

# Oregon Department of Transportation



## **Rail Transit State Safety Oversight Triennial Safety & Security Review of TriMet's MAX Light Rail Transit System**

**Review Conducted October 13-17, 2008**

**Final Report • January 9, 2009**

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## **Acknowledgement**

The Oregon Department of Transportation's (ODOT) State Safety Oversight Program, and in particular the ODOT and contractor personnel responsible for conducting this review, would like to recognize TriMet for facilitating the review process. During the week-long on-site review process, and during pre-review preparations and post-review follow-up, TriMet personnel have been most gracious in providing information, cooperation, and their time. The on-site review described in this report would not have been as effective, perhaps not even possible, without this cooperation.

## Introduction & Executive Summary

The Oregon Department of Transportation operates a rail transit safety and security oversight program (referred to in this report as the Program, or simply ODOT). In addition to satisfying the state's desire to ensure rail transit safety and security, this program fulfills Federal Transit Administration requirements for rail fixed guideway oversight (as found in 49 CFR Part 659). The TriMet MAX Light Rail Transit System is a defined rail fixed guideway system, and therefore is included under the ODOT Program.

One of the principal requirements of the FTA's State Safety Oversight Final Rule, and of the Oregon Administrative Rules that dictate ODOT's program, is the requirement for triennial on-site reviews of safety and security. These reviews are meant as comprehensive assessments of the rail system's implementation of its system safety program plan and system security program plan. All safety- and security-critical aspects of the rail transit operation are scrutinized.

This report details the findings of the 2008 triennial review of TriMet's MAX light rail system. The review was conducted in October 2008 including on-site review activities from October 13 through 17. This review, and the findings and suggestions contained in this report, are intended to help TriMet maintain and improve the level of safety and security at its MAX light rail transit system. This review occurs on a systems level; it is based on TriMet's System Safety Program Plan and its System Security and Emergency Preparedness Plan. The review is intended to judge the effectiveness of those plans, based on Oregon and Federal guidance, and to assess TriMet's compliance with those plans.

As stated above, the review team sincerely appreciates TriMet personnel's efforts to make this review possible. We would also like to acknowledge TriMet's continuing endorsement of the state safety oversight process. The review team realizes that its activities constitute an interruption to normal business, and that the main output of the review is findings and recommendations that translate into additional work for TriMet personnel. ODOT and TriMet agree that safety and security are iterative processes. All involved in the state safety oversight process agree that safety and security in the business of transporting passengers are of paramount importance. Because they are so important, and because they are ongoing processes that can always be improved (even if only slightly), ODOT provides an ongoing external assessment of TriMet's safety and security programs and their implementation.

It is important to note that this report is, by design, focused on areas where TriMet can make its light rail system safer and more secure. This focus is not intended to diminish the many positive attributes of the TriMet system, its safety and security programs, or its personnel's efforts to implement those programs. After this, the fourth on-site triennial review, and two pre-revenue service reviews of MAX light rail system extensions, the ODOT review team is confident that TriMet's personnel are focused on safety and security, and that they have passengers', employees', and the public's best interests in mind in the operation of the rail system.

This report is divided among the various functional areas affecting the safety and security of the TriMet light rail system. Each section contains a list of "Findings" and "Observations." Findings

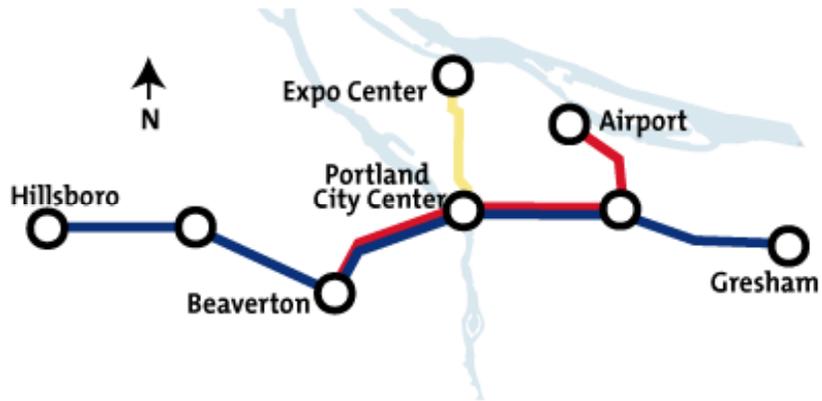
describe specific deficiencies for which ODOT requires that TriMet develop a Corrective Action Plan (CAP). The deficiencies noted in each Finding generally relate to those areas where TriMet is out of compliance with its own specific plans, policies, or procedures, or other state or federal requirements. In contrast to Findings, Observations generally connote safety and/or security-critical areas of concern that, while not technically out of compliance with existing internal or external plans, policies, procedures, or other requirements, should be improved in accordance with established industry standards and best practices, and applicable external guidelines. TriMet is also required to develop CAPs to address each Observation.

