

Road Map Item #: 5.15

Product Name: **SAFETY AND SECURITY MANAGEMENT PLAN (SSMP)**

PMP Appendix: APPENDIX G

Submittal Date: May 1, 2013

**ABSTRACT:** This deliverable provides a blueprint for managing LRT system safety and security throughout the life of the project from Preliminary Engineering to the commencement of Revenue Service of the LRT system. This Rev 6 to the SSMP reflects changes made in response to PMOC comments on previous versions, as well as further refinements determined through coordination with TriMet.

# SAFETY AND SECURITY MANAGEMENT PLAN

Draft Report

May 2013

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# DOCUMENT REVISION RECORD

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## CRC Safety and Security Management Plan Light Rail Transit Alignment

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Revision Number	Date Issued	Approval	Comments
Rev. 00	July 2008 – Initial Draft Issue		
Rev. 01	March 2010 – Second Draft Issue		
Rev. 03	September 2011 – Initial Issue for FD		
Rev. 04	March 9, 2012 Issue for Final Design		
Rev. 05	FD September 2012		
Rev. 06	FFGA May 2013		

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# APPROVAL PAGE

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## Columbia River Crossing Program: Light Rail Transit alignment CRC Safety and Security Management Plan

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CRC Administrator	Date
TriMet Executive Director Capital Projects	Date
C-TRAN Executive Director/CEO	Date
TriMet General Manager	Date
TriMet Safety and Security Executive	Date
C-TRAN Director of Operations	Date

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# ACRONYMS

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ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
APTA	American Public Transportation Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
CA	CRC Administrator
CCTV	Closed-Circuit Television
CEO	Chief Executive Officer
CFR	Code of Federal Regulation
CIL	Certifiable Items List
CONTRACTOR	Contractor of any tier
CPTED	Crime Prevention through Environmental Design
CRC	Columbia River Crossing Program
CQP	Construction Quality Plan
CSSM	Construction Safety and Security Manual
CSSP	Construction (or Contractor's) Safety and Security Plan
C-TRAN	Clark County Public Transportation Benefit Area
DHS	Department of Homeland Security
DQP	Design Quality Plan
DSS	Director of Safety and Security
DSSE	Deputy Safety and Security Executive
CRC ESSC	Columbia River Crossing Executive Safety and Security Committee
FD	Final Design
FEIS	Final Environmental Impact Statement
FFGA	Full Funding Grant Agreement
FHWA	Federal Highway Administration
FLSC	Fire/Life Safety and Security Committee

FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GM	General Manager
HA	Hazard Analysis
JHA	Job Hazard Analysis
LRT	Light Rail Transit
LRV	Light Rail Vehicle
LRVM	LRV Contract Manager
MOW	Maintenance of Way
NFPA	National Fire Protection Association
ODOT	Oregon Department of Transportation
OR-OSHA	Oregon Occupational Safety and Health Administration
PE	Preliminary Engineering
PHA	Preliminary Hazard Analysis
PMOC	Project Management Oversight Consultant
PMP	Project Management Plan
PRO	Pre-Revenue Operations
PROC	Pre-Revenue Operations and Start-up Committee
PROP	Pre-Revenue Operations and Start-up Plan
PR. E	Project Engineer
QA	Quality Assurance
QC	Quality Control
OCS	Overhead Catenary System
RAC	Rail Activation Committee
RAP	Rail Activation Plan
RE	Resident Engineer
ROM	Rail Operations Manager

SED	Systems Engineering Director
SSC	CRC Light Rail Transit Safety and Security Committee
(S)SEPP	(System) Security and Emergency Preparedness Plan
SIT	System Integration Testing
SITC	System Integration Testing Committee
SITP	System Integration Testing Plan
SOA	State Oversight Agency
SOP	Standard Operating Procedure
SSC	Safety and Security Committee
SSE	Safety and Security Executive
SSCP	Safety and Security Certification Plan
SSCVR	Safety and Security Certification Verification Report
SSMP	Safety and Security Management Plan
SSPP	System Safety Program Plan
SUP	Start-Up Plan
TAC	Technical Advisory Committee
TCRC	Transportation Change Review Committee
TDM	Transit Design Manager
TM	Transit Manager
TP	Traction Power
TPSS	Traction Power Substation
TRE	Transit Resident Engineer
TriMet	Tri-County Metropolitan Transportation District
TSA	Transportation Safety Administration
TSEM	Transit Systems Engineering Manager
TVA	Threat and Vulnerability Analysis

WISHA Washington Industrial Safety and Health Act

WSDOT Washington State Department of Transportation

# 1. Management Commitment and Philosophy

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## 1.1 Safety and Security Policy Statement

The Columbia River Crossing (CRC) Safety and Security Committee (SSC) is made up of partner staff including representatives from Washington State Department of Transportation (WSDOT), Oregon Department of Transportation (ODOT), Clark County Public Transportation Benefit Area (C-TRAN), and Tri-County Metropolitan Transportation District (TriMet), as well as law enforcement in both Portland, Oregon and Vancouver, Washington. The Columbia River Crossing Light Rail Transit (LRT) project is of paramount importance to both transit agencies that serve the region. Together, the program team will strive to build a safe, secure, comfortable, reliable, and innovative project that will deliver transportation options to our growing region. Safety and security are values that affect all levels of the LRT activities, including planning, design, construction, testing, and operations. All LRT project personnel and contractors are charged with the responsibility of ensuring the safety and security of all C-TRAN and TriMet customers, employees, contractors, the public, and property.

The SSC is empowered and authorized to develop, implement, and administer a comprehensive, integrated, and coordinated System Safety and Security Program that identifies, prevents, and controls hazardous conditions affecting LRT resources and customers. This commitment to safety and security begins at the planning, design, construction, testing, and start-up phases of the project. All LRT engineering, operations, security and safety staff, project consultants, and construction firms are charged with the responsibility of ensuring the safety and security of customers, project employees, and the general public who come in contact with the LRT.

In collaboration with TriMet's Safety and Security Executive and C-TRAN's Director of Operations, the Transit Manager is delegated the authority to implement the Safety and Security Management Plan (SSMP), a component of the Project Management Plan (PMP). All project staff, including consultants and construction personnel, are directed to comply with the provisions of the SSMP and to fully cooperate in achieving both C-TRAN and TriMet's goal for a safe and secure transit system.

The SSMP lays out the strategies and describes the integration of safety and security activities for an effective safety and security plan designed to reduce the potential for accidents/incidents and increase the efficiency of operations. The SSMP describes the activities, methods for assuring their performance, and identifies the responsible person or entity for each.

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Nancy Boyd  
CRC Administrator  
Washington State Department of Transportation

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Date



## 1.2 Purpose of the Safety and Security Management Plan

The purpose of the SSMP is to provide a blueprint for managing safety and security throughout all phases of the LRT project. It defines the activities and methods for:

- Designing and constructing the highest practical levels of safety and security into the project.
- Identifying, evaluating, and resolving potential safety hazards and security vulnerabilities of the LRT system.
- Testing the system to assure it operates as designed in a safe and secure manner.
- Developing and managing start-up activities to assure operational safety and security.
- Establishing the responsibility and accountability for safety and security during each phase of the LRT project from Preliminary Engineering through Start-Up.

Further, the SSMP:

- States management's commitment to achieve the highest practical level of safety and security for C-TRAN and TriMet customers, employees, contractor personnel, and the public.
- Describes safety and security activities at each project phase.
- Describes integration of safety and security functions and activities within the CRC, C-TRAN, and TriMet's organizational structure.
- Defines the safety and security responsibilities of LRT project personnel for each described activity.
- Identifies the documentation and verification of safety and security activities.
- Describes the framework for assuring construction safety and security.

## 1.3 Applicability and Scope

The scope of the SSMP is comprehensive, covering all phases of the program beginning in Preliminary Engineering and ending at the start of Revenue Service. It covers program developmental activities during Preliminary Engineering, Engineering, Construction, acceptance testing and Start-Up, until the start of Revenue Operations. The SSMP may continue into revenue operations, if needed, to ensure any restrictions to full safety and security certification are satisfactorily resolved. The SSMP encompasses equipment, operating and maintenance plans, facilities, and procedures for the following:

- **System-wide Elements:** including the passenger vehicles, train control system, voice and data communications, Closed-Caption Television (CCTV), grade crossing and

traffic control system, central instrument houses, track, fare collection, supervisory control, traction power, overhead catenary system, fire protection and suppression systems, and auxiliary vehicles and equipment.

- **Fixed Facilities:** including stations, park-and-ride facilities, yard and shop, structures, and the operations control center. Equipment installed in stations stops such as lighting is considered part of the facility.
- **Safety, Security, System Assurance, and Maintenance Plans and Procedures:** including Emergency Preparedness Plan, Training Programs, Personnel Qualifications, Accident/Incident Investigation, Reporting Procedures, Pre-Operations Drills/Exercises, Rulebook and Standard Operating Procedures (SOPs).

The State Oversight Agency (SOA) provides oversight of the existing light rail system under the 49 Code of Federal Regulation (CFR) 659 rules. The SOA will be generally involved in all phases of the project especially during the Testing and Start-Up phases. The SSC will coordinate SOA involvement.

The SSMP will be updated regularly and submitted for review at entry to Preliminary Engineering (PE), entry into Engineering, and entry into the Full Funding Grant Agreement (FFGA).

## 1.4 SSMP Goal

The goal of the SSMP is to achieve the highest practical level of safety and security and to verify readiness to enter revenue service, beginning in Preliminary Engineering and continuing throughout Engineering, Construction, Testing and Start-Up. A systematic approach to hazard and threat/vulnerability management for the LRT project will be overseen by program staff throughout all phases of the project. The program will establish a proactive Construction Safety and Security Program whose goal is to minimize construction-related security breaches and achieve zero accidents for employees and general public.

This SSMP goal will be accomplished by:

- Clearly defining the acceptable levels of safety and security for each project element.
- Verifying that acceptable levels of safety and security are designed and constructed into the LRT project.
- Certifying safety and security elements throughout the project development process starting in Engineering and continuing through Testing and Start-Up.
- Coordinating a final verification of safety and security certification activities to support initiation of the project into revenue service.

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## 2. Integration of Safety and Security into Project Development Process

### 2.1 Safety and Security Activities

Table 2-1 Safety and Security Activities Matrix identifies the major safety and security-related activities that will be performed during the Preliminary Engineering, Engineering, Construction, and Testing and Start-Up phases of the CRC LRT project. A narrative description of the activities follows the table.

