2014
ALHAMBRA SUB	483	539		2	3	2013
ALTOONA SUB	1	91	§236.1005(b)(4)(ii)	4	5	2015
ANCHORAGE SUB	621	644		1	4	2013
ANGLETON SUB	221	343		1	4	2013
AUSTIN SUB	90	260		2	4	2013
AVONDALE SUB	11	15		1	4	2013
AYER SUB	184	355		2	2	2013
BAIRD SUB	252	448		3	4	2014
BEAUMONT SUB	378	621		1	4	2013
BLACK BUTTE SUB	321	429		3	3	2015
BLAIR SUB	326	367		1	5	2013
BOONE SUB	202	326		1	5	2013
BORIE CUT-OFF	98	103		2	1	2013
BRINKLEY SUB	4	71		3	4	2014
BROOKLYN SUB	581	770		3	2	2013
BROWNSVILLE SUB	0	221		4	4	2015
BRYAN SUB	99	121		4	4	2014
CALIENTE SUB	334	577		4	2	2015
CANYON SUB	205	322		5	3	2015

Table 3: Schedule for PTC System Implementation						
Line Segment	From MP	To MP	Exclusion Sought	Phase/ Priority	BRS Zone	Year PTC Commissioned
CARRIZOZO SUB	740	969		5	3	2015
CASCADE SUB	429	581		3	2	2014
CHEROKEE SUB	386	565		4	4	2015
CHESTER SUB	0	172		2	4	2013
CHOCTAW SUB	565	756		4	4	2013
CIMA SUB	162	334		4	3	2015
CLINTON SUB	2	202		2	5	2013
COAST SUB	14	248		1	3	2013
COFFEYVILLE SUB	285	664		4	4	2015
COLORADO SPRINGS SUB	0	110	§236.1005(b)(4)(i)	5	1	2015
COLUMBUS SUB	39	145		1	1	2013
CORPUS CHRISTI SUB	3	150	§236.1005(b)(4)(ii)	4	4	2015
CORSICANA SUB	525	621		4	4	2015
CUERO SUB	14	122		4	4	2015
DALLAS SUB	210	252		4	4	2015
DEL RIO SUB	201	379		2	4	2013
DESOTO SUB	0	57		4	4	2013
DESOTO SUB	57	166	§236.1019(c)(3)	4	4	2013
DUNCAN SUB	436	613		5	4	2015
EAGLE PASS SUB	0	35		4	4	2015
EAST DENVER BELT LINE	0	4	§236.1005(b)(4)(i)	4	1	2015
ELKO SUB	671	532		3	2	2014
ENID SUB	243	436		5	4	2015
ENNIS SUB	121	261		4	4	2015
EUREKA SUB	0	65		4	4	2014
EVANSTON SUB	815	994		2	1	2013
FAIRMONT SUB	1	43	§236.1005(b)(4)(ii)	5	5	2015
FALLS CITY SUB	289	481		2	4	2013
FRESNO SUB	39	311		3	3	2013
FT. WORTH SUB	101	251		4	4	2013
GALVESTON SUB	0	47	§236.1005(b)(4)(ii)	4	4	2015
GENEVA SUB	0	139		1	5	2013
GIDDINGS SUB	0	77		4	4	2015
GILA SUB	733	988		2	3	2014
GLENWOOD SPRINGS SUB	129	450		3	1	2013
GLIDDEN SUB	1	201		2	4	2013
GREELEY SUB	0	98		3	1	2013
GREEN RIVER SUB	452	604	§236.1019(c)(3)	4	1	2013
GREEN RIVER SUB	450	452		4	1	2013
GREEN RIVER SUB	604	626		4	1	2013
HARVARD SUB	0	87		1	5	2013
HEARNE SUB	1	90		4	4	2014
HERINGTON SUB	171	298		5	1	2015
HIAWATHA SUB	43	108	§236.1005(b)(4)(i)	4	1	2015
HOUSTON EAST BELT SUB	0	11		1	4	2013
HOUSTON WEST BELT SUB	229	238		1	4	2013
HOXIE SUB	141	344		2	4	2013
HUNTINGTON SUB	457	291		2	2	2013
JEFFERSON CITY SUB	0	128		1	4	2013
JEWELL SUB	0	50	§236.1005(b)(4)(ii)	5	5	2015
JOLIET SUB	37	127		1	5	2012
JONESBORO SUB	40	263		3	4	2014
JULESBURG SUB	56	81	§236.1005(b)(4)(i)	4	1	2015

Table 3: Schedule for PTC System Implementation						
Line Segment	From MP	To MP	Exclusion Sought	Phase/ Priority	BRS Zone	Year PTC Commissioned
K.C. METRO (COFFEYVILLE)	279	285		4	4	2015
K.C. METRO (FALLS CITY)	285	289		2	4	2014
K.C. METRO (KANSAS)	0	7		2	4	2014
K.C. METRO (KCTRR)	277	283		2	4	2014
K.C. METRO (RIVER)	444	445		1	4	2013
KANSAS SUB	7	143		2	1	2014
KEARNEY SUB	145	282		1	1	2013
KENOSHA SUB	3	80		1	5	2013
KENTON LINE	0	22		2	2	2013
LA GRANDE SUB	185	291		2	2	2013
LAFAYETTE SUB	205	353		1	4	2013
LAKE CHARLES SUB	602	680		3	4	2014
LAKESIDE SUB	557	781		3	2	2014
LARAMIE SUB	510	683		2	1	2013
LAREDO SUB	260	413		4	4	2015
LIMON SUB	430	638	§236.1005(b)(4)(i)	5	1	2015
LITTLE ROCK SUB	344	90		2	4	2013
LIVONIA SUB	10	115		1	4	2013
LOCKHART SUB	0	52		4	4	2015
LORDSBURG SUB	988	1298		2	3	2013
LOS ANGELES SUB	2	162		1	3	2012
LOS NIETOS SUB	0	7		2	3	2014
LOST SPRINGS SUB	171	243		5	4	2015
LUFKIN SUB	2	232		3	4	2014
LYNNDYL SUB	577	784		4	2	2015
MANKATO SUB	1	351	§236.1005(b)(4)(ii)	4	5	2014
MARTINEZ SUB	2	106		1	3	2013
MARYSVILLE SUB	143	288		2	1	2013
MASON CITY SUB	74	193		3	5	2014
MCGEHEE SUB	350	501		4	4	2014
MEMPHIS SUB	288	380		3	4	2014
MIDLOTHIAN SUB	0	50		4	4	2015
MILWAUKEE SUB	3	97		4	5	2015
MINEOLA SUB	90	213		3	4	2015
MOFFAT TUNNEL SUB	129	168	§236.1005(b)(4)(ii)	5	1	2015
MOFFAT TUNNEL SUB	0	129		3	1	2015
MOJAVE SUB	311	492		3	3	2015
MONROE SUB	501	190		4	4	2015
MONTANA SUB	135	184	§236.1005(b)(4)(ii)	5	2	2015
MT. VERNON SUB	254	339		2	4	2013
NAMPA SUB	214	457		2	2	2013
NAVASOTA SUB	0	101		4	4	2014
NEVADA SUB	249	421		3	2	2014
NILES SUB	4	35		1	3	2013
NOGALES SUB	0	66	§236.1005(b)(4)(ii)	4	3	2015
NORTH PLATTE TERMINAL	282	292		1	1	2013
OAKLAND SUB	10	93		1	3	2013
OGDEN SUB	1	111		3	2	2014
OMAHA SUB	329	39		1	1	2013
PALESTINE SUB	0	229		2	4	2013
PANA SUB	145	276		2	4	2013
PARSONS SUB	0	136		4	4	2015
PEORIA SUB	0	93		2	5	2013

Table 3: Schedule for PTC System Implementation						
Line Segment	From MP	To MP	Exclusion Sought	Phase/ Priority	BRS Zone	Year PTC Commissioned
PINE BLUFF SUB	263	525		3	4	2014
POCATELLO SUB	0	214		2	2	2013
PORTLAND SUB	1	185		2	2	2013
POWDER RIVER SUB	166	167		Pilot	1	2013
POWDER RIVER SUB	167	272		Pilot	1	2013
PRATT SUB	298	544		5	1	2015
PROVO SUB	626	746		3	1	2015
RAWLINS SUB	683	815		2	1	2013
REISOR SUB	196	351		3	4	2014
RIVER SUB	128	276		1	4	2013
ROSEVILLE SUB	106	247		3	3	2015
SACRAMENTO SUB	95	205		5	3	2015
SALEM SUB	185	254		2	4	2013
SALINA SUB	73	187	§236.1005(b)(4)(i)	5	1	2015
SALT LAKE SUB	783	819		2	2	2013
SANDERSON SUB	379	611		2	4	2013
SANTA BARBARA SUB	248	400		1	3	2013
SANTA BARBARA SUB	400	423		1	3	2012
SEATTLE SUB	6	183		4	2	2014
SEDALIA SUB	128	277		1	4	2013
SHAFTER SUB	714	911		3	2	2014
SHARON SPRINGS SUB	187	430	§236.1005(b)(4)(i)	5	1	2015
SHARP SUB	664	752		3	2	2013
SHREVEPORT SUB	390	452		3	4	2014
SIDNEY SUB	292	510		2	1	2013
SIOUX CITY SUB	6	77	§236.1005(b)(4)(i)	4	5	2015
SMITHVILLE SUB	69	135		4	4	2015
SOUTH MORRILL SUB	0	166		Pilot	1	2013
SPOKANE SUB	2	141		Pilot	2	2013
SPRINGFIELD SUB	127	283		1	4	2012
STRANG SUB	0	21		1	4	2013
TERMINAL SUB	353	377		1	4	2013
TOPEKA SUB	89	171		2	1	2013
TOYAH SUB	448	769		3	4	2014
TRACY SUB	35	41		1	3	2013
TRENTON SUB	65	500		3	5	2015
TUCUMCARI SUB	544	740		5	1	2015
VALENTINE SUB	611	827		2	4	2013
VALLEY SUB	107	321		3	3	2015
VAN BUREN SUB	344	495		4	4	2014
VILLA GROVE SUB	9	145		2	4	2014
WACO SUB	842	969		2	4	2013
WAGONER SUB	495	663		4	4	2014
WALSENBURG SUB	125	172	§236.1005(b)(4)(i)	5	1	2015
WHITE BLUFF SUB	305	349		4	4	2015
WILLAMETTE BRIDGE LINE	0	1		2	2	2013
WINNEMUCCA SUB	322	536		5	2	2015
WORTHINGTON SUB	121	509	§236.1005(b)(4)(ii)	4	5	2015
WYEVILLE SUB	91	202		4	5	2015
YODER SUB	164	243	§236.1005(b)(4)(ii)	4	1	2015
YUMA SUB	539	733		2	3	2014