In accordance with ODOT SSO Procedures, each CAP must indicate the steps that TriMet will take to address each Finding and Observation, the person(s) and department(s) responsible for implementing the CAP, and a target date for completion. ODOT is aware that some Findings and Observations may refer to issues that cannot be addressed in the short term. As such, CAPs for such Findings and Observations shall lay out a longer-term strategy for moving forward and provide periodic status updates to ODOT. Please refer to ODOT SSO Procedure 8, *Procedure for Overseeing Rail Transit Agency's Corrective Action Plans*, for more detailed information on CAP requirements.

By way of summary, the ODOT Program would like to point out that the Findings and Observations resulting from this report do not constitute safety or security emergencies. Rather, they are all areas where TriMet can improve the way it conducts its rail operations. This is not to say that there are not important and significant Findings and Observations, but rather that the TriMet MAX system is found to be in a good state of overall safety and security.

## System Overview

The Tri-County Metropolitan Transit District, or TriMet, provides transit service in the Portland metropolitan area, including Clackamas, Multnomah, and Washington counties. TriMet operates a light rail transit system called MAX. It serves the downtown Portland area and out to Beaverton and Hillsboro (along the Westside portion of the Blue Line), Gresham (Eastside Blue Line), Portland International Airport (Red Line), and the Expo Center (Yellow Line).



The Eastside portion of the Blue Line was opened in 1986, and the Westside in 1998, while the Red and Yellow lines opened in 2001 and 2004 respectively. In 2009, TriMet plans to open a new line, providing service

between Gateway Transit Center and Clackamas Town Center along I-205. Trains on all lines are one or two light rail vehicles (LRVs). TriMet's LRV fleet is comprised of the Bombardier high-floor (non-wheelchair accessible) LRVs from the original light rail line and a number of Siemens low-floor (accessible) cars. There are more than one hundred LRVs in the fleet. Due to accessibility issues, trains always include at least one low-floor LRV.

All MAX light rail trains are propelled by electric traction motors, which derive power via a roof-mounted pantograph that glides along the overhead contact (or catenary) system. The MAX system is virtually all two tracks wide.



MAX light rail trains serve 64 passenger stations, all of which have a low-platform configuration allowing level boarding with the low-floor LRVs. Nearly all stations are outdoors. The lone exception is Washington Park Station, which is in the West Hills Tunnel. Passengers traveling between downtown Portland stations (including those out to Lloyd Center) can do so without paying fare. At the time of this review, MAX boasted over 100,000 passenger-trips per day.

Additional information regarding each technical area reviewed is found under the respective section below. As noted above, this review (and therefore this report) relate to the MAX light rail system. TriMet's other operations, such as bus, are not part of this assessment.

## System Safety (SSPP & Implementation)

### Description

The implementation of safety activities as described in TriMet's System Safety Program Plan (SSPP) for the MAX Light Rail System was reviewed for compliance with ODOT and FTA State Safety Oversight (SSO) requirements. In addition to verifying implementation compliance with the SSPP, the SSPP content was checked for compliance with federal requirements of 49 CFR Part 659. A checklist used for this purpose is provided as an attachment to this report. During the course of the review, planned modifications to the current SSPP were noted and their impact on review findings is included in this report.

**SSPP Authority:** The document used as the basis for this review is the TriMet System Safety Program Plan of December 2007, appropriately endorsed by the General Manager on December 17, 2007 and authorizes the Safety and Security Department to develop, implement and administer the SSPP as required by 49 CFR § 659.19 (a).

**Management Structure:** The management structure required by 49 CFR § 659.19 (c) is adequately described in SSPP Section C - Overview with one exception noted (see Finding 1.1) concerning the organization chart in the current SSPP which shows only the safety department.

**SSPP Modification:** The process required by 49 CFR § 659.19 (d) for revising the SSPP is adequately described in Section D – Program Review and Updates. Discussions with TriMet personnel and review of documentation provided indicate that the process is active and compliant. The process is currently being followed to meet annual SSPP review and modification requirements, including coordination with ODOT. Modifications are reviewed and managed by the Transit Change Review Committee (previously Rail Change Review Committee – reference to be revised in the next SSPP revision). The revised SSPP is posted annually on TriNet following approval by TriMet and ODOT.