**Table 2-1 Safety and Security Activities Matrix**

Safety and Security Activities	Preliminary Engineering	Engineering	Construction	Testing and Start-Up
2.1.1 Develop & Implement SSMP	X	X	X	X
2.1.2 Develop & Implement Safety and Security Certification Plan (SSCP)	X	X	X	X
2.1.3 Update System Safety Program Plan (SSPP)			X	X
2.1.4 Update Security and Emergency Preparedness Plan (SEPP)			X	X
2.1.5 Identify & Establish Safety and Security Criteria	X	X	X	
2.1.6 Hazard Analysis Identification & Resolution	X	X	X	X
2.1.7 Threat and Vulnerability Assessment & Mitigation	X	X	X	X
2.1.8 Develop & Administer Safety and Security Committees	X	X	X	X
2.1.9 Perform Safety and Security Design Reviews	X	X	X	
2.1.10 Perform Construction Conformance Reviews		X	X	
2.1.11 Develop & Implement Rail Activation Plan			X	X
2.1.12 Develop & Implement Systems Integration Test Plan (including Emergency Drills)		X	X	X
2.1.13 Develop & Implement Start Up Plan			X	X
2.1.14 Develop & Implement Training Plan		X	X	X
2.1.15 Develop/Update & Implement Rules and Standard & Emergency Operating Procedures			X	X
2.1.16 Develop & Implement Pre-Revenue Operations/Simulated Service			X	X
2.1.17 Develop & Implement a Budget & a Schedule for Safety and Security Activities	X	X	X	X
2.1.18 Develop & Implement Safety and Security Monitoring & Reporting		X	X	X
2.1.19 Develop Safety and Security Audit Plan & Conduct Audits			X	X
2.1.20 Obtain State Oversight Agency Approval				X

Safety and Security Activities	Preliminary Engineering	Engineering	Construction	Testing and Start-Up
for Revenue Operations				
2.1.21 Develop and Implement Construction Safety Plan		x	x	x
2.1.22 Conduct Emergency Drills and Exercises			x	x

### 2.1.1 Develop and Implement SSMP

A project-specific Safety and Security Management Plan (SSMP) was developed in the PE phase of the project and has been updated, as appropriate, in each of the succeeding phases. The management and oversight of all of the critical elements contained in the SSMP occurs during SSMP implementation.

### 2.1.2 Develop and Implement SSCP

The project-specific Safety and Security Certification Plan (SSCP) is currently being developed and will be updated in each of the succeeding phases, as appropriate. The implementation of the SSCP includes the development of Certifiable Items Lists (CILs) and conformance checklists, followed by verification of conformance in design, construction, testing and operational requirements and issuance of Certificates of Conformance for each certifiable element as completed. The final steps in the process are the issuance of a System Certificate of Conformance, followed by the Safety and Security Certification Verification Report (SSCVR).

### 2.1.3 Update SSPP

TriMet's LRT System Safety Program Plan (SSPP) is reviewed annually and updated as required, in compliance with SOA (ODOT) requirements. The update that will include the CRC extension to the existing LRT system will likely begin late in the Engineering phase and continue into the Testing and Start-Up phase before it is submitted to ODOT and WSDOT for review and approval.

### 2.1.4 Update SEPP

As with the SSPP, the existing LRT System Security and Emergency Preparedness Plan (SEPP) is reviewed annually and updated as required, in compliance with SOA (ODOT) requirements. The update that will include the CRC extension to the existing LRT system will likely begin late in the Engineering phase and continue into the Testing and Start-Up phase before it is submitted to ODOT and WSDOT for review and approval.

### 2.1.5 Identify and Establish Safety and Security Criteria

This activity includes updating the TriMet Design Criteria and CRC-specific design criteria (for example, design criteria associated with the main river crossing bridge), with emphasis on safety and security-critical items for each element. Also included is the identification of all applicable codes, standards and regulations from which safety and security-critical items may be derived. Finally, items from the technical specifications, as they pertain to construction and/or operational elements, will be identified for safety and security certification. New criteria for operational elements may be identified even during the construction phase.

### **2.1.6 Hazard Analysis Identification and Resolution**

This activity consists of performing a Preliminary Hazard Analysis (PHA) and continues with additional hazard analyses that may be warranted as the project continues through the Engineering, Construction, and Testing and Start-Up phases. The initial PHA workshop for the LRT project was completed in December, 2012. A PHA matrix for each task is being developed, and will be expanded as needed by future HAs. All items on the matrix will be tracked through Engineering, Construction, and Start-Up for resolution. Peer reviews may be conducted if the SSC deems it warranted.

### **2.1.7 Threat and Vulnerability Assessment and Mitigation**

Similar to the HA activity, this activity consists of performing a Preliminary Threat and Vulnerability Analysis (TVA) during PE and additional TVAs that may be warranted as the project continues through its phases. The initial TVA workshop for the LRT project was completed in January, 2013. A TVA matrix for each task is being developed, and will be expanded as needed by future TVAs. All items on the matrix will be tracked through Engineering, Construction, and Start-Up for resolution. Peer reviews may be conducted if the SSC deems it warranted.

### **2.1.8 Develop and Administer Safety and Security Committees**

This activity includes the formation of the Safety and Security Committee (SSC) and the Fire/Life Safety and Security Committee (FLSC) during the PE phase, and the Rail Activation Committee (RAC) during the construction phase. The SSC and FLSC have been formed and are meeting regularly. It also includes project integration with TriMet standing committees, such as the Transportation Change Review Committee (TCRC) where the LRT project integrates with the current system. The activity also includes regular meetings and administration of each committee for its intended purpose throughout the Engineering, Construction and Start-Up phases.

### **2.1.9 Perform Safety and Security Design Reviews**

This activity involves the review of Preliminary Engineering and Engineering packages (drawings, specifications, and contract terms and conditions) from a safety and security perspective to confirm, and then certify, adherence to approved safety and security requirements.

### **2.1.10 Perform Construction Conformance Reviews**

This activity involves the review, inspection, and contractual testing of constructed elements to assure they conform to safety and security requirements and that system elements have been designed and contractually tested to perform as designed, and all be certified as to conformance to the approved design.

### **2.1.11 Develop and Implement Rail Activation Plan (RAP)**

This activity includes the development of a Rail Activation Plan (RAP) during the construction phase, and its implementation through the Start-Up phase. The RAP includes all activities necessary to demonstrate readiness of the agencies and the community to enter revenue service,

including a System Integration Test Plan (SITP) to cover all required tests and emergency drills and a Start-Up Plan (SUP) to cover all elements of readiness for revenue service from an operational and maintenance perspective, as well as the handoff from construction to operations.

#### **2.1.12 Develop and Implement System Integration Test Plan (SITP), Including Emergency Drills**

This activity includes the development of a System Integration Test Plan (SITP) during the construction phase, and its implementation through the Start-Up phase. A SITP is the plan that describes the management of the integration tests and emergency drills needed for validation of the designed integration of the infrastructure and all system elements, operations, and emergency response and management. The SITP will identify all required Systems Integration Tests (SIT) and Emergency Drills, a schedule for performing them, and detailed test and drill procedures.

#### **2.1.13 Develop and Implement Start-Up Plan (SUP)**

This activity includes the development of a Start-Up Plan (SUP) during the construction phase, and its implementation through the Start-Up phase. A SUP includes all non-design, non-construction and non-SIT activities, such as staffing, training, public safety and security awareness, receipt of manuals and drawings, legal, marketing, materials management, service integration, Pre-Revenue Operations (PRO) including a day-by-day PRO plan, among other things.

#### **2.1.14 Develop and Implement Training Plan**

This activity includes development of a training program in the Engineering phase and the implementation of the program through the Construction and Start-Up phases. The training program includes the training of maintenance and other TriMet/C-TRAN personnel on contractor-furnished or installed equipment, facilities, and systems (including associated training syllabuses and manuals), as well as the training of operations personnel on the new alignment, vehicles, and operations control functionality. If needed, the Training Plan may also include TriMet supplied training as a supplement to contractor or vendor supplied training.

#### **2.1.15 Develop/Update and Implement Rules and Standard and Emergency Operating Procedures (SOPs/EOPs)**

This activity, which will be detailed in the SUP, includes the review of existing rules and SOPs/EOPs, and the revision or development of new rules or SOPs/EOPs that may be required to safely, securely, and effectively operate the CRC LRT extension. The review and development is planned to begin during the construction phase and be completed during the Start-Up phase for use in training operating and maintenance personnel.

#### **2.1.16 Develop and Implement Pre-Revenue Operations Plan**

This activity, which is the final element of the SUP, involves the development of a day-by-day pre-revenue operation and start-up (PRO) plan during the construction phase, and its implementation and execution as the last step of the Start-Up phase. It will include simulated normal revenue operation, single-track operation, other non-normal operation, and emergency operations. It may also include the repeat of some emergency drills as a means of familiarizing

LRV operators, other TriMet personnel, C-TRAN personnel, and emergency response personnel who may not have participated during SIT, with the CRC alignment and its operation.

### **2.1.17 Develop and Implement Budget and Schedule for Safety and Security Activities**

This activity involves the development of a budget and schedule for the safety and security activities identified in the SSMP. They will be monitored and managed throughout the Engineering, Construction, and Start-Up phases.

### **2.1.18 Develop and Implement Safety and Security Monitoring and Reporting**

This activity includes the development of methods and tools, approved by the SSC, for monitoring and reporting progress against budget, schedule, and the activities identified in this SSMP. Initial development will be done during PE and the final monitoring tools and reporting requirements will be developed in Engineering, and used in all phases, with adjustments as needed, until unrestricted revenue operations are in progress.

### **2.1.19 Develop and Implement Safety and Security Audit Plan and Conduct Audits**

This activity consists of the development of an audit plan for activities within this SSMP. Audit Plan development will begin during PE and be completed during Engineering. An audit program will be implemented during Engineering, Construction, and Start-Up. The number and types of audits to be conducted will be determined by the SSC.

### **2.1.20 Obtain State Oversight Agency (SOA) Approval for Revenue Operations**

This activity includes the completion of all Certification requirements, SSC approval of the SSCVR, SSPP and SEPP submission to and approval by the SOA, and any other requirements that may be identified by the SOA during the testing and start-up phase of the project.

## **2.2 Procedures and Resources**

The TriMet Safety and Security Executive is assigned the task for overall administration of the SSMP. The Safety and Security Executive is supported by WSDOT, TriMet and C-TRAN Safety and Security staff and by safety/security consultant services, as needed. The level of consultant services is dependent on the particular needs of the LRT project.

The program has budgeted for staffing resources necessary for the ongoing activities of the SSC, including staff from WSDOT, ODOT, C-TRAN, and TriMet as well as local law enforcement in both Portland, Oregon and Vancouver, Washington detailed in the organization chart in Section 3.1.

The program budget includes full-time, dedicated staff resources from TriMet and WSDOT for the full duration of the project. The TriMet staff is assigned to assist in the implementation and oversee and monitor on a day to day basis the safety and security activities in Section 2.1, including SSC and will be responsible for transit safety. Input and oversight is also provided by the Manager, Safety Risk Assessment/Construction Safety and Safety and Security Executive. The Safety and Security Executive is a standing member of the both the Safety and Security Committee and the Fire/Life Safety Committee. The Commander of the TriMet Transit Police



Unit is also an active member of the Safety and Security Committee and Fire/Life Safety Committee. The Safety and Security Committee has been formed and is meeting on a monthly basis.

In addition to the safety and security staff, the program budget contains sufficient contingency to address design or construction changes necessary to bring identified hazards to an acceptable level of risk. The services of safety and security specialty consultants will be secured as necessary to assist in required tasks. The need for consultants will be evaluated as the project progresses. CRC has engaged the services of a safety and security consultant to perform a project-specific preliminary hazard analysis and threat, vulnerability, and consequence assessment. A draft PHA and TVA has been received from each consultant and will be finalized in 2013.

WSDOT safety staff will focus principally on construction safety activities associated with highway and bridge construction activities. CRC has established internal document management procedures and policies relative to the handling of records, and has implemented a policy consistent with TriMet and C-TRAN standards for identifying and managing sensitive security information, consistent with DHS / FTA guidelines. Procedures that will be used for other safety and security activities across the project phases are based on those routinely used in the rail transit industry and were successfully used in the design, construction, and activation of other TriMet LRT segments and ongoing TriMet LRT operations.