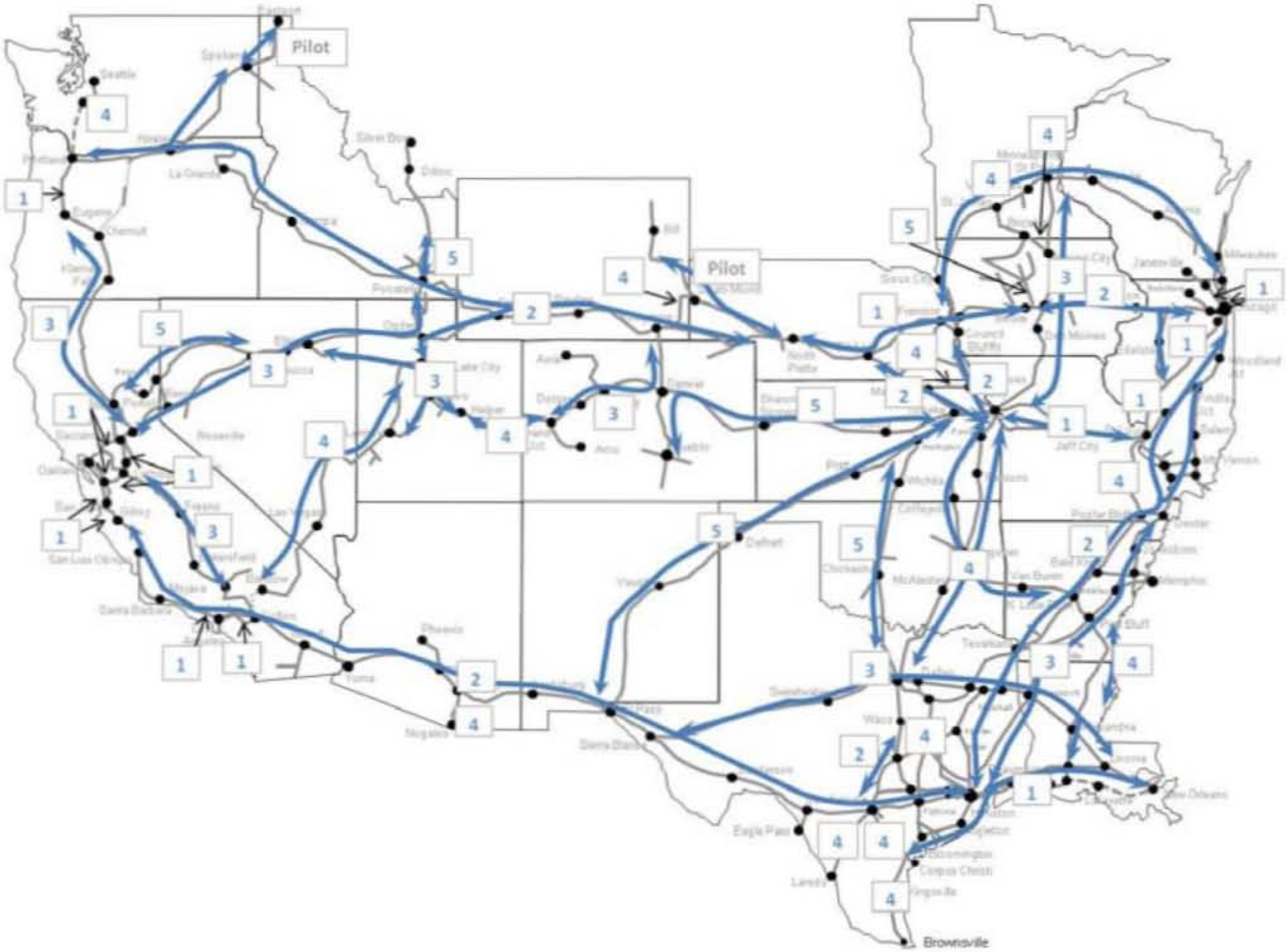

Figure 3: Map of PTC Installation Phases

8 Rolling Stock [§ 236.1011(a)(6)]

This section contains information related to Union Pacific rolling stock that will be equipped with the PTC technology.

8.1 Rolling Stock to be Equipped [§ 236.1011(a)(6)(i)]

Union Pacific's Asset Utilization Team continuously analyzes the locomotive fleet based on numerous criterions such as age, reliability, fuel efficiency, compliance with environmental regulations, etc., as well at the requirement to complete installation of PTC on mandated lines by 31 December 2015.

Union Pacific plans to ultimately equip approximately 6000 of the 8000 total locomotives anticipated to be in its CY 2016 fleet to support its PTC implementation plan. Of the 6000-locomotive PTC fleet, approximately 5300 will be 6 axle locomotives which is approximately 100% of the anticipated 6 axle fleet and the remaining 700 will be 4 axle locomotives which is approximately 40% of the 4 axle fleet. Union Pacific anticipates that additional locomotives will be equipped by lessors.

Table 4 identifies the various locomotive models in Union Pacific's locomotive fleet that will be equipped with PTC.

6 AXLE		4 AXLE	
SD70ACE	C45AC	GP60	MP20GP
SD9043	C44AC	GP40-2	MP15
SD70M		GP39-2	RP20
SD60		GP38-2	GS21B
SD40-2		GP15-1	

Table 4: Locomotive Models Targeted for PTC Installation

Union Pacific is planning to perform installation of PTC equipment on locomotives at the following of its shop locations:

- North Little Rock, AR (Jenks)
- North Platte, NE
- Ft. Worth, TX
- Hinkle, OR
- Colton, CA
- North Little Rock, AR (Ramp)
- South Morrill, NE
- Chicago, IL (M19A)
- Denver, CO
- Roseville, CA

To support PTC locomotive installations, Union Pacific estimates it will have to increase its work force by approximately 80-90 people.

8.1.1 Historic Locomotive Fleet

Union Pacific maintains and operates a small fleet of historic steam and diesel locomotives. The technical ability and feasibility of equipping the locomotives in that fleet with the PTC onboard apparatus remains under review.

8.2 Schedule [§ 236.1011(a)(6)(ii)]

The table below is the projected schedule for the installation of PTC equipment on Union Pacific's locomotive fleet.

Year	2012	2013	2014	2015	2016
Installations	1200	1200	1200	1200	1200

Table 5: PTC Fleet Equipping Plan By Year

Due to component specifications not being complete and therefore the unavailability of components, Union Pacific will not commence a large-scale installation program until January 2012. This will allow the complete development and testing of the various components and minimize the need to re-shop locomotives. Union Pacific plans to begin installing 100 PTC systems each month beginning in January 2012 and completing the installations by December of 2016. After the deadline of December 31, 2015 for commencing full PTC operations, Union Pacific understands it must manage its PTC equipped fleet such as to ensure that all trains dispatched into PTC territories are operated with equipped locomotives. Locomotives in the remaining unequipped portion of its PTC fleet will be placed to the trail in consist position until such time as they are PTC-equipped.

Union Pacific's goal is to equip all locomotives which will be overhauled each year beginning January 2012 as well as other model of locomotives to reach the 1200 per year target. Therefore, there are no plans to target specific model of locomotives as shown in Section 8.1 but rather to equip all overhaul locomotives and equip other locomotives as they come in for scheduled maintenance.

8.3 Goals for Incremental PTC Operations [§ 236.1011 (a)(6)(iii)]

As a result of the progressive equipping of its PTC fleet and build-out of PTC routes, Union Pacific will incrementally increase the number of trains which it will operate in revenue service under PTC control. At any point in time prior to 31 December 2015, the number of trains operating under PTC control is driven primarily by a combination of factors, including the following:

- Portion of the Union Pacific PTC locomotive fleet that is equipped throughout the calendar year;
- Portion of the foreign-road locomotive PTC-equipped locomotive fleet operating on Union Pacific lines at any time;
- Portion of PTC line segments and route-miles equipped throughout the calendar year;
- Portion of PTC line segments subsequently excluded from the PTC baseline;
- Availability and/or assignment of locomotives in the PTC fleet to trains operating on PTC line segments in accordance with business practices, state environmental regulations, etc.;
- Success or failure in performing initialization of the PTC onboard system; and

- Traffic volumes driven by business conditions.

Subsequent to receipt of *PTC System Certification* allowing revenue service PTC operations, Union Pacific will promulgate operating rules which require an attempt to initialize the onboard PTC system on any equipped controlling locomotive operating over a PTC line segment on which revenue service PTC operations have been commissioned prior to and through 31 December 2015. Union Pacific will enact the following measures subsequent to 31 December 2015:

- Modify its business practices for management of its locomotive fleet to accommodate assignment of PTC-equipped locomotives to line segments where revenue service PTC operation has been commissioned; and
- Hold back or perform a change-out of a PTC-equipped lead locomotive on any train preparing to depart its initial terminal should the initialization attempt fail; and

Any or all of these measures may not be enacted prior to that date, however.

Because of the risk-based plan to progressively equip PTC line segments and the natural assignment of more equipped locomotives to equipped lines, benefits of PTC operation will be incrementally realized. Subsequent to 31 December 2015, all trains operating on Union Pacific PTC line segments will operate under PTC control, except certain of those operated by non-Class I freight carriers.

Table 6 below identifies Union Pacific's incremental goals for the rate at which it will operate trains under PTC control in revenue service for each calendar year between and including 2010 and 2015. These yearly goals are expressed as the ratio identified in Equation 2, as prescribed by §236.1006(b)(1).

$$\frac{\#\ Trains\ Operated\ in\ Revenue\ Service\ on\ a\ PTC\ Line\ Segment\ Under\ PTC\ Control}{Total\ \#\ Trains\ Operated\ in\ Revenue\ Service\ on\ Railroad}$$

Equation 2: PTC Operations Ratio

Any train that operated under PTC control on at least one PTC line segment is counted in the numerator of the equation. *PTC line segments* are those identified in Section 7.2 of this PTCIP. Union Pacific notes that these goals are preliminary in nature and will update them coincident with any Request for Amendment to this PTCIP.