**SSPP Implementation:** Activities required by 49 CFR § 659.19 (e) to implement the SSPP are described in Section E – Program Implementation and Activities. Tasks required to be performed by the rail transit safety function are adequately described and were verified through personnel interviews and review of documentation provided. This section also describes safety-related tasks performed by other rail transit departments with two exceptions noted (see Finding 1.2) concerning Contracts and Procurement and Human Resources. These organizations are identified in the Safety Task Matrix but their safety responsibilities are not described in the implementation section. Discussions with TriMet personnel and review of documentation provided indicates that implementation activities are occurring as described in and compliant with the SSPP. Safety integration is evidenced through documented activities such as the Accident Incident Database (ACID), TCRC agendas/logs and minutes of Safety Committees. The Safety and Security Department will soon hire an additional operational safety specialist to reach full complement, including 3 capital project specialists and 2 operational specialists. These positions are critical to the ability of the Safety and Security Department to fulfill the responsibilities identified in the SSPP for safety oversight of capital projects,

contractors, operations, facilities and occupational safety. Adequate resources in this area must also be considered when additional extensions to the TriMet System are planned.

**Hazard Management:** The hazard management process required by 49 CFR § 659.19 (f) is adequately described in SSPP Section F – Hazard Management Program. References to RCRC and BCRC will be changed to TCRC in the next SSPP revision. Responsibilities of the TCRC are described in SOP #001 of 6/19/08. Hazard identification, analysis and corrective action are logged and monitored through ACID, the TCRC Follow-Up Action Log and the Safety All Open Items CAP list. Hazards reported from several sources including accident/incident logs, audits, inspections and QA processes are analyzed, tracked and resolved through specific identified processes and tracking mechanisms. Interviews with TriMet personnel and documentation provided including CAP lists, safety meeting minutes, PHA's, TCRC agenda and log, the South Corridor Safety & Security Task Force, construction safety and facility safety reports indicate an active hazard management program compliant with the SSPP. Coordination with ODOT complies with SSPP and federal requirements. Hazard resolution and tracking are significant hazard management requirements. The TCRC Follow-Up Action Log and Safety All Open Items CAP list are key program elements and should be specifically referenced in the SSPP description of the hazard management process (see Finding 2).

**System Modification:** The system modification process required by 49 CFR § 659.19 (g) is adequately described in SSPP Section G – Control of Modifications (and referenced SOP #001). The reference to Rail Change Review Committee will change to TCRC in the next SSPP revision. The TCRC is specifically responsible (as per referenced SOP #001) for changes to SOP's, and configuration of in-service equipment and facilities. This activity was verified through interviews with TriMet personnel and reviews of the TCRC agendas and Follow-Up Action Log and complies with the SSPP.

**Safety Certification:** The safety certification process required by 49 CFR § 659.19 (h) is described in SSPP Section H – Safety Certification Process. The SSPP does not specifically mention that certification is required for new starts and does not define major projects requiring certification to differentiate them from system modifications (see Finding 1.3). The SSPP description provides an outline of the process. Specific Safety & Security Certification programs are detailed in separate project documents as referenced in the SSPP. Interviews with TriMet Safety & Security and Capital Projects & Facilities personnel and review of documentation including the South Corridor SSCP, PHA, SC Safety & Security Task Force Minutes and the South corridor Light Rail Quality Assurance Program provided background information to confirm program activity. TriMet Internal Audit Report No. 06-13 raised some issues regarding TriMet QA monitoring of the South Corridor project. Information regarding the status of TriMet response and follow-up to this internal audit was requested but not available for inclusion in this report.

**Safety Data:** The process required by 49 CFR § 659.19 (i) to collect and analyze safety data is adequately described in SSPP Section I – Information Flow to Safety. Sources of information and organizations responsible for reporting safety information are identified. Specific uses for the information are listed. Detailed procedures for data analysis are described in other SSPP sections. Data reporting, collection and analysis appear to be compliant with the SSPP.

**Accident Investigation:** The process required by 49 CFR § 659.19 (j) for accident notification, investigation and reporting is adequately described in SSPP Section J – Accident Notification, Investigation and Reporting. A detailed description of the notification process is provided in the SSPP. Detailed investigation procedures are provided in SOP #576 which is referenced in the SSPP. A process is identified for the urgent review of serious or major incidents. Specifics of the process are contained in SOP #217 which is not referenced in the SSPP. This SOP should be referenced to provide a more specific description of the process identified in the SSPP (see Finding 1.4). Accidents meeting SOP #217 criteria are analyzed by the Safety and Security Department and TCRC, resulting in determination of corrective action and tracking through the TCRC Follow-Up Action Log. Review of the ACID report and TCRC Log plus interviews with TriMet personnel indicate that the implemented process complies with the SSPP. ODOT coordination requirements are also being met.