### **2.2.1 Plans, Manuals, and Procedures**

These documents address CRC's safety and security processes and procedures and will be updated as appropriate throughout the program. The latest approved version will be used in implementing the SSMP:

- ***Design Criteria:*** Criteria developed during PE will be refined early in Engineering.
- ***Design Quality Plan:*** The Design Quality Plan (DQP) will be completed early in Engineering.
- ***Construction Quality Plan:*** The Construction Quality Plan (CQP) will be completed in Engineering.
- ***Safety and Security Certification Plan:*** The Safety and Security Certification Plan (SSCP) portion needed for design certification will be completed early in Engineering; the balance of the SSCP will be completed by the end of Engineering.
- ***Construction Safety and Security Manual:*** The Construction Safety and Security Manual (CSSM) will be developed in time for issuance before the first construction contract is issued to bid
- ***Rail Activation Plan:*** The Rail Activation Plan (RAP) will be developed during the Construction Phase
- ***System Integration Test Plan:*** The System Integration Test Plan (SITP) will be developed during the Construction Phase.

- ***Pre-Revenue Operations & Start-Up Plan:*** The Pre-Revenue Operations & Start-Up Plan (PROP) will be developed during the Construction Phase. It will contain a detailed red-tag procedure.
- ***System Safety Program Plan:*** The designated SSOA will approve the System Safety Program Plan (SSPP), developed during the late Construction Phase for submission/approval during the testing and start-up phase.
- ***System Security and Emergency Preparedness Plan:*** The designated SSOA will approve the System Security and Emergency Preparedness Plan (SEPP), developed during the late Construction Phase for submission/approval during the testing and start-up phase.
- ***Tri-Met / C-TRAN SOPs, EOPs, Operating Rulebook, and Maintenance Procedures:*** The latest editions of each will be reviewed during the late construction phase and early testing and start-up phase and be revised as necessary to accommodate the operational and maintenance needs of the CRC extension of the LRT system.

The schedule for safety and security activities across the four project phases are included in Appendix A. It shows the timeline for activities through the end of construction and start-up phases. Details for the last two phases of the project will be developed during Engineering.

## **2.3 Interface with Management**

The following positions are directly involved with the implementation of the SSMP on the LRT project during one or more project phases. Refer to Section 3.1, Table 3-1 for the reporting relationships of the positions.

The CRC Safety and Security Executive (SSE) position will be filled by TriMet's Safety and Security Executive. This position will lead the safety and security effort for the LRT project. In addition, the SSE will be supported by a Deputy Safety and Security Executive (DSSE) position filled by the C-TRAN Director of Operations, the TriMet Manager, Safety Risk Assessment/Construction Safety, and a C-TRAN safety specialist, who will provide technical support. A TriMet safety lead will be assigned full time to the CRC Program, while the C-TRAN Specialist will be assigned to the LRT project on an as needed basis during Engineering and subsequent phases. The Specialists will assist the SSE, DSSE and the rest of the program management team in the execution of the SSMP. As activities warrant, additional safety and security staff may be utilized or safety/security consultant services obtained.

### **2.3.1 CRC Project Directors (PD)**

The CRC Project Directors positions are filled by WSDOT/ODOT staff. The PDs have final responsibility for the LRT project and are responsible for prioritizing and obligating the resources needed for successful completion of the program. The PD represents the program to outside agencies and interests including the Federal Transit Administration, the Federal Highway Administration, the U.S. Department of Transportation, state and local governments, and has a role in negotiations/dispute resolution with contractors.

### **2.3.2 CRC Transit Manager**

The CRC Transit Manager (TM) position is being filled by TriMet staff. The TM is responsible for day-to-day coordination of all activities related to the LRT project. The Transit Manager ensures integration and coordination between dedicated project staff, ODOT, WSDOT, and local jurisdiction efforts, consultants, and supporting division personnel. The TM defines LRT objectives and monitors work plans for all activities needed for successful completion of the project, including engineering, project control, construction management, safety and security, and community relations. The TM manages the quality assurance staff and is responsible for management of the construction safety and security program. The TM leads the implementation and execution of the safety and security certification process. The TM assists in developing plans and procedures for readiness, coordinates with the Operations and the Systems Engineering Director for safety and security certification, testing and Start-Up. The TM also works directly with the CRC Structures Highway Engineering Managers to coordinate bridge construction and safety and security efforts with respects to the LRT project. Other position responsibilities include coordination with the Project Management Oversight Consultant (PMOC). This position works closely with the Deputy Transit Manager. The TM reports to the CRC Project Directors and is a member of the SSC.

### **2.3.3 CRC Deputy Transit Manager**

The Deputy Transit Manager (DTM) position is currently vacant. The DTM is responsible for day-to-day coordination of all activities related to the LRT project in the Vancouver, Washington portion of the program and is an integral part of the Federal Transit Administration (FTA) approval process. The DTM is responsible for developing and maintaining relationships with Vancouver jurisdictional agencies and local stakeholders. Other responsibilities include coordination with the PMOC and maintaining project schedules. This position coordinates with the Transit Manager and is responsible for assuming the duties of Transit Manager in their absence. The DTM is a member of the SSC.

### **2.3.4 CRC Transit Design Manager**

The Transit Design Manager (TDM) position is filled by TriMet staff. The TDM manages the engineering contracts. The TDM manages the issuance of task orders and adherence to scope, schedule, and budget objectives; coordinates the activities of matrix staff resources to resolve issues and ensure technical compliance with agency requirements; ensures safety and security issues are addressed in design; initiates the design certification process and ensures adherence to CRC Transit Design Criteria for the LRT project. This position reports to the Transit Manager, and is a member of the SSC.

### **2.3.5 CRC Transit Project Engineers**

The Project Engineer (PR. E) positions are currently vacant but will be filled by either TriMet staff or consultant personnel during the Engineering phase. During Engineering, the PR. E will participate in developing contract specifications and special provisions and reviewing the design drawings. During the construction phase, PR. Es have the authority and responsibility for enforcing contract provisions, including construction safety and security provisions. These positions report to the Transit Manager.

### **2.3.6 Transit Systems Engineering Manager (TSEM)**

The Transit Systems Engineering Manager (TSEM) position is currently vacant but will be filled by either a TriMet staffer or consultant during the Engineering phase to manage the Type 5 Vehicle contract. Duties of the TSEM include responsibility for developing LRV contract requirements, issuing task orders, and ensuring adherence to scope, schedule, and budget objectives. This position is responsible for assuring each delivered LRV is fully safety and security certified.

The TSEM coordinates with the CRC Transit Systems Engineering Director (SED) and the TriMet Rail Operations Manager (ROM) to assure LRV performance integrates with system and operational elements of the project. This position reports to the Transit Manager.

### **2.3.7 CRC Safety and Security Executive**

The CRC Safety and Security Executive (SSE) position is being filled by the TriMet Safety and Security Executive. The SSE is the focal point of system safety and security for the CRC Program. The Safety and Security Executive has broad management authority and oversight of TriMet's corporate safety program, including rail, bus and paratransit services. This position is also responsible for the development of TriMet's security policies and procedures, training and staffing, and contract management.

The Safety and Security Executive manages and oversees all aspects of safety and security for the LRT project, including:

- Developing and managing the SSCP.
- Generating the CILs and CSSM
- Developing and including safety and security requirements in contract documents.
- Coordinating safety and security audits and reports
- Managing the safety and security aspects of training, testing, and start-up activities,
- Managing HA and TVA.
- Submitting and securing SOA approval of the SSPP and SEPP.
- Developing the SSCVR.

The SSE reports to the PD and has dotted-line interfaces with the managers of Transit, Structures Engineering, and Highway Engineering. This position chairs the SSC.

### **2.3.8 CRC Deputy Safety and Security Executive**

The Deputy Safety and Security Executive (DSSE) position is being filled by the C-TRAN Director of Operations. The DSSE works closely with the SSE to oversee the safety and security staff and functions, with emphasis on safety and security aspects of Vancouver LRT. The DSSE assumes the responsibility for the SSE in his absence and is the Vice Chair of the SSC.

### **2.3.9 CRC Senior Safety and Security Specialists**

The Senior Safety and Security Specialist positions are filled by TriMet and C-TRAN staff. During Engineering, TriMet has assigned the Manager, Safety Risk Assessment/Construction Safety that will likely transition full time to the project, while a C-TRAN Senior Safety and Security Specialist will be assigned to the LRT project on an as-needed basis during Engineering and subsequent phases. The Manager, Safety Risk Assessment/Construction Safety and C-TRAN's Senior Safety and Security Specialist will perform the day-to-day activities needed to implement and administer the construction safety and security programs and monitor and oversee the system safety and security certification program. They also participate on the SSC and coordinate with appropriate rail operations and Transit, Structures, and Highway Engineering staff and are responsible for:

- Assuring designs comply with federal, state, local, and program / agency safety and security standards.
- Reviewing plans, design drawings and specifications for adherence to safety and security design criteria and standards.
- Monitoring and evaluating effectiveness of the construction safety and security plans through the performance of audits.

The Manager, Safety Risk Assessment/Construction Safety and Senior Safety and Security Specialist report to either the SSE or the DSSE and have dotted-line interfaces with the CRC Structures and Highway Engineering Managers for construction safety and security.

### **2.3.10 TriMet Systems Engineering Director**

The Systems Engineering Director (SED) is responsible for day-to-day coordination of all systems activities related to the CRC Program. The Systems Engineering Director ensures integration and coordination between dedicated project staff, consultants and agency Operations and Maintenance personnel. The SED defines project objectives and monitors work plans for all activities needed for successful completion of systems elements of the project, including signals, communications, traction electrification, vehicles and fare collection, as well as system integration, testing and start-up. This position reports to the Executive Director, TriMet Capital Projects Division and TM.

### **2.3.11 CRC Structures Engineering Manager**

The CRC Structures Engineering Manager position is filled by WSDOT staff. This position is responsible for ensuring that all aspects of the conceptual design for structures associated with the CRC Program meet the design standards and policies for WSDOT, ODOT, TriMet, FHWA, and FTA. This position is responsible for managing the consultant design team's development of conceptual designs and costs estimates, as well as coordinating with the program stakeholders including ODOT, WSDOT, FHWA, FTA, the cities of Portland and Vancouver, Metro, RTC, Port of Portland, Port of Vancouver, TriMet, and C-TRAN. This position reviews and approves design deliverables to ensure that the design concepts are constructible and fundable.

### **2.3.12 CRC Highway Engineering Manager**

The CRC Highway Engineering Manager position is filled by WSDOT staff. This position is responsible for the day-to-day management of the Highway Engineering Team. This position works closely with internal teams including Environmental, Transit, Traffic, and Communications as well as ODOT, WSDOT, FHWA, FTA, the cities of Portland and Vancouver, RTC, Metro, C-TRAN, Tri-Met, and other stakeholders. This position is responsible for delivering the WSDOT and ODOT design and construction program within the CRC area and is responsible for strategic planning and leadership necessary to ensure the successful delivery of area transportation design and construction.