Table 6: Goals for Incremental PTC Operations

Calendar Year (CY)	Plan %Locomotive Fleet PTC-Equipped at End of CY	Plan %Route Miles PTC-Equipped at End of CY[1]	Goal %Trains Operated Under PTC for CY
2010	1%	0%	0%

[1] Subject to FRA's disposition of Union Pacific's request to exclude certain line segments from the PTC baseline.

Table 6: Goals for Incremental PTC Operations			
Calendar Year (CY)	**Plan %Locomotive Fleet PTC-Equipped at End of CY**	**Plan %Route Miles PTC-Equipped at End of CY[1]**	**Goal %Trains Operated Under PTC for CY**
2011	1%	0%	0%
2012	15%	1.4%	0.1% - 3%
2013	30%	37%	3% - 15%
2014	45%	54%	15% - 35%
2015	60%	75%	35% - 60%

Union Pacific will report its progress toward achieving its goals for pre- 31 December 2015 PTC operations in accordance with §236.1006(b)(2). Subsequent to 31 December 2015, Union Pacific will dispatch all trains into PTC territory with equipped locomotives.

8.4 Tenant Railroads [§ 236.1011(a)(6)(iv)]

Union Pacific expects each of its tenant carriers who submits a PTCIP to specify therein its plan for equipping that portion of its locomotive fleet which will operate on Union Pacific PTC-equipped line segments. Union Pacific has further identified each tenant carrier who is not required to submit a PTCIP in accordance with §236.1009(a), but whose locomotives must be equipped for operation on PTC line segments on or before 31 December 2015. Such tenant carriers will be required to operate equipped locomotives on Union Pacific PTC line segments either by FRA regulation or other business agreement.

Union Pacific submitted a written inquiry to each such tenant carrier requesting identification of and plans to equip that portion of its locomotive fleet which will operate on Union Pacific PTC-equipped line segments. Table 7 identifies each of Union Pacific's tenant carriers who will not be submitting its own PTC Implementation Plan in accordance with §236.1009(a), its type, and whether or not that carrier will be required to operate equipped locomotives on Union Pacific PTC line segments on or before 31 December 2015, and the status of that carrier's response to Union Pacific's written inquiry, if applicable. Written inquiries are on file; copies of individual responses are in Appendix C of this PTCIP. Union Pacific will continue to work to gather responses from those carriers who have not yet responded and coordinate installation plans. Union Pacific will periodically provide copies of received responses to the FRA.

Table 7: Tenant Carriers Not Submitting PTCIP			
Tenant Carrier	**Type**	**Equipped On or Before 12/31/2015**	**Response to UP Inquiry Received**
Acadiana Railway Company	Freight	YES	
Alamo Gulf Coast	Freight		
Altamont Commuter Express	Passenger	YES	10 April 2010
Alton & Southern Railroad	Freight		
Arizona Eastern Railway	Freight	YES	
Arkansas & Missouri Railroad	Freight		
Arkansas & Oklahoma Railroad	Freight		
Blacklands Railroad	Freight		

Table 7: Tenant Carriers Not Submitting PTCIP			
Tenant Carrier	**Type**	**Equipped On or Before 12/31/2015**	**Response to UP Inquiry Received**
Blue Mountain Railroad	Freight		
Caddo Valley Railroad Company	Freight	YES	
California Northern Railroad	Freight	YES	8 April 2010
Carrizo Gorge Railroad	Freight		
Central Oregon & Pacific Railroad	Freight	YES	
Chicago Terminal Railroad	Freight		
Dakota, Minnesota & Eastern Railroad	Freight	YES	
Dallas, Garland & Northeastern Railroad	Freight	YES	
Dardnelle & Russellville Railroad Company	Freight		
Delta Southern Railroad	Freight		
East Camden Highland Railroad	Freight		
Eastern Idaho Railroad	Freight	YES	
Fort Worth & Western Railroad	Freight	YES	
Great Northwest Railroad	Freight		
Great Western Railway	Freight		
Idaho Northern & Pacific Railroad	Freight	YES	
Indiana Harbor Belt Railroad	Freight		
Iowa Interstate Railroad	Freight		
Iowa Northern Railroad	Freight		
Iowa Traction Railroad	Freight		
Iowa, Chicago & Eastern Railroad	Freight		
Kansas & Oklahoma Railroad	Freight	YES	1 April 2010
Kiamichi Railroad	Freight		
Kyle Railway	Freight	YES	
Little Rock & Western Railroad	Freight	YES	
Los Angeles Junction Railroad	Freight		
Louisiana & Delta Railroad	Freight	YES	
Minnesota Commercial Railway	Freight		
Minnesota Southern Railway	Freight		
Missouri & Northern Arkansas Railroad	Freight	YES	8 April 2010
Modesto & Empire Traction Company	Freight		
Nebraska Central Railroad	Freight	YES	
Pacific Harbor Lines	Freight		
Peninsula Terminal Company	Freight		
Port Terminal Railroad Company	Freight		
Portland & Western Railroad	Freight	YES	
Progressive Rail, Inc.	Freight		
Rescar, Inc.	Freight		
Rockdale, Sandow & Southern Railroad	Freight		

Table 7: Tenant Carriers Not Submitting PTCIP			
Tenant Carrier	**Type**	**Equipped On or Before 12/31/2015**	**Response to UP Inquiry Received**
Salt Lake, Bingham & Garfield Railway	Freight	YES	
San Joaquin Valley Railroad Company	Freight	YES	8 April 2010
Sierra Northern Railroad	Freight		
San Luis & Rio Grande Railroad	Freight		
South Kansas & Oklahoma Railroad	Freight		
Stillwater Central Railroad	Freight		
Twin Cities & Western Railroad	Freight		
Utah Railway	Freight	YES	5 April 2010
Yreka Western Railroad Company	Freight	YES	

9 Wayside Devices [§ 236.1011(a)(7)]

Union Pacific will install PTC wayside equipment at three types of wayside locations along its line segments to be equipped with PTC:

- Control Points / Interlockings;
- Intermediate Signals; and
- Monitored Switches.

The equipment and work specific to each location type is described in the subsections below. However, the following work must be performed at each and every location, regardless of type:

- Installation of PTC radio, antenna, and supporting pole.
- Evaluation of available AC and battery power. PTC wayside equipment may require up to ten times the power of existing wayside equipment. Where necessary the AC power, rectifiers, and batteries will need to be upgraded to accommodate the additional load.
- Renewal or upgrade of grounding and surge protection to meet current standards sufficient to protect the PTC wayside equipment being installed.
- Evaluation of the suitability of existing enclosures. Where insufficient, new enclosures will be installed.
- Evaluation of existing underground cabling. Where insufficient, new cabling will be installed.

Union Pacific is renewing the signal systems present on some of its line segments on which PTC will be installed with solid-state processor equipment. Although these signal systems remain safe and viable in their current configuration, the addition of PTC wayside equipment to them would present particular cost, disarrangement, and reliability challenges. The signal systems where pole line remains are relay-based and were installed in the 1940's thru the 1970's. Components are housed in enclosures that typically do not have room to add the necessary PTC processors and radios. Addition of PTC wayside equipment to these signal systems as they currently exist would require installation of additional enclosures and the wiring of “stand-alone” WIUs via conduit into the signal wires of the existing relay-based systems. The end result would be a hybrid arrangement consisting of both relay-based and solid-state processor components. Reliability and maintainability of such an arrangement would be difficult. Replacement of relay-based systems with solid-state processor-based systems and pole line elimination accomplishes two objectives:

1. The PTC processor is an integral part of the new signal system rather than an add-on. It will more reliably report the signal and switch status to the PTC system. It will also include built-in utilities which will allow diagnosis of system failures and help effect repairs in a shorter time frame thus improving overall system reliability.
2. The processor-based equipment utilizes electronic-coded track circuits to transmit information from one signal location to the next. In relay-based systems, this information is transmitted over the pole line, which is now eliminated and can be removed.

9.1 Control Point / Interlocking Locations

Control Point or Interlocking locations may be comprised of either relay- or processor-based equipment. Where processor-based equipment exists, the existing vital processor board will be replaced with an upgraded PTC-ready vital processor board, which will also support the PTC WIU function. Relay-based equipment at end-of-siding or universal crossover locations will be replaced with pre-wired vital processor-based systems. This will occur as part of the pole line elimination. At more complex relay-based locations, a stand-alone WIU will be installed to monitor wayside device status and will be wired to the existing equipment.

9.2 Intermediate Signal Locations

Intermediate signal locations may be comprised of either relay- or processor-based equipment. Where processor-based equipment exists, the existing vital processor board will be replaced with an upgrade PTC-ready vital processor board, which will support the PTC WIU function. Relay-based equipment will be replaced with pre-wired vital processor-based systems. This will occur as part of the pole line elimination.

9.3 Monitored Switches

The position of switches not otherwise integrated into a signaling system will be independently monitored by arrangement of signaling appliances and WIU. Such monitored switch locations require the installation of a conventional switch circuit controller, stand-alone processor-based WIU, and cabling to connect them. Switches in signaled territory are integrated into the signaling system and their position is reflected in the signal indications conveyed to PTC.

9.4 PTC Wayside Equipment Installation Schedule

Union Pacific's schedule for installation of PTC wayside equipment appears in Table 8 and Table 9, sorted by Line Segment and Work Complete date, respectively.