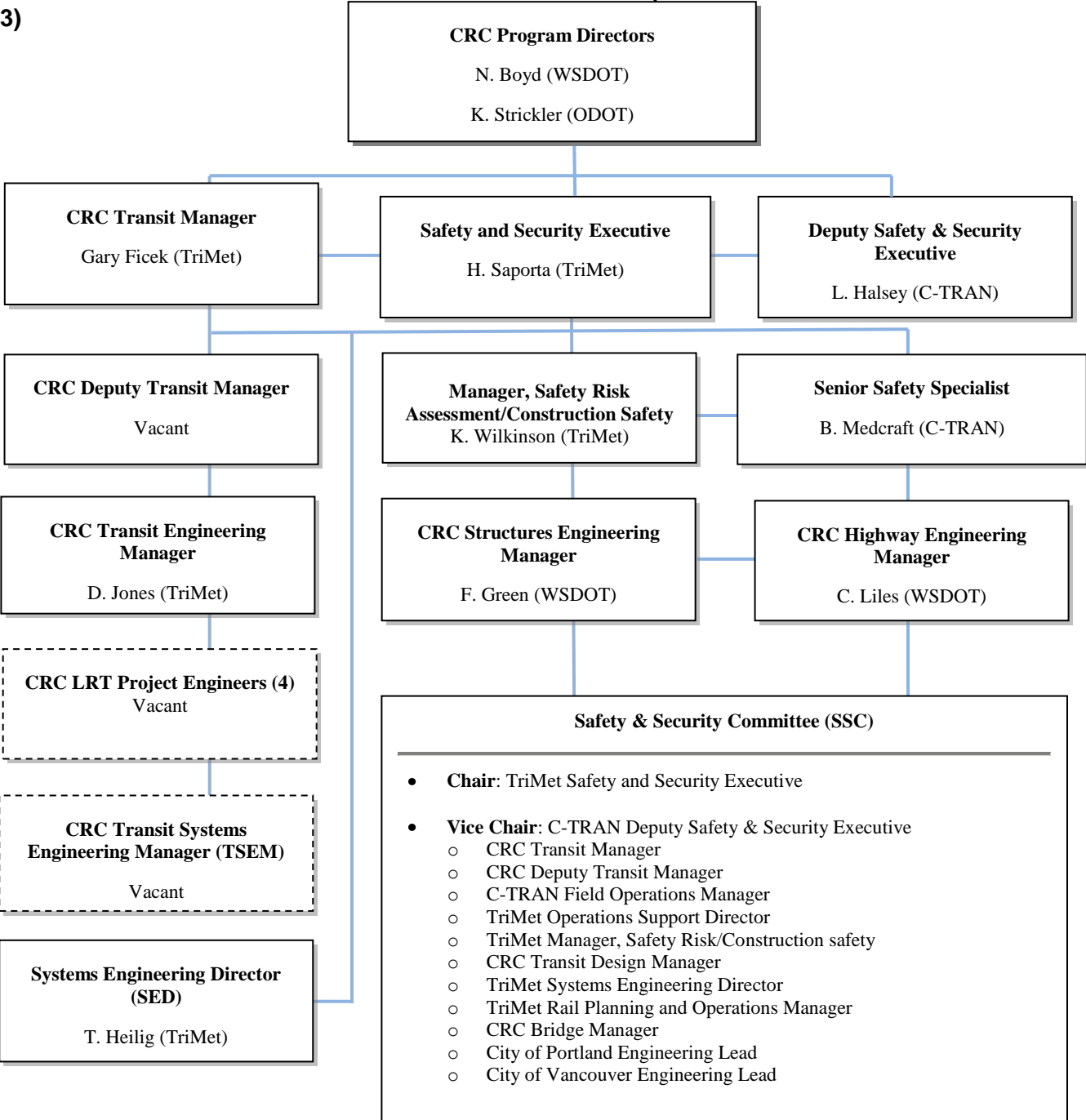
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# 3. Assignment of Safety and Security Responsibilities

## 3.1 Responsibility and Authority

Figure 3-1 shows the CRC Program’s Safety and Security Organization, with incumbents as of the date of this plan.

**FIGURE 3-1. CRC SAFETY AND SECURITY ORGANIZATIONAL CHART (INCUMBENTS AS OF MAY 2013)**





The CRC PDs have delegated the authority for the development and management of the SSMP to the Transit Manager, Deputy Transit Manager; Safety and Security Executive, and Deputy Safety and Security Executive. Through the SSE and DSSE assignments, TriMet and C-TRAN have integrated the safety and security responsibilities of their respective agencies into the CRC Program. These assignments demonstrate the agency's commitment to the process and highlight the priority of safety and security within both agencies and the LRT project.

Section 2.3 of this document provides a list of positions and their specific responsibilities for safety and security on the LRT project.

A more detailed list of SSE responsibilities than provided in Section 2.3 is provided below.

- Manages the safety and security program.
- Develops and manages the SSCP and chairs the SSC.
- Coordinates the system safety effort with systems engineering, civil engineering, quality assurance, integration and testing and program management.
- Assists in the identification of necessary technical safety criteria and requirements (including those associated with interfacing hardware, software and facilities) and ensures their incorporation into designs, specifications and planning documents.
- Ensures that submitted HA and TVA reports contain sufficient information to permit the TM and the SSC to make informed decisions and recommendations.
- Reviews system safety and security tasks, prioritizes risks and recommends engineering, procedural or other changes necessary to reduce the risks to an acceptable level.
- Ensures the implementation, documentation and tracking of all hazards, threats and vulnerabilities from identification through resolution or mitigation.
- Works with other CRC personnel to develop the CSSM and contract safety and security language, review and approve each contractor's site-specific construction safety and security plan (CSSP).
- Ensures that contractor CSSP's includes plans to address hazards, threats and vulnerabilities in their activities and at their work sites.
- Oversees and audits contractor adherence to their CSSP's.
- Ensures the Fire, Life, Safety, Committee is addressing concerns, recommending engineering or procedural changes.
- Participates in all major design reviews and provides lists of preliminary hazards, threats and vulnerabilities and other safety or security concerns and completes HAs and TVAs appropriate to the level-of-design detail.

- Provides recommendations for corrective actions and controls, based on analyses, sound engineering practices and management principles.
- Documents and reports ongoing safety and security activities and concerns.
- Participates in all major rail activation activities, including development and implementation of the RAP, SITP and PROP, and conducts SIT, PRO, and other start-up activities. Reviews and accepts the delivered project, system, sub-system or component, and provides a safety and security assessment and certification package, with any exceptions documented.
- Revises the TriMet SSPP and SEPP to address the CRC extension, submits them to the SOA for approval.
- Participates in review of contractor delivered projects, training, emergency drill and PRO results needed to initiate revenue service, and provides a safety and security assessment and a safety and security certification package for operational readiness, with any exceptions documented.
- Maintains safety and security oversight of project tests, operations, or other activities at a level consistent with the potential for loss over the life of the system to ensure that, in all instances, hazards, threats, and vulnerabilities are controlled, eliminated, or mitigated by corrective action.
- Develops, and submits the final SSCVR for approval, including full documentation of any exceptions to full certification and operational work-arounds.

## **3.2 Committee Structure**

### **3.2.1 Columbia River Crossing Safety and Security Committee (SSC)**

The SSC has been established and oversees all safety and security elements of the LRT project. This committee has been active since the start of the PE phase and will continue through start-up to resolve exceptions to full safety and security certification, without work-arounds. This committee is the main avenue for addressing safety and security issues on the LRT project. The committee is responsible for reviewing designs, providing comments on items like CCTV placement, operating concerns, maintenance issues, in addition to the full array of other safety and security critical items. Comments from the SSC will be incorporated into the design of the project, and topics discussed at the meetings will be tracked through completion.

The SSC is responsible for approving the SSCP and overseeing the management of the Safety and Security Certification Process. The SSC is responsible for coordinating with the wide array of technical specialties necessary to ensure that a comprehensive approach has been developed for all activities relating to safety and security certification for the LRT project. The SSC also ensures coordination with the safety and security aspects of the bridge project.

The SSC is composed of the following:

- **Chair:** TriMet Safety and Security Executive
- **Vice Chair:** C-TRAN Deputy Safety and Security Executive
  - CRC Transit Manager
  - CRC Deputy Transit Manager
  - C-TRAN Field Operations Manager
  - TriMet LRT Manager, Safety Risk Assessment/Construction Safety
  - CRC Transit Design Manager
  - TriMet Operations Support Director
  - TriMet Systems Engineering Director
  - TriMet Rail Planning Manager
  - CRC Bridge Manager
  - City of Portland Engineering Lead
  - City of Vancouver Engineering Lead
- In addition to the identified members, meetings may be attended by involved TriMet and C-TRAN personnel, including Legal and Community Affairs staff, SOA personnel, FTA/PMOC personnel, or invited technical experts. Project stakeholder staff are also invited to the meeting.

It is the responsibility of the SSC to oversee the timely development and completion of the various plans, procedures and lists needed in all four project phases, as well as their management and execution. The SSC's oversight is instrumental in ensuring the design and construction certifications, system integration tests, and pre-revenue operations and start-up plans are timely developed and executed. Elements not yet certified will be tracked on an open-items list and any work-arounds that may be needed for the project to proceed must be approved by the SSC. The SSC must also approve any work-around necessary to begin revenue service, as well as any exceptions to full revenue operation.

The principal duties of the SSC as they relate to Safety and Security Certification are to:

- Assists in the identification of hazards and vulnerabilities in the project and ensures that appropriate resolution or mitigation measures are developed.
- Advises designers and program staff in development of appropriate resolution or mitigation measures, specifications and certification lists.

- Ensures the continued development and evolution of certification lists as the project moves through Engineering, Construction, Testing and Start-Up.
- Monitors the progress towards completion of the certification list.
- Maintains an up-to-date matrix of open items and resolution of certification issues.
- Reviews conformance assessments and provides decisions on acceptance or correction of non-conforming items, including the nature of the required correction.
- Oversees certification and integration testing in the lead-up to revenue service.
- Coordinates pre-revenue readiness, emergency preparedness and safety/security outreach activities.
- Assist the SSE in developing the final SSCVR for approval by the PDs.

The SSC Chair (or designee) is responsible for arranging meetings, communicating decisions and queries to appropriate project staff for action, preparing meeting agendas and minutes. The Chair also maintains an open-items matrix, monitors safety and security activities and audits project files.

The SSC is the forum for formal discussion of safety and security issues. Meeting minutes are documented. Resolution of issues at the committee level is the goal.

### **3.2.2 CRC Executive Safety and Security Committee**

When the SSC is unsuccessful in resolving an issue, a written report will be prepared by the Chair. The report will summarize the alternative points of view, and will then be submitted to the CRC Project Director, TriMet General Manager, and C-TRAN General Manager with copies to each SSC member. The CRC Project Director, TriMet General Manager, and C-TRAN General Manager Team will provide direction for resolution of the issue. The final action taken will be presented at the next available SSC meeting and reflected in the minutes.

#### **3.2.2.1 Fire, Life, Safety and Security Committee (FLSC)**

- An FLSC specific to the LRT project was formed in Preliminary Engineering. The FLSC members include:
  - Chair: TriMet Safety and Security Executive
  - Vice Chair: C-TRAN Operations Director
  - CRC Transit Design Manager
  - TriMet Operations Support Director
  - TriMet Manager, Safety Risk Assessment/Construction Safety
  - C-TRAN Field Operations Manager
  - TriMet Transit Police Division of the Portland Police Bureau Representative
  - Vancouver Police Department Representative

- Portland Fire Bureau Operations/ Fire Marshall Representative
- Vancouver Fire Department Operations/ Fire Marshall Representative
- Portland Office of Emergency Management Representative
- WSDOT Safety and Health Representative
- Transportation Security Administration Representative
- And other applicable stakeholders as needed.

The FLSC helps to ensure compliance with fire and life safety codes and assists in emergency response preparedness prior to revenue service. This project specific FLSC serves as a subcommittee to the SSC.

#### **3.2.2.2 LRT Start Up Committee (System Integration Start-Up Committee)**

A project-specific LRT Start-Up Committee will be set-up as a subcommittee to the SSC. The purpose of the Start-Up Committee will be to implement the SITP and coordinate the numerous public safety and security, outreach and public information activities that are necessary to successfully introduce the LRT project to the community. The membership of this subcommittee will be determined during Construction.

#### **3.2.2.3 Rail Activation Committee (RAC)**

The RAC will be formed during the construction phase of the project. The purpose of the RAC is to ensure coordination between LRT staff, TriMet and C-TRAN Operations staff and the general contractor to bring the extension of TriMet's light rail system online for testing, training, pre-revenue operations, other start-up committees, and ultimately revenue service. The RAC ensures that training on civil and systems items takes place on the alignment and the systems therein. Sequencing of testing, training, and turnover will be addressed in this committee. In addition, the coordination of preview rides and other special events that may take place along the alignment during the final phases of testing and training will be covered in this committee. The System Integration Test Committee (SITC) and Pre-Revenue Operations and Start-Up Committee (PROC) will be formed as subcommittees to the RAC. The SITC will develop and manage the SITP, develop integration test and emergency drill procedures and conduct tests / drills. The PROC will develop and manage the PROP, identify and manage to completion all needed operational start-up activities, including development of a detailed day-by-day plan and conduct of pre-revenue operations at the conclusion of SIT. The membership of the RAC and its subcommittees will be determined during Construction. Committee members may include:

- LRT staff: signal engineers, Overhead Catenary System (OCS) and Traction Power (TP) engineers, track engineers, PR. E, Communication engineer, Community Affairs
- C-TRAN/TriMet Operations staff: Maintenance of Way (MOW) signals supervisor, MOW track supervisor, MOW OCS supervisor, MOW, Traction Power System Supervisor (TPSS), Field Operations Manager, MOW Engineering, MOW Communication Supervisor, Field Operations Coordinator, Safety, Operations Support, Rail Transportation Training Supervisor, Rail Equipment Maintenance Manager

#### **3.2.2.4 Transit Change Review Committee (TCRC)**

The TCRC is responsible for Configuration Control. The TCRC reviews any changes to the existing LRT system, design criteria and SOPs. The TCRC reviews and approves:

- New SOPs resulting from change or extension in the system.
- Updating or creating new operating procedures.
- Reviews any major safety/security incidents on the system.
- Reviews any alterations to existing equipment or light rail vehicles.
- Reviews new light rail vehicles.

This committee is also involved in the start-up of extensions, due to the approval authority for new SOPs, operating procedures, and training programs. Committee members will include representatives from TriMet/C-TRAN Operations, TriMet Maintenance, TriMet Maintenance of Way, TriMet/C-TRAN Safety, TriMet Field Operations, TriMet Facilities Maintenance, TriMet Training Department, TriMet Systems Engineering, and TriMet/C-TRAN Service Planning and Development.

### **3.3 Safety and Security Responsibilities Matrix**

The Integrated Safety and Security Tasks/Responsibilities Matrix combine the responsibilities for both safety and security tasks for the project into a single management document. This matrix also reflects TriMet's and C-TRAN's ongoing commitment to the consolidation of the safety and security function's oversight and direction into a single department within each agency. The tasks matrix reflects in detail that safety and security functions are intrinsic to both project management and TriMet operations.

The "Integrated Safety and Security Tasks Matrix" (Table 3-1 below) shows the responsibilities of various individuals and committees as they relate to these specific tasks. Because of TriMet's commitment to integrating both safety and security into the LRT project, these tasks and accompanying responsibilities have been combined into a single matrix. Given the nature of the project, in many cases C-TRAN staff, which are similarly positioned to TriMet staff, may be engaged jointly or in similar activities as they prepare their own operational plans, customer service and outreach and collaborate on project related preparations. The SSC will monitor these activities.

**Table 3-1 Integrated Safety and Security Responsibilities Matrix**

Safety and Security Activities	Preliminary Engineering	Engineering	Construction	Testing and Start-Up
Develop & Implement SSMP	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive
Develop & Implement Safety and Security Certification Plan (SSCP)	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive
Update System Safety Program Plan (SSPP)				TriMet Safety and Security Executive
Update Security and Emergency Preparedness Plan (SEPP)				TriMet Safety and Security Executive
Identify & Establish Safety and Security Criteria	TriMet Safety and Security Executive	TriMet Safety and Security Executive		
Hazard Analysis Identification & Resolution	TriMet Safety and Security Executive	TriMet Safety and Security Executive		TriMet Safety and Security Executive
Threat and Vulnerability Assessment & Mitigation	TriMet Safety and Security Executive	TriMet Safety and Security Executive		TriMet Safety and Security Executive
Develop & Administer Safety and Security Committees	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive
Perform Safety and Security Design Reviews	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists		
Perform Construction Conformance Reviews			CRC Transit Design Manager	
Develop & Implement Rail Activation Plan			Start-Up Manager	Start-Up Manager
Develop & Implement Systems Integration Test Plan (including Emergency Drills)			Start-Up Manager	Start-Up Manager
Develop & Implement Start Up Plan			Start-Up Manager	Start-Up Manager
Develop & Implement Training Plan			TriMet Operations Training Manager	TriMet Operations Training Manager
Develop/Update & Implement Rules and Standard & Emergency Operating Procedures			TriMet Director of Operations Support	TriMet Director of Operations Support
Develop & Implement Pre-Revenue Operations/Simulated Service			TriMet Director of Operations Support	TriMet Director of Operations Support
Develop & Implement a Budget & a Schedule for Safety and Security Activities	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive	TriMet Safety and Security Executive
Develop & Implement Safety and Security Monitoring & Reporting	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists
Develop Safety and Security Audit Plan & Conduct Audits		TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists
Obtain State Oversight Agency Approval for Revenue Operations				TriMet Safety and Security Executive
Develop and Implement Construction Safety Plan		TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	TriMet Manager, Safety Risk Assessment/ Construction Safety/ C-TRAN Senior Safety Specialists	

## 4. Safety and Security Analysis

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### 4.1 Approach to Safety and Security

The LRT project uses a formal process for the identification and management of safety hazards and security threats and vulnerabilities. The purpose of the process is to:

- Identify and evaluate the effects of hazardous conditions and security threats and vulnerabilities on personnel, equipment and the public.
- Define and evaluate countermeasures to eliminate or control the identified hazards and security threats and vulnerabilities.
- Provide timely notification of the identified hazards and threats and vulnerabilities to project personnel for resolution.
- Document the safety and security concepts incorporated and used during design.
- Provide the basis for developing procedures to either complement the design safety and security concepts or resolve the hazard and security threat/vulnerability through procedures or other means if the design cannot adequately resolve the issue.

The SSC will meet throughout the design of the LRT project to provide input to reflect operational needs of TriMet and C-TRAN. The committee's input will enhance the safety and security of the employees, customers, and the public. Hazard analysis, field mockups, testing, and in-depth work sessions will be used to assist in the decision making process.

Hazard, threat and vulnerability evaluations will be performed through a series of workshops with stakeholders from all engineering disciplines and LRT operations. These workshops were conducted in late 2012, early 2013.

A safety hazard or security vulnerability is defined as any real or potential condition that can cause injury, death, or damage to or loss of equipment or property; a condition that may be a prerequisite to an accident, assault, or theft; or a situation that has the potential to do harm.

The objective of the safety and security analyses workshops is to:

- Identify potential hazards, threats, or vulnerabilities resulting from inadequate or potential failure of system elements. Determine the potential impact of the hazards, threats, or vulnerabilities on the overall system, people, property, and the environment.
- Identify hazardous activities that could affect the safe operation of the transit system.
- Identify vulnerabilities that could threaten system security.



- Identify potential accidents and security breaches and the consequences (e.g., fatalities, injuries, damage, etc.) associated with each potential condition.
- Identify measures that will prevent accidents and minimize vulnerabilities by eliminating or controlling the underlying causal factors.
- Document the hazard analyses and TVA results in a clear and concise manner, thereby facilitating resolution of the identified unresolved hazardous or vulnerable conditions and identifying the issues that have been resolved.

The various disciplines will bring subject matter expertise to the workshop sessions. Each workshop will be facilitated by a safety and security professional to ensure that the appropriate level of analysis is performed. The workshop participants will provide input to:

- Identify hazards and security threats and vulnerabilities.
- Evaluate the hazards and security issues.
- Assist in the assignment of risk index.
- Identify risk mitigation measures that will allow the transition of hazards to an acceptable disposition level.

When stakeholders need additional data or other information to understand the hazard or security issue, further analysis will be performed. The outcome of each workshop will be recorded in the form of a briefing note for the SSC.

The workshop briefing notes, along with the recommended mitigation measures, will be presented to the SSC for implementation and resolution. These findings will be tracked separately through the committee to ensure they are all addressed.

## **4.2 Requirements for Safety and Security Analysis**

### **4.2.1 Hazard Analysis**

Hazard analysis includes a set of methodologies that first searches for the potential to do harm in the system. After finding such hazards, further analysis attempts to mitigate the hazard to an acceptable level. The objective of the hazard identification and analysis process is to identify and define as many hazardous conditions as possible and initiate the Hazard Resolution process before those conditions or associated activities cause an accident. A Hazard Identification Workshop was held with Subject Matter Experts in late 2012.

### **4.2.2 Hazard Identification**

New safety hazards and security vulnerabilities will be identified through field assessments, surveys, design reviews, testing programs, and start-up activities.

The categorization of hazards is consistent with risk-based criteria for severity and reflects the principle that not all hazards pose an equal amount of risk. Table 4-1 summarizes the Hazard Severity categories.

**Table 4-1 Hazard Severity Categories**

Category	Severity	Characteristics
I	Catastrophic	Death or system loss
II	Critical	Severe injury, severe occupational illness or major system damage
III	Marginal	Minor injury, minor occupational illness or minor system damage
IV	Negligible	Less than minor injury, occupational illness or system damage

The probability rating of a particular event or specific hazard may be defined by the number of times the event or hazard is likely to occur during the planned life expectancy of the LRT. The hazard probability is derived from TriMet and C-TRAN safety data, historical safety data from similar light rail systems, and from expert opinion, such as the peer review group representatives.

Table 4-2 is a summary of the Hazard Probability categories.

**Table 4-2 Hazard Probability Categories**

Description	Level	Specific Individual Event	Fleet or Inventory
Frequent	A	Likely to occur frequently	Continuously experienced
Probable	B	Will occur several times in the system's lifecycle	Will occur frequently
Occasional	C	Likely to occur sometime in the system's lifecycle	Will occur several times
Remote	D	Unlikely, but possible to occur in the system's lifecycle	Unlikely, but can be expected to occur
Improbable	E	So unlikely it can be assumed occurrence may not be experienced	Unlikely to occur but possible

**4.2.3 Hazard Risk Assessment**

The Risk Assessment Matrix (Table 4-3 below) is then used to assess the level of risk for each identified hazard and to determine what action(s) must be taken to correct or lower the risk to an acceptable level.