Table 8: Schedule of PTC Wayside Devices Installation (Sorted by Line Segment)

Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
ADAMS SUB	202	314		49		5	2010	2012
ALBERT LEA SUB	193	352	26	40	5	5	2013	2014
ALEXANDRIA SUB	115	190	10	18		4	2013	2014
ALHAMBRA SUB	483	539	36	19		3	2010	2012
ALTOONA SUB	1	91	1	40	7	5	2013	2015
ANCHORAGE SUB	621	644	1	4	6	4	2011	2013
ANGLETON SUB	221	343	30	23		4	2011	2012
AUSTIN SUB	90	260	45	55		4	2010	2011
AVONDALE SUB	11	15	1	2		4	2011	2013
AYER SUB	184	355	14	84		2	2011	2013
BAIRD SUB	252	448	39	60		4	2013	2014
BEAUMONT SUB	378	621	29	50		4	2010	2011
BLACK BUTTE SUB	321	429	28	38		3	2013	2015
BLAIR SUB	326	367	13	8		5	2011	2012
BOONE SUB	202	326	13	71		5	2011	2012
BORIE CUT-OFF	98	103		1		1	2012	2013
BRINKLEY SUB	4	71	1	33		4	2013	2014
BROOKLYN SUB	581	770	56	66		2	2010	2012
BROWNSVILLE SUB	0	221	13	9	54	4	2014	2015
BRYAN SUB	99	121		9		4	2013	2014

Table 8: Schedule of PTC Wayside Devices Installation (Sorted by Line Segment)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
CALIENTE SUB	334	577	80	66		2	2013	2015
CANYON SUB	205	322	36	37		3	2010	2015
CARRIZOZO SUB	740	969	34	75		3	2015	2015
CASCADE SUB	429	581	44	64		2	2012	2014
CHEROKEE SUB	386	565	11	90		4	2014	2015
CHESTER SUB	0	172	46	52		4	2011	2013
CHOCTAW SUB	565	756	37	58		4	2010	2011
CIMA SUB	162	334	59	38		3	2014	2015
CLINTON SUB	2	202	37	106		5	2011	2012
COAST SUB	14	248	29	130		3	2010	2012
COFFEYVILLE SUB	285	664	30	71		4	2013	2015
COLORADO SPRINGS SUB	0	110	19	48		1	2015	2015
COLUMBUS SUB	39	145	26	84		1	2011	2013
CORPUS CHRISTI SUB	3	150		4	64	4	2014	2015
CORSICANA SUB	525	621	17	23	1	4	2014	2015
CUERO SUB	14	122	1	7	16	4	2014	2015
DALLAS SUB	210	252	20	9		4	2014	2015
DEL RIO SUB	201	379	41	40		4	2012	2013
DESOTO SUB	57	166	18	43		4	2010	2013
DESOTO SUB	0	57	11	25		4	2010	2013
DUNCAN SUB	436	613	4	12	44	4	2015	2015
EAGLE PASS SUB	0	35			24	4	2014	2015
EAST DENVER BELT LINE	0	4	4			1	2014	2015
ELKO SUB	671	532	8	110		2	2012	2014
ENID SUB	243	436	2		72	4	2015	2015
ENNIS SUB	121	261	10	60		4	2014	2015
EUREKA SUB	0	65		29		4	2013	2014
EVANSTON SUB	815	994	26	162		1	2010	2012
FAIRMONT SUB	1	43			18	5	2015	2015
FALLS CITY SUB	289	481	25	90		4	2012	2013
FRESNO SUB	39	311	86	90		3	2011	2013
FT. WORTH SUB	101	251	28	27		4	2010	2011
GALVESTON SUB	0	47	1	1	41	4	2014	2015
GENEVA SUB	0	139	42	62		5	2011	2013
GIDDINGS SUB	0	77	13	24		4	2014	2015
GILA SUB	733	988	64	94		3	2012	2014
GLENWOOD SPRINGS SUB	129	450	58	46		1	2010	2012
GLIDDEN SUB	1	201	41	57		4	2012	2013
GREELEY SUB	0	98	26	34	20	1	2010	2013
GREEN RIVER SUB	452	604	49	41		1	2010	2012
GREEN RIVER SUB	450	452	1	2		1	2010	2012
GREEN RIVER SUB	604	626	9	1		1	2010	2012
HARVARD SUB	0	87	18	116	2	5	2011	2013
HEARNE SUB	1	90	2	38		4	2013	2014
HERINGTON SUB	171	298	8	54		1	2015	2015
HIAWATHA SUB	43	108	1	5	6	1	2014	2015
HOUSTON EAST BELT SUB	0	11	16	8	3	4	2011	2013
HOUSTON WEST BELT SUB	229	238	18	4	3	4	2011	2012

Table 8: Schedule of PTC Wayside Devices Installation (Sorted by Line Segment)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
HOXIE SUB	141	344	51	70		4	2011	2013
HUNTINGTON SUB	457	291	59	50		2	2011	2013
JEFFERSON CITY SUB	0	128	18	62		4	2011	2013
JEWELL SUB	0	50		1	14	5	2015	2015
JOLIET SUB	37	127	16	33		5	2011	2012
JONESBORO SUB	40	263	47	74		4	2012	2014
JULESBURG SUB	56	81		21	7	1	2014	2015
K.C. METRO (COFFEYVILLE)	279	285	6	1		4	2014	2015
K.C. METRO (FALLS CITY)	285	289	3	2		4	2012	2014
K.C. METRO (KANSAS)	0	7	12	4		4	2012	2014
K.C. METRO (KCTRR)	277	283	7	4		4	2012	2014
K.C. METRO (RIVER)	444	445				4	2012	2013
KANSAS SUB	7	143	36	48		1	2012	2014
KEARNEY SUB	145	282	34	90		1	2011	2013
KENOSHA SUB	3	80	10	49	15	5	2011	2013
KENTON LINE	0	22	10	9		2	2011	2012
LA GRANDE SUB	185	291	43	31		2	2010	2012
LAFAYETTE SUB	205	353	34	33		4	2010	2011
LAKE CHARLES SUB	602	680		22	5	4	2013	2014
LAKESIDE SUB	557	781	26	106	2	2	2012	2014
LARAMIE SUB	510	683	47	98		1	2012	2013
LAREDO SUB	260	413	18	58	24	4	2014	2015
LIMON SUB	430	638	14	14	70	1	2015	2015
LITTLE ROCK SUB	344	90	75	56		4	2011	2012
LIVONIA SUB	10	115	30	19	5	4	2011	2012
LOCKHART SUB	0	52	1	5	3	4	2014	2015
LORDSBURG SUB	988	1298	46	145		3	2012	2013
LOS ANGELES SUB	2	162	31	16		3	2011	2012
LOS NIETOS SUB	0	7	3	5	4	3	2012	2014
LOST SPRINGS SUB	171	243		1	21	4	2015	2015
LUFKIN SUB	2	232	2	116		4	2013	2014
LYNNDYL SUB	577	784	64	60		2	2013	2015
MANKATO SUB	1	351	1	26	54	5	2013	2014
MARTINEZ SUB	2	106	46	48		3	2011	2013
MARYSVILLE SUB	143	288	28	91		1	2012	2013
MASON CITY SUB	74	193	14	45		5	2013	2014
MCGEHEE SUB	350	501	25	37		4	2013	2014
MEMPHIS SUB	288	380	18	27	8	4	2013	2014
MIDLOTHIAN SUB	0	50	2	23		4	2014	2015
MILWAUKEE SUB	3	97	6	42		5	2014	2015
MINEOLA SUB	90	213	34	43		4	2013	2015
MOFFAT TUNNEL SUB	129	168	8	11	4	1	2013	2015
MOFFAT TUNNEL SUB	0	129	60	38	1	1	2013	2015
MOJAVE SUB	311	492	50	79		3	2013	2015
MONROE SUB	501	190	14	24		4	2014	2015
MONTANA SUB	135	184	2	44		2	2014	2015
MT. VERNON SUB	254	339	23	19		4	2012	2013
NAMPA SUB	214	457	63	98		2	2011	2013
NAVASOTA SUB	0	101	19	27		4	2013	2014
NEVADA SUB	249	421	36	54		2	2012	2014
NILES SUB	4	35	14	13		3	2011	2012

Table 8: Schedule of PTC Wayside Devices Installation (Sorted by Line Segment)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
NOGALES SUB	0	66			26	3	2014	2015
NORTH PLATTE TERMINAL	282	292	14	8		1	2011	2012
OAKLAND SUB	10	93	29	22		3	2011	2013
OGDEN SUB	1	111	4	84		2	2012	2014
OMAHA SUB	329	39	16	28		1	2011	2013
PALESTINE SUB	0	229	35	54		4	2011	2013
PANA SUB	145	276	22	35		4	2012	2013
PARSONS SUB	0	136	3	42	3	4	2014	2015
PEORIA SUB	0	93	5	12	21	5	2011	2012
PINE BLUFF SUB	263	525	55	74		4	2012	2014
POCATELLO SUB	0	214	61	87		2	2011	2013
PORTLAND SUB	1	185	44	94		2	2010	2012
POWDER RIVER SUB	166	167	1			1	2010	2011
POWDER RIVER SUB	167	272	13	52		1	2010	2011
PRATT SUB	298	544	35	77		1	2015	2015
PROVO SUB	626	746	32	38	2	1	2013	2015
RAWLINS SUB	683	815	29	93		1	2012	2013
REISOR SUB	196	351	2	68		4	2013	2014
RIVER SUB	128	276	14	59		4	2011	2012
ROSEVILLE SUB	106	247	15	49		3	2013	2015
SACRAMENTO SUB	95	205	24	24		3	2015	2015
SALEM SUB	185	254	12	16		4	2012	2013
SALINA SUB	73	187	2	62		1	2015	2015
SALT LAKE SUB	783	819	15	16	2	2	2011	2012
SANDERSON SUB	379	611	51	46		4	2012	2013
SANTA BARBARA SUB	248	400	14	101		3	2010	2012
SANTA BARBARA SUB	400	423	5	12		3	2010	2012
SEATTLE SUB	6	183	9	5		2	2013	2014
SEDALIA SUB	128	277	18	54		4	2011	2012
SHAFTER SUB	714	911	49	61		2	2012	2014
SHARON SPRINGS SUB	187	430	18	20	72	1	2015	2015
SHARP SUB	664	752	13	26		2	2012	2013
SHREVEPORT SUB	390	452		6	12	4	2013	2014
SIDNEY SUB	292	510	37	93		1	2012	2013
SIOUX CITY SUB	6	77	3	31	13	5	2014	2015
SMITHVILLE SUB	69	135	1	8	13	4	2014	2015
SOUTH MORRILL SUB	0	166	24	97		1	2010	2011
SPOKANE SUB	2	141		1	60	2	2010	2011
SPRINGFIELD SUB	127	283	24	43		4	2011	2012
STRANG SUB	0	21	14	3	5	4	2011	2012
TERMINAL SUB	353	377	18	8		4	2011	2012
TOPEKA SUB	89	171	19	29		1	2012	2013
TOYAH SUB	448	769	52	130		4	2013	2014
TRACY SUB	35	41	2	5		3	2011	2012
TRENTON SUB	65	500	24	66		5	2013	2015
TUCUMCARI SUB	544	740	26	82		1	2015	2015
VALENTINE SUB	611	827	47	60		4	2012	2013
VALLEY SUB	107	321	53	71		3	2013	2015
VAN BUREN SUB	344	495	2	65		4	2013	2014
VILLA GROVE SUB	9	145	28	39		4	2012	2014
WACO SUB	842	969	2	40	14	4	2012	2013
WAGONER SUB	495	663	8	81		4	2013	2014

Table 8: Schedule of PTC Wayside Devices Installation (Sorted by Line Segment)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
WALSENBURG SUB	125	172			8	1	2015	2015
WHITE BLUFF SUB	305	349	11	11		4	2014	2015
WILLAMETTE BRIDGE LINE	0	1	3			2	2011	2012
WINNEMUCCA SUB	322	536	46	52		2	2014	2015
WORTHINGTON SUB	121	509	4	20	63	5	2014	2015
WYEVILLE SUB	91	202		46		5	2014	2015
YODER SUB	164	243		2	18	1	2014	2015
YUMA SUB	539	733	56	73		3	2012	2014

Table 9: Schedule of PTC Wayside Devices Installation (Sorted by Work Complete Date)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
AUSTIN SUB	90	260	45	55		4	2010	2011
BEAUMONT SUB	378	621	29	50		4	2010	2011
CHOCTAW SUB	565	756	37	58		4	2010	2011
FT. WORTH SUB	101	251	28	27		4	2010	2011
LAFAYETTE SUB	205	353	34	33		4	2010	2011
POWDER RIVER SUB	166	167	1	3		1	2010	2011
POWDER RIVER SUB	167	272	13	49		1	2010	2011
SOUTH MORRILL SUB	0	166	24	97		1	2010	2011
SPOKANE SUB	2	141		1	60	2	2010	2011
ADAMS SUB	202	314		49		5	2010	2012
ALHAMBRA SUB	483	539	36	19		3	2010	2012
ANGLETON SUB	221	343	30	23		4	2011	2012
BLAIR SUB	326	367	13	8		5	2011	2012
BOONE SUB	202	326	13	71		5	2011	2012
BROOKLYN SUB	581	770	56	66		2	2010	2012
CLINTON SUB	2	202	37	106		5	2011	2012
COAST SUB	14	248	29	130		3	2010	2012
EVANSTON SUB	815	994	26	162		1	2010	2012
GLENWOOD SPRINGS SUB	129	450	58	46		1	2010	2012
GREEN RIVER SUB	452	604	49	41		1	2010	2012
GREEN RIVER SUB	450	452	1	2		1	2010	2012
GREEN RIVER SUB	604	626	9	1		1	2010	2012
HOUSTON WEST BELT SUB	229	238	18	4	3	4	2011	2012
JOLIET SUB	37	127	16	33		5	2011	2012
KENTON LINE	0	22	10	9		2	2011	2012
LA GRANDE SUB	185	291	43	31		2	2010	2012
LITTLE ROCK SUB	344	90	75	56		4	2011	2012
LIVONIA SUB	10	115	30	19	5	4	2011	2012
LOS ANGELES SUB	2	162	31	16		3	2011	2012
NILES SUB	4	35	14	13		3	2011	2012
NORTH PLATTE TERMINAL	282	292	14	8		1	2011	2012
PEORIA SUB	0	93	5	12	21	5	2011	2012
PORTLAND SUB	1	185	44	94		2	2010	2012
RIVER SUB	128	276	14	59		4	2011	2012
SALT LAKE SUB	783	819	15	16	2	2	2011	2012
SANTA BARBARA SUB	248	400	14	101		3	2010	2012
SANTA BARBARA SUB	400	423	5	12		3	2010	2012
SEDALIA SUB	128	277	18	54		4	2011	2012
SPRINGFIELD SUB	127	283	24	43		4	2011	2012
STRANG SUB	0	21	14	3	5	4	2011	2012
TERMINAL SUB	353	377	18	8		4	2011	2012
TRACY SUB	35	41	2	5		3	2011	2012
WILLAMETTE BRIDGE LINE	0	1	3			2	2011	2012
ANCHORAGE SUB	621	644	1	4	6	4	2011	2013
AVONDALE SUB	11	15	1	2		4	2011	2013
AYER SUB	184	355	14	84		2	2011	2013
BORIE CUT-OFF	98	103		1		1	2012	2013
CHESTER SUB	0	172	46	52		4	2011	2013

Table 9: Schedule of PTC Wayside Devices Installation (Sorted by Work Complete Date)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
COLUMBUS SUB	39	145	26	84		1	2011	2013
DEL RIO SUB	201	379	41	40		4	2012	2013
DESOTO SUB	57	166	18	43		4	2010	2013
DESOTO SUB	0	57	11	25		4	2010	2013
FALLS CITY SUB	289	481	25	90		4	2012	2013
FRESNO SUB	39	311	86	90		3	2011	2013
GENEVA SUB	0	139	42	62		5	2011	2013
GLIDDEN SUB	1	201	41	57		4	2012	2013
GREELEY SUB	0	98	26	34	20	1	2010	2013
HARVARD SUB	0	87	18	116	2	5	2011	2013
HOUSTON EAST BELT SUB	0	11	16	8	3	4	2011	2013
HOXIE SUB	141	344	51	70		4	2011	2013
HUNTINGTON SUB	457	291	59	50		2	2011	2013
JEFFERSON CITY SUB	0	128	18	62		4	2011	2013
K.C. METRO (RIVER)	444	445				4	2012	2013
KEARNEY SUB	145	282	34	90		1	2011	2013
KENOSHA SUB	3	80	10	49	15	5	2011	2013
LARAMIE SUB	510	683	47	98		1	2012	2013
LORDSBURG SUB	988	1298	46	145		3	2012	2013
MARTINEZ SUB	2	106	46	48		3	2011	2013
MARYSVILLE SUB	143	288	28	91		1	2012	2013
MT. VERNON SUB	254	339	23	19		4	2012	2013
NAMPA SUB	214	457	63	98		2	2011	2013
OAKLAND SUB	10	93	29	22		3	2011	2013
OMAHA SUB	329	39	16	28		1	2011	2013
PALESTINE SUB	0	229	35	54		4	2011	2013
PANA SUB	145	276	22	35		4	2012	2013
POCATELLO SUB	0	214	61	87		2	2011	2013
RAWLINS SUB	683	815	29	93		1	2012	2013
SALEM SUB	185	254	12	16		4	2012	2013
SANDERSON SUB	379	611	51	46		4	2012	2013
SHARP SUB	664	752	13	26		2	2012	2013
SIDNEY SUB	292	510	37	93		1	2012	2013
TOPEKA SUB	89	171	19	29		1	2012	2013
VALENTINE SUB	611	827	47	60		4	2012	2013
WACO SUB	842	969	2	40	14	4	2012	2013
ALBERT LEA SUB	193	352	26	40	5	5	2013	2014
ALEXANDRIA SUB	115	190	10	18		4	2013	2014
BAIRD SUB	252	448	39	60		4	2013	2014
BRINKLEY SUB	4	71	1	33		4	2013	2014
BRYAN SUB	99	121		9		4	2013	2014
CASCADE SUB	429	581	44	64		2	2012	2014
ELKO SUB	671	532	8	110		2	2012	2014
EUREKA SUB	0	65		29		4	2013	2014
GILA SUB	733	988	64	94		3	2012	2014
HEARNE SUB	1	90	2	38		4	2013	2014
JONESBORO SUB	40	263	47	74		4	2012	2014
K.C. METRO (FALLS CITY)	285	289	3	2		4	2012	2014
K.C. METRO (KANSAS)	0	7	12	4		4	2012	2014
K.C. METRO (KCTRR)	277	283	7	4		4	2012	2014
KANSAS SUB	7	143	36	48		1	2012	2014

Table 9: Schedule of PTC Wayside Devices Installation (Sorted by Work Complete Date)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
LAKE CHARLES SUB	602	680		22	5	4	2013	2014
LAKESIDE SUB	557	781	26	106	2	2	2012	2014
LOS NIETOS SUB	0	7	3	5	4	3	2012	2014
LUFKIN SUB	2	232	2	116		4	2013	2014
MANKATO SUB	1	351	1	26	54	5	2013	2014
MASON CITY SUB	74	193	14	45		5	2013	2014
MCGEHEE SUB	350	501	25	37		4	2013	2014
MEMPHIS SUB	288	380	18	27	8	4	2013	2014
NAVASOTA SUB	0	101	19	27		4	2013	2014
NEVADA SUB	249	421	36	54		2	2012	2014
OGDEN SUB	1	111	4	84		2	2012	2014
PINE BLUFF SUB	263	525	55	74		4	2012	2014
REISOR SUB	196	351	2	68		4	2013	2014
SEATTLE SUB	6	183	9	5		2	2013	2014
SHAFTER SUB	714	911	49	61		2	2012	2014
SHREVEPORT SUB	390	452		6	12	4	2013	2014
TOYAH SUB	448	769	52	130		4	2013	2014
VAN BUREN SUB	344	495	2	65		4	2013	2014
VILLA GROVE SUB	9	145	28	39		4	2012	2014
WAGONER SUB	495	663	8	81		4	2013	2014
YUMA SUB	539	733	56	73		3	2012	2014
ALTOONA SUB	1	91	1	40	7	5	2013	2015
BLACK BUTTE SUB	321	429	28	38		3	2013	2015
BROWNSVILLE SUB	0	221	13	9	54	4	2014	2015
CALIENTE SUB	334	577	80	66		2	2013	2015
CANYON SUB	205	322	36	37		3	2010	2015
CARRIZOZO SUB	740	969	34	75		3	2015	2015
CHEROKEE SUB	386	565	11	90		4	2014	2015
CIMA SUB	162	334	59	38		3	2014	2015
COFFEYVILLE SUB	285	664	30	71		4	2013	2015
COLORADO SPRINGS SUB	0	110	19	48		1	2015	2015
CORPUS CHRISTI SUB	3	150		4	64	4	2014	2015
CORSICANA SUB	525	621	17	23	1	4	2014	2015
CUERO SUB	14	122	1	7	16	4	2014	2015
DALLAS SUB	210	252	20	9		4	2014	2015
DUNCAN SUB	436	613	4	12	44	4	2015	2015
EAGLE PASS SUB	0	35			24	4	2014	2015
EAST DENVER BELT LINE	0	4	4			1	2014	2015
ENID SUB	243	436	2		72	4	2015	2015
ENNIS SUB	121	261	10	60		4	2014	2015
FAIRMONT SUB	1	43			18	5	2015	2015
GALVESTON SUB	0	47	1	1	41	4	2014	2015
GIDDINGS SUB	0	77	13	24		4	2014	2015
HERINGTON SUB	171	298	8	54		1	2015	2015
HIAWATHA SUB	43	108	1	5	6	1	2014	2015
JEWELL SUB	0	50		1	14	5	2015	2015
JULESBURG SUB	56	81		21	7	1	2014	2015
K.C. METRO (COFFEYVILLE)	279	285	6	1		4	2014	2015
LAREDO SUB	260	413	18	58	24	4	2014	2015
LIMON SUB	430	638	14	14	70	1	2015	2015