**Table 4-3 Risk Assessment Matrix**

Frequency of Occurrence	Hazard Categories			
	I <i>Catastrophic</i>	II <i>Critical</i>	III <i>Marginal</i>	IV <i>Negligible</i>
(A) Frequent	1A	2A	3A	4A
(B) Probable	1B	2B	3B	4B
(C) Occasional	1C	2C	3C	4C
(D) Remote	1D	2D	3D	4D
(E) Improbable	1E	2E	3E	4E
Hazard Risk Index	Criteria By Index			
1A, 1B, 2A, 2B, 3A	Unacceptable to Project sponsors (TriMet, C-TRAN, WSDOT, ODOT)			
1C, 1D, 2C, 2D, 3B, 3C	Undesirable - Requires concurrence from the GMs			
1E, 2E, 3D, 3E, 4A, 4B	Acceptable with review –Requires Review by TriMet Security and Safety staff and SSC			
4C, 4D, 4E	Acceptable			

When the Hazard Severity Index is combined with the Hazard Probability Index, the result is the Risk Assessment Index. Each Risk Assessment Index requires a specific level of action. A hazard with a risk index of "Unacceptable" is not permitted. The design must be re-evaluated to eliminate, or minimize, and control the hazard to an acceptable level.

#### **4.2.4 Hazard Resolution and Control**

The Hazard Resolution and Control process involves the analysis and corrective action taken to reduce the risk associated with an identified hazard to the lowest practical level. The order of precedence for satisfying system safety requirements and resolving the identified hazards is as follows:

- Design for minimum risk. Design new facilities and equipment to eliminate hazards. If an identified hazard cannot be eliminated, its associated risks must be reduced to an acceptable level (see Risk Assessment Criteria) through the design selection.
- Utilization of safety devices. In the event that an identified hazard cannot be eliminated or its associated risk cannot be reduced through design selection, risk must be reduced to an acceptable level through the use of protective safety features or devices. Provision must be made and procedures must be issued for periodic inspection and functional checks of safety devices.
- Warning devices. When neither design nor safety devices can effectively eliminate identified hazards or reduce risk to an acceptable level, warning devices must be used to detect the condition and produce an adequate warning signal to alert individuals to the hazard. Warning devices should be standardized to minimize the probability of incorrect reaction of personnel to these warning signals.
- Develop Special Procedures and Training. When it is impossible or impractical to eliminate hazards through design selection or adequately reduce its associated risks through safety or warning devices, then approved procedures and special training programs must be used. Procedures may include the use of personal protective equipment. Precautionary notations and warning signs must be standardized. TriMet employees who perform critical tasks require certification of personal proficiency.
- Note: Warning, caution, and other forms of written advisories cannot be used as the only method of risk reduction for Category I (Catastrophic) and Category II (Critical) hazards.

### **4.3 Security Analysis**

Planning in advance of a terrorist act, crimes committed on transit property or other security incident is essential in providing passengers and employees with a safe and secure environment. A security incident may result in serious injuries or death, destruction of property and facilities, and the inability to continue transit operations to the region. To evaluate the susceptibility to potential threats and identify design corrective actions that can reduce or mitigate the risk of serious consequences from a security incident, the LRT project has conducted a Threat and Vulnerability analysis as previously stated above. The outcome of this analysis has been

provided to the design team so that they can be addressed during design to the extent possible. Additional assessments will be made as the project advances toward revenue service by security and safety staff from both TriMet and C-TRAN and coordinated through the SSC.

#### **4.3.1 Threat**

A threat is defined as any action with the potential to:

- Cause loss of, or damage to, an asset.
- Death or injury to personnel and the public.

The SSC will assess security threats from theft, vandalism, graffiti, auto theft, robbery, trespassing, sabotage, terrorism, and other criminal activities that may occur within the LRT system. The frequency and severity of the threats against people and property will be determined through input from TriMet Transit Police, the City of Vancouver Police and other security personnel who may participate. People and property are defined as follows:

- **People:** Passengers, employees, and the general public.
- **Property:** Stations, Light Rail Vehicles, Wayside facilities (communication rooms/cabinets and signal rooms/cabinets), fare vending machines, etc.

#### **4.3.2 Vulnerability**

Vulnerability is the susceptibility of the system that can be taken advantage of to carry out a particular type of security event. Vulnerabilities may be created by:

- Design and construction of the stations, guideway, wayside facilities, park-and-ride lots and other physical assets.
- Equipment and technology used in the LRT project.
- Operating procedures.
- Policing and security practices.
- Proximity of transit system to potential targets that are not transit related.

CRC Safety and Security staff, TriMet Transit Police and City of Vancouver Police assists in the identification of vulnerabilities and in developing countermeasures to minimize the vulnerability to an acceptable level.

#### **4.3.3 Criticality Matrix**




To illustrate consequences, the frequency of threat and the likelihood of occurrence (vulnerability) are combined into a risk level (criticality) matrix, shown in Table 4-4 below. The consequences are assessed in terms of severity of impact and probability of occurrence for a given threat. The criticality matrix organizes the resulting consequences into categories of high, serious, and low.

The matrix aids TriMet, C-TRAN, and the SSC to prioritize vulnerabilities and to focus first on the most serious threats requiring resolution. Threats with vulnerabilities identified as “High” require further investigation of the potential occurrence and indicate that the condition cannot remain as-is, but must be mitigated. A “Serious” rating in the matrix indicates that countermeasures should be implemented, if at all possible, within fiscal constraints. A “Low” rating means that with review by TriMet and C-TRAN, the risk may be accepted without providing any countermeasures.

**Table 4-4 Criticality Matrix**

		Hazard Categories			
Frequency of Occurrence		I Catastrophic	II Critical	III Marginal	IV Negligible
(A) Frequent		H (IA)	H (IIA)	S (IIIA)	S (IVA)
(B) Probable		H (IB)	H (IIB)	S (IIIB)	L (IVB)
(C) Occasional		H (IC)	S (IIC)	L (IIIC)	L (IVC)
(D) Remote		S (ID)	L (IID)	L (IIID)	L (IVD)
(E) Improbable		S (IE)	L (IIE)	L (IIIE)	L (IVE)

Hazard Risk Index	Risk Decision Criteria	Characteristics
IA, IB, IC, IIA, IIB		High (H): Threat must be mitigated
ID, IE, IIC, IIIA, IIIB, IVA		Serious (S): Threat should be mitigated if possible within fiscal constraints
IID, IIE, IIIC, IIID, IIIE, IVA, IVB, IVC, IVD, IVE		Low (L): Threat is acceptable with review by management

Source: Federal Transit Administration Public Transportation System Security and Emergency Preparedness Planning Guide

#### 4.3.4 Threat and Vulnerability Resolution Process

Security threats and vulnerabilities are addressed to minimize crime exposure on the LRT. Threat and vulnerability resolution includes:

- Redesign of the identified system element to eliminate or minimize the vulnerability.
- Security awareness program for operating and maintenance personnel.
- Procedures to minimize the impact of a security event.
- Physical enhancements.

#### 4.3.5 Other Safety and Security Analyses

Additional formal hazard analyses will be performed throughout design of the project to address changing conditions encountered during the design process. A detailed hazard matrix and a rating from the Risk Matrix will be used to provide guidance to designers regarding design options. This matrix will be used to track items to completion to ensure the chosen design is incorporated into the project.

## 5. Development of Safety and Security Design Criteria

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### 5.1 Approach to Development of Safety and Security Requirements and Design Criteria

CRC Design Criteria provide guidelines and information that govern the LRT project design. These criteria help to ensure that safety and security are “designed into” the LRT project and include the concepts of “Crime Prevention through Environmental Design” (CPTED).

LRT staff, in consultation with TriMet’s Safety and Security Executive and C-TRAN’s Deputy Safety and Security Executive, is responsible for developing the criteria. The criteria are updated to reflect lessons learned on previous projects as well as industry advances.

Safety and security design criteria form the basis for the technical specifications and contract drawings. Basic safety and user requirements are included in procurement specifications for facilities, hardware and systems contracts and are coordinated with LRT project staff, including safety and security staff. Many of the safety and security requirements in the specifications take the form of specific deliverables, such as manuals, reports, approved contract submittals, factory test procedures and results, and inspection reports.

The Safety and Security Certification Program assures that the LRT project is constructed and tested in accordance with the safety and security requirements of the technical specifications.

#### 5.1.1 Codes and Standards

In addition to the CRC Design Criteria, the American Railway Engineering and Maintenance-of-Way Association (AREMA) design standards may be used to direct the LRT design.

Additional sources of design criteria for safety and security are derived from:

- The technical specifications from previous contracts.
- Applicable federal, state, and local codes and regulations, including Uniform Building Code, Oregon Occupational Safety and Health Administration (OR-OSHA), Washington Industrial Safety and Health Act (WISHA), etc.
- Standards defined by industry associations and boards, such as APTA, the American National Standards Institute (ANSI) and the National Fire Protection Association (NFPA).
- Program performance requirements.
- Requirements derived from safety/security peer reviews.

- Safety and security studies, such as Transportation Research Board reports.
- Manual on Uniform Traffic Control Devices, Federal Highway Administration, 2003.
- Transit Security Design Considerations, FTA, November 2004.
- Pertinent safety and security criteria and studies from other transit systems.

## **5.2 Design Reviews**

The Transit Design Manager coordinates design reviews with all LRT project staff. All reviews include TriMet and C-TRAN staff representing safety and security, facilities management, operations and maintenance to ensure that proposed designs comply with TriMet safety and security requirements and gives full consideration to concerns unique to C-TRAN's operating environment. Design reviews are conducted by the SSC.

During design reviews, consideration is given to such items as:

- System interactions.
- Human factors.
- Environmental parameters.
- Isolation of energy sources.
- Materials compatibility.
- Use and long-term storage of critical materials.
- Emergency responses, including emergency egress and rescue paths.
- Fire sources and protection.
- Equipment layout.
- Lighting requirements.
- Operational requirements.
- Maintenance requirements.
- Controlling access to platforms either through CPTED principles or other design concepts to be considered by the project team.

Maximum use is made of existing data and expertise from TriMet and C-TRAN experiences.

### **5.3 Deviations and Changes**

Changes or exceptions to safety and security critical components of the design criteria during the course of the design and construction of the LRT project will be brought to the SSC for review and approval of the changes. Design Managers, Project Engineers, or appropriate project staff will be required to provide the appropriate drawings, technical specifications, and design criteria that requires an exception, and reasons for the exception being necessary. The committee will review the information and either approve or not approve the exception. If the exception is not approved, the SSC may require the project staff to return with additional alternatives to review until an acceptable solution is found. This process will be in place throughout the Engineering and Construction phases of the LRT project.



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## 6. Process for Ensuring Qualified Operations and Maintenance Personnel

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### 6.1 Operations and Maintenance Personnel Requirements

The following requirements will be addressed in the LRT Project Safety and Security Certification Plan, as well as applicable TriMet Policies and Procedures:

- Operations and maintenance personnel requirements.
- Plans, rules and procedures.
- Training program.
- Emergency preparedness.
- Public awareness.

LRT project is responsible for ensuring qualified TriMet and C-TRAN operations and maintenance personnel are trained and have the resources needed prior to taking maintenance and operational responsibility of the line. A schedule for resources and training needs will be developed during the course of the project.

### 6.2 Plans, Rules and Procedures

As the LRT project progresses through Engineering and into Construction, existing emergency plans, rules, and procedures will be updated, as needed, to meet the needs of the LRT project. In addition, new plans, rules, and procedures will be developed to close any gaps that may exist in updated materials. Any revised or new procedures will be reviewed by the SSC and TriMet's Transportation Change Review Committee (TCRC). New and updated procedures will be included in training programs for the effected personnel.

The individual plans, procedures, rules, manuals, and any other operating documentation required, will be included on certifiable items lists in the SSCP as they are identified. A detailed schedule will be included in the Rail Activation schedule that will be developed prior to the initiation of the Testing and Start-up Phase of the project.

### 6.3 Training Program

Training curriculum will be developed during the course of design and construction of the LRT project for all facets of TriMet and C-TRAN operations and maintenance that will be affected by the project. As the LRT project progresses, training staff will be able to develop course materials, new rules and procedures, update existing rules and procedures, as well as identify other organizations that would be required to or benefit from TriMet training programs. Training for

Operations and Maintenance employees regarding operating and maintenance procedures on the new alignment, emergency procedures, accident response procedures, inclement weather procedures, and any other procedures identified during Engineering, Construction, and Start-Up and testing will be developed, formalized by the TCRC, and distributed to all affected employees. A schedule of training classes and topics for each affected work group will be developed in order to ensure all persons are trained.

## **6.4 Emergency Preparedness**

Drills, field exercises, tabletops, and other activities related to the preparation of emergency response agencies from Oregon and Washington will be developed during the course of the construction of the LRT project. Tours of the project alignment will be given to the key players for each agency that may respond to an incident involving light rail on the CRC alignment, in order for a practical drill scenario to be developed.

Emergency responders that could be involved in a response to an incident involving the LRT alignment will also receive familiarization training of the alignment, vehicles, right-of-way equipment, and emergency procedures currently established in the TriMet light rail system. Unique areas of the alignment will be given special attention to ensure response protocol and procedures are developed for those particular areas.

Training for emergency responders from both Oregon and Washington will be developed in the FLSC meetings, in which responders can detail the type of support needed from the LRT Project.

All specific exercises, tabletop drills, Emergency Drills, or other preparedness activities will be identified in the SITP and the PROP. Their scheduled performance will show on the project's Rail Activation schedule and detailed daily PRO schedule, and the criteria for success and evaluation methodology for each Emergency Drill will be included in the individual drill procedures.

## **6.5 Public Awareness**

Prior to opening the new line, CRC is committed to establishing an ongoing, comprehensive public awareness campaign, for safety education, security awareness and emergency preparedness. CRC staff will work closely with partner agencies (C-TRAN, TriMet, WSDOT, ODOT, and the Cities of Portland and Vancouver) to develop a campaign which capitalizes on existing safety and security outreach efforts. These campaigns may include elements of the Transit Watch and Operation Lifesaver programs.

The campaign will emphasize the changing environment with the addition of light rail, vehicle, and pedestrian safety at crossings and along the tracks; and the dangers of trespassing along the rails. The comprehensive campaign will be targeted to students, motorists, pedestrians, transit riders, first responders, adjacent business and residential properties.

A variety of methods will be used to communicate the safety and security messages including presentations, tours, advertising and web outreach.

## 7. Safety and Security Verification Process (Including Final Safety and Security Certification)

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### 7.1 Design Criteria Verification Process

The Hazard Analysis (HA) and Threat and Vulnerability Assessment (TVA) will be an integral part of the design process. The design section of the SSCP details how the design safety and security requirements will be verified. Safety and security requirements include those identified in the design criteria, as well as those requirements resulting from the PE driven HA and TVA. Hazards identified will be reviewed and documented in the SSCP.

CILs will be developed for both civil and systems components of the LRT project, which will include a review of design elements and verification checklist. Completion of the CILs is part of the formal safety and security certification. The detailed procedure for design certification, including delineation of authority and responsibility, is included in the SSCP.

### 7.2 Construction Specification Conformance Process

The construction section of the SSMP details the process used during procurement, construction, and installation to ensure project elements are consistent with the engineering requirements and are safety certified.

Formal documentation will be required from contractors, installers, and vendors, including inspection and testing reports, to verify fulfillment of contractual requirements and safety/security standards. Tools used to confirm satisfaction with contract terms include audits (both on- and off-site) and witnessing of material tests performed by contractors and manufacturers. It must be demonstrated that:

- All elements of the system provided under construction, procurement, and installation contracts conform to the safety and security specification requirements.
- All required contractual testing has been satisfactorily performed and evidence submitted, if required.
- The as-built configuration contains the safety and security-related requirements identified in the applicable specifications and other contract documents.

Any changes to the established design configuration that have an effect on safety and security shall:

- Meet applicable code and regulatory rules and regulations;
- Be approved by the SSC; and

- Pass safety and security certification.

Detailed procedures for construction certification, including delineation of authority and responsibility, are included in the SSCP.

### 7.3 Testing/Inspection Verification

Verification of testing and inspection requirements is done in two stages, both require that all safety and security elements be adequately inspected, tested and documented before acceptance. All contractually required inspections and tests (factory, material, and field) are overseen by the Quality Assurance (QA) Administrator, construction managers, Quality Control (QC), and by safety and security personnel as necessary. Tests that are required to assure proper integration of systems, or are safety or security sensitive are included in the SITP. During the construction, integration and start-up phases, many contractual and integrated tests are conducted for the purpose of validating proper operation of equipment furnished and constructed for the project. Those that are necessary prior to substantial completion of construction are identified in the contract documents and will be performed by contractors under project oversight. LRT testing and commissioning processes require a detailed RAP be prepared by the project for the execution of the RAC.

#### 7.3.1 Rail Activation Plan

The RAP is made up of three plans:

- **Safety and Security Certification Plan (SSCP):** The SSCP identifies requirements, processes and responsibilities for the CIL for each certifiable element; hazard and vulnerability resolution verification; and the certification of design, construction, integration testing, pre-revenue operations, training; development of needed operational plans and procedures; and other required elements for safe and secure operation.
- **System Integration Testing Plan (SITP):** The SITP identifies tests and drills required to be performed and for each, prerequisites required planning and materials, test success criteria, and responsibilities for performing and witnessing the test or drill. System integration testing (SIT) is performed during the integration testing phase of the project, which begins after all contractual testing is done and substantial completion is given to the contractor. Each test or drill will have a RAC approved detail procedure, with appropriate data sheets. A testing schedule will be published as part of the SITP. Contractor personnel may perform tests, however, they must be overseen and witnessed by CRC personnel to verify results and document the test reports. After all SITs are satisfactorily completed, reports accepted, and results verified by the RAC, the SITs will be safety and security certified by the procedures in the SSCP. The SITP will contain the detailed SIT procedures and management roles and the SSCP will contain the details of SIT certification.
- **Pre-Revenue Operations and Start-Up Plan (PROP):** The PROP will be developed under RAC oversight during Construction, and finalized in the early SIT phase. It includes all operational scenarios that will be run at the conclusion of SIT to test

schedules and ready operators and other operations and maintenance staff for revenue operations. The plan also identifies all other operational needs to be met prior to the start of service. These include Rulebook revisions, SOP updates, training, manuals, public education, and SOA requirements.

## **7.4 Hazard and Vulnerability Resolution Verification**

The Hazard and Vulnerability Resolution Verification process is detailed in Section 4.2 of this document. The hazard and vulnerability identification and resolution process was described in Section 4. Each identified and management-approved hazard or vulnerability resolution or mitigation is added to design and construction requirements and recorded on a tracking list. The list is used by project safety and security, designers, construction managers, and the RAC to follow each through the Engineering, Construction, and Testing and Start-Up processes. For each hazard or vulnerability resolution or mitigation, the means of verifying its adequacy is defined in the tracking documents and may vary from simple observation to comprehensive testing. The verification that all hazard and vulnerability resolutions have been appropriately included in the design is included in the verification of Engineering. The verification that all hazard and vulnerability resolutions have been appropriately constructed is included in the verification of construction. Those that require systems integration for resolution will be included in the appropriate tests within with SITP. The detailed procedures for hazard and vulnerability certification, within the design and construction certification requirements, are included in the SSCP.

## **7.5 Operational Readiness Verification**

Operational readiness will begin with the development of the PROP. The PROP will detail the necessary training, plans, SOPs, manuals, and qualifications needed for TriMet and C-TRAN Operations and Maintenance personnel to run and maintain the LRT system once in revenue service. Details for this plan will be developed by CRC Program staff, CRC systems and civil contractors, TriMet Operations, TriMet Maintenance-of-Way, TriMet and C-TRAN safety, C-TRAN Operations and TriMet Training. The PROP will be approved by the TCRC and the SSC. Requirements from the PROP, such as training of operations and maintenance employees, will be tracked on an Operational Readiness safety certification list to ensure proper tracking, documents, and training has occurred for all affected employees.

Verification is required for:

- Development of all needed plans, rules and procedures;
- Preparation and acceptance of manuals documenting operation and maintenance requirements of systems, equipment, and facilities; and
- Proper training of operations and maintenance personnel, including simulation of revenue operations.

These requirements and means of verification are detailed in the PROP. The verification mechanism is also described in the SSCP.

## 7.6 Safety and Security Certification Requirements

One of the major activities of the CRC Program is the implementation of the SSCP. The purpose of the SSCP is to ensure that, prior to the start of revenue passenger service, design and operating hazards and security vulnerabilities are identified, evaluated, and properly controlled or mitigated, to the extent possible, with available resources. The SSCP provides traceable verification that all safety-critical and security systems, subsystems, procedures and training programs have been reviewed for conformance with all applicable safety and security requirements, including codes, standards, and industry practices. The program provides TriMet and C-TRAN's executive leadership with reasonable assurance that the LRT project can operate safely and securely.

Certification will be determined based on project delivery methodology and will be overseen by CRC safety staff. The Safety Certification process is closely monitored by the SSC.

The goals of the SSCP are to verify that identified safety and security requirements have been met and to provide evidence that LRT equipment, systems and facilities are safe to use.

The objectives of the SSCP are to document that:

- Facilities and equipment have been constructed, manufactured, inspected, installed and tested in accordance with safety and security requirements in the design criteria and contract documents.
- Operations and maintenance procedures and rules have been developed and implemented to ensure safe operations.
- Training programs have been developed for operating and emergency response personnel.
- Operations and maintenance personnel have been trained and qualified.
- Normal and emergency procedures and plans have been developed.
- Emergency response agency personnel have been prepared to respond to emergency situations in or along the LRT system.
- Safety and security-related system integration tests have been conducted.
- All security-related issues have been addressed and resolved.

### 7.6.1 Safety and Security Certification Process

The certification process begins with system design and continues through the start of revenue operation. An outline of the certification process is shown below.

The Safety Certification Process includes the following components:

- The SSCP is developed for the LRT project.
- Certifiable Elements and Certifiable Items Lists are developed for the LRT project.
- The SSC monitors the system hazard identification and resolution process.
- Design Conformance Checklists are developed and completed checklists are approved to verify that safety and security criteria are included in specifications and drawings.
- Specification Conformance Checklists are developed and completed checklists approved to verify that facilities, systems and equipment are constructed, installed and tested in accordance with the design and specifications.
- Integrated Tests Conformance Checklists are developed and completed checklists approved to verify the functionality and compatibility of integrated systems and equipment.
- Certification of Start Up Requirements
- All open safety and security issues are resolved.
- Final Project Safety and Security Certificates are prepared under the guidance of the SSC.

The Safety and Security Executive, through the SSC, monitors certification progress in preparing and completing the conformance checklists in a timely manner, reviews documentation assessments of the documentation that supports conformance with the safety and security requirements, and any open or unresolved items. The committee, based on the documentation, assessments and open-items, determines whether to accept the completed checklists and open-items list as-is or to require corrective actions to bring the checklists and/or open-items to an acceptable level. Upon evidence of satisfactory conformance with the certification requirements, the Safety and Security Executive issues a written safety/security Certificate of Conformance for the individual system element or sub-element, as applicable, along with any restrictions or work-arounds. In the event the documentation or action is security sensitive, disclosure is limited to those with a need-to-know.