Table 9: Schedule of PTC Wayside Devices Installation (Sorted by Work Complete Date)								
Line Segment	From MP	To MP	Control Points	Int Signals	Switches	BRS Zone	Work Start	Work Complete
LOCKHART SUB	0	52	1	5	3	4	2014	2015
LOST SPRINGS SUB	171	243		1	21	4	2015	2015
LYNNDYL SUB	577	784	64	60		2	2013	2015
MIDLOTHIAN SUB	0	50	2	23		4	2014	2015
MILWAUKEE SUB	3	97	6	42		5	2014	2015
MINEOLA SUB	90	213	34	43		4	2013	2015
MOFFAT TUNNEL SUB	129	168	8	11	4	1	2013	2015
MOFFAT TUNNEL SUB	0	129	60	38	1	1	2013	2015
MOJAVE SUB	311	492	50	79		3	2013	2015
MONROE SUB	501	190	14	24		4	2014	2015
MONTANA SUB	135	184	2	44		2	2014	2015
NOGALES SUB	0	66			26	3	2014	2015
PARSONS SUB	0	136	3	42	3	4	2014	2015
PRATT SUB	298	544	35	77		1	2015	2015
PROVO SUB	626	746	32	38	2	1	2013	2015
ROSEVILLE SUB	106	247	15	49		3	2013	2015
SACRAMENTO SUB	95	205	24	24		3	2015	2015
SALINA SUB	73	187	2	62		1	2015	2015
SHARON SPRINGS SUB	187	430	18	20	72	1	2015	2015
SIOUX CITY SUB	6	77	3	31	13	5	2014	2015
SMITHVILLE SUB	69	135	1	8	13	4	2014	2015
TRENTON SUB	65	500	24	66		5	2013	2015
TUCUMCARI SUB	544	740	26	82		1	2015	2015
VALLEY SUB	107	321	53	71		3	2013	2015
WALSENBURG SUB	125	172			8	1	2015	2015
WHITE BLUFF SUB	305	349	11	11		4	2014	2015
WINNEMUCCA SUB	322	536	46	52		2	2014	2015
WORTHINGTON SUB	121	509	4	20	63	5	2014	2015
WYEVILLE SUB	91	202		46		5	2014	2015
YODER SUB	164	243		2	18	1	2014	2015

10 Designating Track as Main Line or Non-Main Line [§ 236.1011(a)(8)]

Table 10 identifies each line segment on which Union Pacific is the *host railroad* (§236.1003), whether that segment meets the definition of *PTC Main Line* (per §236.1003) or not, and whether a *Main Track Exclusion Addendum* (*MTEA*, §236.1019) is sought. Route miles listed those represent route miles controlled by Union Pacific. Mile posts identify line segment boundaries; however, route miles between boundaries are subject to mile pole equations and Foreign Railroad control.

Excluded from this table are all line segments designated as *Industrial Leads* or *Business Tracks* in the Union Pacific Timetable. Operations on these line segments are conducted in accordance with the provisions of *restricted speed* (§236.812), which excludes them from the definition of *PTC Main Line*. These line segments are further described and identified in Section 10.1.

Table 10: Line Segments and Their Status as *PTC Main Line*

Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
ABERDEEN SUB	0	28	35				Y		
ADAMS SUB	202	314	112			Y	Y	**Y**	
ALBERT LEA SUB	193	352	137			Y	Y	**Y**	
ALEXANDRIA SUB	115	190	76			Y	Y	**Y**	
ALHAMBRA SUB	483	539	56		Y	Y	Y	**Y**	
ALTOONA SUB	1	91	89			Y	Y	**Y**	
ANCHORAGE SUB	621	644	23			Y	Y	**Y**	
ANGLETON SUB	221	343	122			Y	Y	**Y**	
ARBOR SUB	1	56	52						
ATHENS SUB	0	14	14						
AUSTIN SUB	90	260	170		Y	Y	Y	**Y**	
AVONDALE SUB	11	15	4			Y	Y	**Y**	
AVOYELLES SUB	0	13	12	Non-Signaled Yard Limits		Y	Y		
AYER SUB	184	355	172			Y	Y	**Y**	
BAIRD SUB	252	448	196			Y	Y	**Y**	
BAYTOWN SUB	0	49	49	Non-Signaled Yard Limits		Y	Y		
BEAUMONT SUB	378	621	193		Y	Y	Y	**Y**	
BELVIDERE SUB	31	78	47				Y		
BLACK BUTTE SUB	321	429	105		Y	Y	Y	**Y**	
BLAIR SUB	326	367	40			Y	Y	**Y**	

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
BMI SUB	0	11	11				Y		
BOONE SUB	202	326	121			Y	Y	**Y**	
BORIE CUT-OFF	98	103	4			Y	Y	**Y**	
BRINKLEY SUB	4	71	66			Y	Y	**Y**	
BROOKLYN SUB	581	770	167		Y	Y	Y	**Y**	
BROWNSVILLE SUB	0	221	221			Y	Y	**Y**	
BRYAN SUB	99	121	21			Y	Y	**Y**	
CACHE VALLEY SUB	0	51	51						
CALEXICO SUB	667	709	42				Y		
CALIENTE SUB	334	577	241			Y	Y	**Y**	
CANE CREEK SUB	0	37	37						
CANYON SUB	205	322	114			Y	Y	**Y**	
CARRIZOZO SUB	740	969	229			Y	Y	**Y**	
CASCADE SUB	429	581	152		Y	Y	Y	**Y**	
CEDAR CITY SUB	0	32	32				Y		
CHEROKEE SUB	386	565	186			Y	Y	**Y**	
CHESTER SUB	0	172	172			Y	Y	**Y**	
CHIPPEWA FALLS SUB	0	12	12						
CHOCTAW SUB	565	756	190			Y	Y	**Y**	
CIMA SUB	162	334	172			Y	Y	**Y**	
CLINTON SUB	2	202	197			Y	Y	**Y**	
CLYMAN SUB	112	140	28						
COAST SUB	14	248	235		Y		Y	**Y**	
COFFEYVILLE SUB	285	664	183			Y	Y	**Y**	
COLETO CREEK SUB	0	15	15						
COLORADO SPRINGS SUB	0	110	71			Y	Y	**Y**	
COLUMBUS SUB	39	145	105			Y	Y	**Y**	
CORPUS CHRISTI SUB	3	150	146			Y	Y	**Y**	
CORSICANA SUB	525	621	96			Y	Y	**Y**	
CRAIG SUB	168	27	88			Y			
CUERO SUB	14	122	108			Y	Y	**Y**	
DALLAS SUB	210	252	41		Y	Y	Y	**Y**	
DEL RIO SUB	201	379	178		Y	Y	Y	**Y**	
DESOTO SUB	57	166	106		Y		Y	**Y**	Y
DESOTO SUB	0	57	57		Y	Y	Y	**Y**	
DFW SUB	612	644	0						
DRY VALLEY SUB	0	24	24				Y		

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
DUNCAN SUB	436	613	177			Y	Y	**Y**	
EAGLE PASS SUB	0	35	35			Y	Y	**Y**	
EAST DENVER BELT LINE	0	4	4			Y	Y	**Y**	
EL CENTRO SUB	130	148	18						
EL DORADO SUB	461	497	36				Y		
ELKO SUB	671	532	139		Y	Y	Y	**Y**	
ENERGY LINE	0	12	12			Y			
ENID SUB	243	436	190			Y	Y	**Y**	
ENNIS SUB	121	261	141			Y	Y	**Y**	
ESTHERVILLE SUB	0	79	78						
EUREKA SUB	0	65	65			Y	Y	**Y**	
EVANSTON SUB	815	994	179			Y	Y	**Y**	
FAIRMONT SUB	43	108	65						
FAIRMONT SUB	1	43	42			Y	Y	**Y**	
FALLS CITY SUB	289	481	192			Y	Y	**Y**	
FORT COLLINS SUB	4	30	26						
FORT DODGE SUB	0	76	76				Y		
FRESNO SUB	39	311	272		Y	Y	Y	**Y**	
FT. WORTH SUB	101	251	150			Y	Y	**Y**	
GALVESTON SUB	0	47	45			Y	Y	**Y**	
GENEVA SUB	0	139	139		Y	Y	Y	**Y**	
GERALD GENTLEMAN SUB	0	10	9			Y			
GIDDINGS SUB	0	77	77			Y	Y	**Y**	
GILA SUB	733	988	255		Y	Y	Y	**Y**	
GLENWOOD SPRINGS SUB	129	450	145		Y	Y	Y	**Y**	
GLIDDEN SUB	1	201	200		Y	Y	Y	**Y**	
GREELEY SUB	0	98	98			Y	Y	**Y**	
GREEN RIVER SUB	452	604	152		Y	Y	Y	**Y**	Y
GREEN RIVER SUB	450	452	2		Y	Y	Y	**Y**	
GREEN RIVER SUB	604	626	23		Y	Y	Y	**Y**	
HALLAM SUB	0	38	38						
HARLINGEN SUB	0	24	24				Y		
HARTLAND SUB	107	120	12						
HARVARD SUB	0	87	87		Y	Y	Y	**Y**	
HEARNE SUB	1	90	89			Y	Y	**Y**	
HELENA SUB	280	327	46						
HERINGTON SUB	171	298	126			Y	Y	**Y**	

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
HIAWATHA SUB	43	108	65			Y	Y	**Y**	
HOUSTON EAST BELT SUB	0	11	11		Y	Y	Y	**Y**	
HOUSTON WEST BELT SUB	229	238	9		Y	Y	Y	**Y**	
HOXIE SUB	141	344	203		Y	Y	Y	**Y**	
HULBERT SUB	474	479	5						
HUNTINGTON SUB	457	291	181			Y	Y	**Y**	
JEFFERSON CITY SUB	0	128	125		Y	Y	Y	**Y**	
JEWELL SUB	50	97	47				Y		
JEWELL SUB	0	50	50			Y	Y	**Y**	
JOLIET SUB	37	127	90		Y			**Y**	
JONESBORO SUB	40	263	222			Y	Y	**Y**	
JULESBURG SUB	0	56	57				Y		
JULESBURG SUB	56	81	25			Y	Y	**Y**	
K.C. JCT. CUT-OFF	0	2	2			Y			
K.C. METRO (COFFEYVILLE)	279	285	6			Y	Y	**Y**	
K.C. METRO (FALLS CITY)	285	289	4			Y	Y	**Y**	
K.C. METRO (KANSAS)	0	7	7			Y	Y	**Y**	
K.C. METRO (KCTRR)	277	283	6			Y	Y	**Y**	
K.C. METRO (RIVER)	444	445	1			Y	Y	**Y**	
KANSAS SUB	7	143	137			Y	Y	**Y**	
KEARNEY SUB	145	282	137			Y	Y	**Y**	
KENOSHA SUB	3	80	77		Y	Y	Y	**Y**	
KENTON LINE	0	22	22			Y	Y	**Y**	
KERRVILLE SUB	2	16	13						
LA GRANDE SUB	185	291	105			Y	Y	**Y**	
LA HABRA SUB	0	10	9				Y		
LAFAYETTE SUB	205	353	146		Y	Y	Y	**Y**	
LAKE CHARLES SUB	602	680	78			Y	Y	**Y**	
LAKE SUB	30	32	2			Y			
LAKESIDE SUB	557	781	224			Y	Y	**Y**	
LARAMIE SUB	510	683	172			Y	Y	**Y**	
LAREDO SUB	260	413	152			Y	Y	**Y**	
LAURENS SUB	0	30	28						
LAWTON SUB	0	43	43						
LIMON SUB	430	638	208			Y	Y	**Y**	
LINCOLN SUB	0	57	56				Y		
LITTLE ROCK SUB	344	90	236		Y	Y	Y	**Y**	

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
LIVONIA SUB	10	115	105		Y	Y	Y	**Y**	
LOCKHART SUB	0	52	52			Y	Y	**Y**	
LONE PINE SUB	380	432	50				Y		
LORDSBURG SUB	988	1298	310		Y	Y	Y	**Y**	
LOS ANGELES SUB	2	162	58		Y	Y	Y	**Y**	
LOS NIETOS SUB	0	7	7			Y	Y	**Y**	
LOST SPRINGS SUB	171	243	71			Y	Y	**Y**	
LUFKIN SUB	2	232	229			Y	Y	**Y**	
LYNNDYL SUB	577	784	208		Y	Y	Y	**Y**	
MALAD SUB	0	52	52				Y		
MANKATO SUB	1	351	118			Y	Y	**Y**	
MARION SUB	298	340	42			Y			
MARTINEZ SUB	2	106	104		Y	Y	Y	**Y**	
MARYSVILLE SUB	143	288	146			Y	Y	**Y**	
MASON CITY SUB	74	193	119			Y	Y	**Y**	
MCGEHEE SUB	350	501	152			Y	Y	**Y**	
MCHENRY SUB	58	69	11						
MEAD LAKE SUB	0	17	17						
MEMPHIS SUB	288	380	93			Y	Y	**Y**	
MIDLOTHIAN SUB	0	50	50			Y	Y	**Y**	
MILWAUKEE SUB	3	97	94			Y	Y	**Y**	
MINA SUB	0	43	43						
MINEOLA SUB	90	213	123		Y	Y	Y	**Y**	
MODOC SUB	508	553	45						
MOFFAT TUNNEL SUB	129	168	38			Y	Y	**Y**	
MOFFAT TUNNEL SUB	0	129	129		Y	Y	Y	**Y**	
MOJAVE SUB	311	492	182			Y	Y	**Y**	
MONROE SUB	501	190	101			Y	Y	**Y**	
MONTANA SUB	184	390	204				Y		
MONTANA SUB	135	184	49			Y	Y	**Y**	
MONTEREY SUB	89	105	16						
MONTGOMERY SUB	39	63	24						
MT. VERNON SUB	254	339	85			Y	Y	**Y**	
NAMPA SUB	214	457	242			Y	Y	**Y**	
NASHVILLE SUB	457	493	36				Y		
NAVASOTA SUB	0	101	101			Y	Y	**Y**	
NEVADA SUB	249	421	171		Y	Y	Y	**Y**	

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
NEW MADRID SUB	30	37	7			Y			
NILES SUB	4	35	31		Y	Y	Y	**Y**	
NOGALES SUB	0	66	66			Y	Y	**Y**	
NORTH FORK SUB	0	96	96			Y			
NORTH PLATTE TERMINAL	282	292	10			Y	Y	**Y**	
OAKLAND SUB	10	93	83		Y	Y	Y	**Y**	
OGDEN SUB	1	111	110			Y	Y	**Y**	
OKLAHOMA CITY SUB	482	515	33				Y		
OMAHA SUB	329	39	62			Y	Y	**Y**	
OSKALOOSA SUB	246	312	66						
PALESTINE SUB	0	229	229			Y	Y	**Y**	
PANA SUB	145	276	131			Y	Y	**Y**	
PARSONS SUB	0	136	94			Y	Y	**Y**	
PEORIA SUB	93	132	39				Y		
PEORIA SUB	0	93	93			Y	Y	**Y**	
PEQUOT SUB	57	63	6						
PERRY SUB	355	363	8	Rule 6.28					
PHOENIX SUB	803	980	176				Y		
PINCKNEYVILLE SUB	64	125	61						
PINE BLUFF SUB	263	525	262			Y	Y	**Y**	
PLEASANT VALLEY SUB	0	21	21						
POCATELLO SUB	0	214	214			Y	Y	**Y**	
PORTLAND SUB	1	185	184			Y	Y	**Y**	
POWDER RIVER SUB[2]	167	272	105			Y			
POWDER RIVER SUB	166	167	1			Y	Y	**Y**	
PRATT SUB	298	544	243			Y	Y	**Y**	
PROVO SUB	626	746	119		Y	Y	Y	**Y**	
RAKE SUB	0	57	57						
RAWLINS SUB	683	815	131			Y	Y	**Y**	
REISOR SUB	196	351	156			Y	Y	**Y**	
RIVER SUB	128	276	148			Y	Y	**Y**	
ROCKPORT SUB	0	16	16			Y			
ROCKWELL SUB	0	2	2	Non-Signaled Yard Limits		Y	Y		

[2] This line segment is carried forward into the implementation plan even though it is <u>not</u> PTC *Main Line* by definition.

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
ROSENBERG SUB	0	3	3	Rule 6.28					
ROSEVILLE SUB	106	247	140		Y	Y	Y	**Y**	
SACRAMENTO SUB	95	205	110		Y	Y	Y	**Y**	
SALEM SUB	185	254	65			Y	Y	**Y**	
SALINA SUB	73	187	114			Y	Y	**Y**	
SALT LAKE SUB	783	819	36			Y	Y	**Y**	
SAN PEDRO SUB	3	21	18				Y		
SANDERSON SUB	379	611	220		Y	Y	Y	**Y**	
SANTA BARBARA SUB	248	400	151		Y	Y	Y	**Y**	
SANTA BARBARA SUB	400	423	24		Y	Y	Y	**Y**	
SCOVILLE SUB	7	43	36						
SEATTLE SUB	6	183	27		Y	Y	Y	**Y**	
SEDALIA SUB	128	277	148		Y	Y	Y	**Y**	
SHAFTER SUB	714	911	198		Y	Y	Y	**Y**	
SHARON SPRINGS SUB	187	430	243			Y	Y	**Y**	
SHARP SUB	664	752	88			Y	Y	**Y**	
SHORELINE SUB	97	147	50			Y			
SHREVEPORT SUB	390	452	62			Y	Y	**Y**	
SIDNEY SUB	292	510	217			Y	Y	**Y**	
SIKESTON SUB	191	211	20						
SIOUX CITY SUB	6	77	71			Y	Y	**Y**	
SMITHVILLE SUB	69	135	66			Y	Y	**Y**	
SOUTH MORRILL SUB	0	166	166			Y	Y	**Y**	
SPARTA SUB	41	78	36						
SPOKANE SUB	2	141	138			Y	Y	**Y**	
SPRINGFIELD SUB	127	283	144		Y	Y	Y	**Y**	
STRANG SUB	0	21	21			Y	Y	**Y**	
TARA SUB	0	71	70				Y		
TENNESSEE PASS SUB	118	342	60			Y			
TERMINAL SUB	353	377	24		Y	Y	Y	**Y**	
TOPEKA SUB	89	171	82			Y	Y	**Y**	
TOYAH SUB	448	769	321			Y	Y	**Y**	
TRACY SUB	41	94	52				Y		
TRACY SUB	35	41	6		Y		Y	**Y**	
TRENTON SUB	65	500	151			Y	Y	**Y**	
TROY GROVE SUB	26	65	38						
TUCUMCARI SUB	544	740	196			Y	Y	**Y**	