### **7.6.2 Final Certification**

After a Certificate of Conformance is issued for each major element and sub-element and the SSC is satisfied, the Safety and Security Executive recommends to the TriMet GM and C-TRAN Executive Director/CEO the issuance of a System Safety & Security Certificate. The Certificate signifies that the LRT is safe and secure for revenue service. Restrictions and work-arounds not affecting the safety or security of the LRT may remain on certain systems, allowing TriMet to operate the light rail system in a restricted mode. Such restrictions and work-arounds are documented and communicated in writing to all affected parties and remain in effect until fully resolved by the SSC.



If the SSC determines the safety and security requirements have not been met or insufficient evidence is available to demonstrate certification conformance, it has the responsibility and authority to recommend to the TriMet GM and C-TRAN Executive Director/CEO that revenue service be delayed until corrective action is taken.

### **7.6.3 Final Verification Report**

A Safety and Security Certification Verification Report (SSCVR) will be prepared for the CRC Program, which will be approved by the SSC. The report will summarize the safety and security certification status and the readiness for start of safe and secure LRT operations. The Final Report:

- Summarizes the safety and security certification process and describes status of:
  - Conformance checklist.
  - System testing activities.
  - Operations, maintenance and training activities.
  - Hazard and open items identification and resolution.
- Describes any operating restrictions.
- Recommends action that should be taken to eliminate the restrictions.
- Provides a recommended schedule for eliminating restrictions.

## 8. Construction Safety and Security

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### 8.1 Construction Safety and Security Program Elements

Construction safety and security is a top priority in all regional highway and transit construction projects. TriMet has developed a construction safety and security program that is applicable to all light rail construction projects, including the CRC project. The specific requirements of the program are outlined in the TriMet document TriMet's Capital Projects Construction Safety Program, dated June 2010. The purpose of the TriMet Capital Projects Construction Safety Program document is to specify the construction contractor requirements in the development of site-specific safety and security plans that manage the safety and security risks associated with construction projects, including but not limited to contractor employee injury, property damage, public injury and pedestrian and vehicular traffic for the LRT project. Compliance with the safety and security requirements is a stipulated provision in all LRT construction contracts.

The minimum safety and security requirements to be covered by the contractor's site specific Construction Safety and Security Plan (CSSP), must be submitted for approval before any physical work will be allowed on the contract, and will be contained in a TriMet Construction Safety and Security Manual (CSSM). The CSSM will be developed early in the Engineering Phase and included as part of the specifications of all construction contracts. In addition, the CSSP will be required to meet any additional contract specific safety and security requirements, unique to the individual contract work, that are provided in the contract's Special Conditions or Technical Specifications.

Ultimate responsibility for the development of site-specific plans belongs with the construction contractor. The LRT Safety and Security office is tasked with reviewing and recommending approval/disapproval of the Contractor Safety and Security Plan, and for overseeing the contractor's construction safety and security program. The Transit Manager is responsible for enforcing the safety and security provisions of TriMet's Construction Safety and Security Program. It is intended that the program partners will work together to identify the best method of insuring the project. It is anticipated an outside insurer can assist the program by providing the following services:

- Perform on-site safety and security surveys.
- Assist with the investigation of accidents.
- Attend and participate in safety meetings with contractors.
- Monitor Compliance with the TriMet Construction Safety and Security Program.
- Ensure contractor is following the approved site-specific safety program.
- Analyze loss trends.

## **8.2 Construction Phase Hazard and Vulnerability Analysis**

The purpose of this analysis will be to identify and resolve or mitigate hazards, threats, and vulnerabilities that may be unique to the construction phase of the project, including but not limited to theft of materials, vandalism, sabotage, and trespass.

A requirement of the site specific safety and security plans will be contractor performance of a job hazard analysis (JHA) for each specific construction activity. These JHAs are required to be submitted to the program PR. E for review and comment. The PR. E will forward each JHA to the SSE or DSSE for review and comment and incorporate received comments before granting approval of the JHA. The contractor will be required to review the JHA with all affected employees during the initial start-up of the task, during and modification of the process, and after any incident. Updates will occur in the field as seen necessary by contractor or CRC Program staff.

Site inspections will be performed on a regular basis as per the site specific safety and security plan developed in the last stages of Engineering. Inspections must be documented and items that are found out of compliance will be tracked to ensure proper mitigation has taken place. Site inspections will be performed by contractor and CRC personnel.

If safety and security issues arise that will affect the final configuration of the system during the course of construction, specific hazard analyses or TVAs would be performed by CRC safety and security staff, with support from technical experts as required. A thorough review of analyses will be done by the SSC, and resulting disposition decisions will be documented in the SSC meeting minutes. If an approved disposition affects the safety and security certification of an item, appropriate changes will be made to the CIL and tracked accordingly.

## **8.3 Safety and Security Incentives**

If incentives will be provided, they will be described in the construction documents.

## **9. Requirements for 49 CFR Part 659, Rail Fixed Guideway Systems; State Safety Oversight**

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A single State Safety Oversight agency will be appointed to provide oversight of the Columbia River Crossing Light Rail Project. The agency will work to ensure compliance with 49 CFR Part 659, Rail Fixed Guideway Systems; State Safety Oversight.

The oversight agency will review both the SSPP and the System Security and Emergency Preparedness Plan (SEPP) for conformance with the program standard and procedures. Each December, the System Safety Program Plan and the System Security Program Plan are updated; these updates will reflect the current status of the rail project. Approval of the SSPP and SEPP revised to include the CRC LRT extension will be received from the SOA prior to initiation of revenue operations.

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## **10. Federal Railroad Administration (FRA) Coordination**

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The requirements related to Federal Railroad Administration (FRA) coordination are not applicable to the LRT project.

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# 11. Department of Homeland Security (DHS) Coordination

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## 11.1 Activities

TriMet's Safety and Security Executive, Harry Saporta, works closely with the Department of Homeland Security/Transportation Security Administration (DHS/TSA) to ensure that all transit security matters are addressed to meet DHS/TSA requirements. The Safety and Security Executive receives regular communications from DHS/TSA, works in close partnership with local Surface Transport Security Inspectors (STSI) and other DHS/TSA officials, and attends the FTA/TSA Safety and Security Roundtable meetings to ensure that TriMet remains current on Homeland Security matters and requirements.

TriMet used previous threat, vulnerability, and consequence assessments, and is conducting a security risk assessment specific to the LRT project in the development of design and operating security requirements, including procedures and training, for this Project. The identified threats and vulnerabilities found are currently being evaluated, with appropriate mitigation measures applied to the LRT project. TriMet is working closely with DHS/TSA staff in the development of security risk mitigation strategies for the LRT project.

## 11.2 Implementation Schedule

There are currently no programs managed by DHS relating to the Program; the Safety and Security Executive receives regular communications from DHS, works in close partnership with local TSA officials and attends the FTA/TSA Safety and Security Roundtable meetings to ensure TriMet remains current on Homeland Security matters and requirements.

## 11.3 Coordination Process

The Safety and Security Executive is responsible for coordinating with DHS and for informing the Columbia River Crossing Program team and the project Safety and Security Committee of any DHS requirements that are applicable to the Program during the Engineering, Construction, Testing and Start-Up phases.

The LRT project works closely with DHS/TSA Surface Transportation Inspection and Law Enforcement staff to ensure that all security matters are addressed to meet DHS/TSA requirements. DHS/TSA coordination is included as a topic on CRC Fire/Life Safety Committee meeting agendas and DHS/TSA representatives are invited to attend Safety and Security meetings as observers.



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**Appendix A: Program Safety  
and Security Schedule**

Appendix A: Program Safety and Security Schedule	2011				2012				2013				2014				2015				2016				2017				2018				2019							
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND				
					⊕				⊕												⊕								⊕								⊕			
<b>Safety and Security Activities</b>	Preliminary Engineering				30% Transit Design				CRC in Engineering				Construction Starts				Transit Civil/Track Commence				Systems Install Begins				Transit Civil/Track Complete				Systems Install Complete				Testing / Begin Revenue Service				System Start Up and			
Design Criteria									⊙																															
Develop & Implement SSMP Safety and Security Management Plan									⊙																								⊙							
Develop & Implement SSCP Safety and Security Certification Plan									⊙																								⊙							
Update SSPP System Safety Program Plan													⊙				⊙																⊙							
Update SEPP System & Emergency Prep Plan													⊙				⊙																⊙							
Identify & Establish Safety & Security Criteria					⊙																																			
Hazard Analysis Identification & Resolution					⊙								⊙																				⊙							
Threat & Vulnerability Assessment & Mitigation					⊙								⊙																				⊙							
Develop & Administer Safety & Security Committees					FLS SCC								RAC																											
Perform Safety & Security Design Reviews					⊙				⊙				⊙				⊙																							
Perform Construction Conformance Reviews																																								
Develop & Implement Rail Activation Plan													⊙								⊙												⊙							
Develop & Implement Systems Integration Testing Plan													⊙								⊙												⊙							
Develop & Implement Start Up Plan																																								
Develop & Implement Training Plan																																								
Develop/Update & Implement Rules & Standard & Emergency Operating Procedures																	⊙																⊙							
Develop & Implement Pre-Revenue Operations/Simulated Service																																								
Develop & Implement a Budget & Schedule for Safety & Security Activities					⊙				⊙				⊙				⊙																⊙							
Develop & Implement Safety & Security Monitoring and Reporting									⊙				⊙								⊙												⊙							
Develop Safety & Security Audit Plan & Conduct Audits																																								
Obtain State Oversight Agency Approval for Revenue Operations																																					⊙			

⊙ Represents Initial Process Beginning or CRC Update      Rail Activation Committee (RAC)      Fire Life Safety Committee (FLS)      Safety and Security Committee (SSC)      ⊕ Milestones

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## **Appendix B: Program SSMP Staffing**

Appendix B: Program SSMP Staffing FFGA	2011				2012				2013				2014				2015				2016				2017				2018				2019															
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4												
	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND								
Safety and Security Participants (CRC)	Preliminary Engineering				30% Transit Design				CRC in Engineering				Construction Begins																																			
Director N. Boyd	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05				
Director K. Strickler	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05				
Structures Engineer F. Green	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Highway Engineer C. Liles	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Transit Manager G. Ficek	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Deputy Transit Manager - Vacant	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Transit Design Manager D. Jones	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
Safety and Security Executive H. Saporta	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25				
Deputy Safety and Security Executive L. Halsey	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Manager, Safety K. Wilkinson [1]	0.25	0.25	0.25	0.25	0.35	0.35	0.35	0.35	0.5	0.5	0.5	0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
Senior Safety Specialist B. Medcraft	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Safety Administrative Assistant - Sannon	0.1	0.1	0.1	0.1	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25				
Operations and FLS Liaison - Van Dyke	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Field Operations Manager D. Wright	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
LRT Project Engineers (4 vacant)											0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2								
Transit Systems Eng. Manager (Vacant)											0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2								
Systems Engineering Director T. Heilig	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Systems Specialist G. Wallis	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Ruby Junction Lead J. Griffiths	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Bridge Manager L. Peterson	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
WSDOT Highway Lead D. Reck	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
ODOT Highway Lead A. Myton	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
Community Affairs K. Belokonny	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				



Milestones

[1] Note, FT position to transition in 2014 may be an additional hire managed by K. Wilkinson.

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