Table 10: Line Segments and Their Status as *PTC Main Line*									
Line Segment	FromMP	ToMP	Route Miles	Restricted Speed	Passenger Trains	>=5 MGT/Yr	TIH/ PIH	PTC Main Line	MTEA
TULSA SUB	292	324	32						
VALENTINE SUB	611	827	212		Y	Y	Y	**Y**	
VALLEY SUB	107	321	208		Y	Y	Y	**Y**	
VAN BUREN SUB	344	495	151			Y	Y	**Y**	
VILLA GROVE SUB	9	145	136		Y	Y	Y	**Y**	
WACO SUB	842	969	127		Y	Y	Y	**Y**	
WAGONER SUB	495	663	168			Y	Y	**Y**	
WALSENBURG SUB	119	123	4	Rule 6.28		Y	Y		
WALSENBURG SUB	175	180	5	Non-Signaled Yard Limits			Y		
WALSENBURG SUB	125	172	47			Y	Y	**Y**	
WARM SPRINGS SUB	0	18	17				Y		
WHITE BLUFF SUB	305	349	43			Y	Y	**Y**	
WILLAMETTE BRIDGE LINE	0	1	0			Y	Y	**Y**	
WILMINGTON SUB	0	12	12				Y		
WINNEMUCCA SUB	322	536	213			Y	Y	**Y**	
WINONA SUB	154	3	10						
WORTHINGTON SUB	121	509	147			Y	Y	**Y**	
WYEVILLE SUB	91	202	110			Y	Y	**Y**	
WYNNE SUB	235	280	45						
YAKIMA SUB	0	7	4				Y		
YODER SUB	164	243	80			Y	Y	**Y**	
YUMA SUB	539	733	194		Y	Y	Y	**Y**	

10.1 Industrial Leads and Business Tracks

Union Pacific designates certain tracks in its Timetable as *Industrial Leads* or *Business Tracks*. These tracks are other than Main Tracks on which the method of operation specified in the Timetable is Rule 6.28 of the General Code of Operating Rules (GCOR) which requires movement at Restricted Speed prepared to stop within one-half the range of vision, short of train, engine, obstruction or switch not properly lined that may require the speed of a train or engine to be reduced but a speed of 20 MPH must not be exceeded. Rule 6.28 requires operation on line segments on which it is in effect to be in accordance with the provisions of restricted speed as defined in §236.812, thus exempting them from the *PTC Main Line* definition.

Table 11 identifies 286 Industrial Leads operated by Union Pacific, comprising approximately 1750 route miles of its rail network (the list of Business Tracks is too long for inclusion).

Table 11: Industrial Leads		
Airline	Alameda	Alden
Alton	Ankeny	Arenal
Arkansas City	Atchinson	Azusa
Bagnell	Barbours Cut	Bastrop
Bayou Pierre	Bayport Loop	Beloit
Bergstrom	Bestwall	Bingham
BMI Henderson	Bondurant	Bonham
Bonne Terre	Booth Yard	Boulder
Brea Chem	Broadway	Brownsville Port
Camp Beauregard	Camp Douglas	Camp Stanley
Cape Girardeau	Capital Drive	Cargill
Carty	Casper	Castle Valley
Cedar Bayou	Cedar Rapids	Celanese
Chandler	Chaska	Chemung
Chesterville	Chevron	Chicago Heights
Chino	Chocolate Bayou	Church
Cissna Park	Clifton	Cline Mine
Clinton	Coeur D'Alene	Columbia Tap
Commerce	Comstock	Conway
Coos Bay	Cragin	Craig
Crestmore	Crystal City	Crystal Lake
Cumberland	Cypress Bend	Dabney
Dakota City	Dart	Declezville
Del Amo	Dixon River	DK&S
DM&E East	DM&E West	Dolet Hills
Dolores	Dows	Eagle Grove
Edgewater	El Segundo	Elkol
Ellerbeck	Empire	Endicott

Table 11: Industrial Leads		
Evansville	Evona	Exxon
Fallon	Farm	Farnhamville
Flanigan	Fort Dodge	Freeport
Ft. Bliss	Fullerton	Garfield
Gatesville	General Chemical	Georgia St.
Gerogetown	Gilmore	Glass Track
Golden Valley	Granite City	Granite Rock
Granville	Gurdon	Hansen
Harbor	Hartley	Haven
Henderson	Hill Field	Hillsboro
HL&P	Holland	Hollingsworth
Hollister	Holtville	Homedale
Hope	Hot Springs	Hull Ave.
Huntsville	Idaho Northern	Ingalton
International	Ione	IPP
Jacksonville AFB	Jacksonville	Janesville
Jim Bridger	JWS	Kalan
Kanawha	Katy Eureka	KD
Kearney	Kellogg	Kerrville
Kohler	Kosmos	Labadie
Lake Charles	Lake	Lake Mills
Lakewood	Las Vegas	Lawton
Lesperance	LeTourneau	Lexington
Litchfield	Lompoc	Loyalton
Malden	Marblehead	Marcola
Marshall	Mason City	McHenry
McPherson	Medicine Bow	Milpitas
Miner	Monfort	Montalvo
Montroes	Mosher	N. Milpitas
N. San Jose	National Ave	Navigation

Table 11: Industrial Leads		
Nellis	Newark	Norkan
North Madera	Oak Creek	Oakdale
Olmito	Olympia	Orange
Orchard	Palo Alto	Parachute
Paramount	Patata	Pearson
Phillips Refinery	Pilot Rock	Pixley
Placerville	Plaines	Plainville
Popp	Port Chicago	Port Lavaca
Powerville	Provo	Pryor
Ramsey	Redwood Harbor	Redwood Junction
Reno	Richland	River
Riverside	Robinson	Rock Island
Rock Street	Rockwell	Rocky Flats
Roelyn	Rohr	Roll
Rosebluff	Roseport	Rowley
S. Rivergate	Sabine	San Jose
Santa Ana	Santa Cruz	Santa Monica
Seabrook	Seadrift	Sealy
Seaside	Sergeant Bluff	Shreveport
Solvay	Somerton	South Pass
South Torrington	Spence	Spreckels
St. Charles	St. John's	St. Joseph
Stanton	State Line	State Street
Stauffer	Ste. Genevieve	Stillwater
Stoddard	Stuttgart	Sumner
Sunnyside	Superior	Syracuse
T&NO	Tempe	Tenark
Texas City	Texas Gulf Soda	Tidewater
Tillamook	Tintic	Toledo
Torrence	Trigo	Tulsa

Table 11: Industrial Leads		
Tustin	Umatilla	Ute
UTIP	Vasona	Velsicol
Victoria	Warm Springs	Waterloo
Waukee	Waukesha	Weber
Weeping Water	West Des Moines	Westbank
Westville	Wharton	White Bluff
White Hills	Wichita	Woodbridge
Woods Cross		

11 Exceptions to Risk-Based Prioritization [§ 236.1011(a)(9)]

All factors considered in development of Union Pacific's sequence and schedule for installation of PTC along its lines, including any exceptions to risk-based prioritization, are identified and described in Section 7.1.

12 Strategy For Full PTC System Deployment [§ 236.1011(b)]

Union Pacific currently has no plan to significantly expand its PTC deployment to line segments other than those on which installation is required per 49 CFR 236 Subpart I. However, as indicated in this PTCIP, Union Pacific does plan to install PTC on certain line segments where installation might not otherwise be required, or where exclusion from the PTC baseline in accordance with §236.1005(b)(4) might legitimately be sought. An example of one such line segment is a portion of the Powder River Subdivision between Henry, NE (MP 172.6) and Shawnee Junction, WY (MP 271.5), where no passenger or TIH/PIH traffic existed in 2008.

The basis for Union Pacific's decision to install PTC on line segments where it is not required includes convenience for pilot or testing activities or where PTC operational continuity between required line segments might be maintained.

13 Main Line Track Exclusion Addendum [§ 236.1019]

Union Pacific and its respective passenger tenant have identified the line segments identified below for which a *limited operations exception* is sought in accordance with §236.1019(c)(3). Union Pacific will provide timetable and track profile data to FRA upon request to support consideration of any request identified in this section.

13.1 Desoto Subdivision

Union Pacific and Amtrak request granting of a limited operations exception for a portion of the Desoto Subdivision between MP 56.5 and MP 165.67 under §236.1019(c)(3). This line segment is eligible for consideration for a limited operations exception. Annual gross tonnage was low in 2008 (see Appendix B) and falls within the eligibility limit of 15 MGT/year; and the two passenger trains per day are within the limit of 4 or fewer. The two passenger daily trains, Amtrak's *Texas Eagle* long-distance route, are not scheduled to operate over this line segment at the same time. An extremely low volume of PIH/TIH material is transported over this line segment, none of which originated or terminated within the identified limits. Appendix B provides additional characteristics of this line segment.

13.2 Green River Subdivision

Union Pacific and Amtrak request granting of a limited operations exception for a portion of the Green River Subdivision between MP 452.0 and MP 603.9 under §236.1019(c)(3). This line segment is eligible for consideration for a limited operations exception. Annual gross tonnage was low in 2008 (see Appendix B) and falls within the eligibility limit of 15 MGT/year; and the two passenger trains per day are within the limit of 4 or fewer. The two passenger daily trains, Amtrak's *California Zephyr* long-distance route, are not scheduled to operate over this line segment at the same time. An extremely low volume of PIH/TIH material is transported over this line segment, none of which originated or terminated within the identified limits. Appendix B provides additional characteristics of this line segment.

Appendices to Positive Train Control Implementation Plan (PTCIP)

Version 1.1

05/21/2010

Submitted in fulfillment of 49 CFR Part 236, Subpart I, § 236.1011

REVISION HISTORY

Date	Version	Description	Author
04/16/2010	1	Initial Plan	UP
05/21/2010	1.1	Revision Per FRA Comments on Version 1	UP

Table of Contents

Appendix A – Installation Risk Analysis Methodology **1**

Appendix B – Line Segment Traffic, Operational, and Route Characteristics [§ 236.1011(a)(5) **46**

Appendix C – Copies of Tenant Railroad Responses [236.1011(a)(6)(iv)(B)] **61**

Table of Figures

[Confidential Information and Sensitive Security Information Redacted]

Table of Tables

[Confidential Information and Sensitive Security Information Redacted]

Appendix A – Installation Risk Analysis Methodology

[Confidential Information and Sensitive Security Information Redacted Pages 1-45]

Appendix B – Line Segment Traffic, Operational, and Route Characteristics [§ 236.1011(a)(5)]

[Confidential Information and Sensitive Security Information Redacted Pages 46-60]

Appendix C – Copies of Tenant Railroad Responses [236.1011(a)(6)(iv)(B)]

[Confidential Information and Sensitive Security Information Redacted Pages 61-69]