**Internal Safety Reviews:** The process required by 49 CFR § 659.19 (l) for scheduling and performing internal safety reviews is described in SSPP Section L – Internal Safety Reviews. The process description in the SSPP and the referenced Internal Safety Audit Process meet Part 659 requirements. A review of completed audits indicated that they are completed primarily by the System Safety Manager, but also may be performed by the TriMet Internal Audit Department or contractors to TriMet. Review of audit information and interviews with audit personnel indicate that the implemented process generally complies with the SSPP. A checklist process is used but some information required by the SSPP was missing on checklists provided for this review (see Finding 3).

**Rules Compliance, Facility Inspections, Maintenance Audit and Inspection:** The processes required by 49 CFR § 659.19 (m, n, o), including monitoring of rule compliance, facility safety and maintenance audits are described in SSPP Sections M, N and O. The rules compliance process includes requirements for operator safety checks and reporting of rule violations with information entered into ACID for monitoring of trends and analysis of hazards through TCRC. Facilities are inspected quarterly by Safety Specialists and deficiencies tracked by the Safety and Security Department using the Open Items List (this list should be referenced as it addresses 49 CFR Part 659 requirements for hazard management integration). The SSPP indicates that maintenance logs are audited by the Safety and Security Department. However, interviews with Safety and Security personnel indicated that this audit function is not performed. This was also listed as a finding in Internal Audit Report 06-02. As a result, maintenance and inspection procedures and records are internally tracked by the Maintenance Departments through MMIS, but there does not appear to be any external monitoring or process to integrate identified problems into hazard management (see Finding 4).

**Training and Certification:** Interviews with personnel and review of documentation provided affirmed the role of the Safety and Security Department and implementation of training activities identified in the SSPP (as Safety and Security responsibilities) in Section P – Training and Certification Program.

**Configuration Management Control:** The process required by 49 CFR § 659.19 (q) for configuration management control is described in SSPP Section Q – Configuration Management Control Process. The process description references the RCRC (to be changed to TCRC) as having authority and responsibility for control of changes. TCRC procedures and responsibilities are defined in SOP #001 and include review of changes to Standard Operating

Procedures and configuration of in-service equipment and facilities. The SOP provides for inclusion of key operations, maintenance and support departments. The SSPP, SOP #001 and review of the TCRC Follow-Up Action Log affirm compliance with 49 CFR Part 659 requirements.

**Safety Program for Employees and Contractors:** The employee/contractor safety program required by 49 CFR § 659.19 (r) is described in SSPP Section R – Safety Program for Employees and Contractors. The SSPP references TriMet’s Construction Safety Program document which addresses the specific requirements of 49 CFR Part 659. Interviews with the Safety and Security Department and documentation provided indicate program implementation as required by the SSPP. Internal Audit Report No. 06-13 raised some issues regarding adequate TriMet QA monitoring of the South Corridor project which includes contractor compliance with federal and state laws as well as TriMet requirements for safety. Information regarding the status of TriMet response and follow-up to this internal audit was requested but not available for inclusion in this report.

**Hazardous Materials:** The hazardous materials program required by 49 CFR § 659.19 (s) is described in SSPP Section S – Hazardous Communications Program. The SSPP includes programs to control procurement, use, storage and proper disposal of hazardous materials, as well as training for these activities. The Safety and Security Department works with Environmental Compliance in Facilities Management (as explained in the SSPP) to manage and monitor the process. Procurement & Contracts verifies that hazardous materials are approved for use prior to allowing purchases. An on-line system is used to check or request approval of all MSDS items. Interviews with personnel and review of on-line systems and information verify compliance with SSPP requirements.

**Procurement:** Inclusion of safety in the procurement process required by 49 CFR § 659.19 (u) is described in SSPP Section U – Procurement. Interviews with personnel and review of documents indicate that the process has been implemented as described and involves Safety and Security, Procurement & Contracts, Environmental Compliance and Capital Projects & Facilities.

## Evaluation Criteria

The following evaluation criteria were used to review the SSPP and access implementation:

- ODOT System Safety and Security Program Standards
- FTA State Safety Oversight Regulations
- FTA State Safety Oversight Guidance Materials

The SSPP itself forms the criteria by which its implementation is evaluated.

## Findings and Observations

1. *Finding: Some areas of the SSPP should be modified to fully conform to the FTA SSO Rule (49 CFR Part 659), Oregon Administrative Rules 741-06 and ODOT Program Standards.*

Checklist items from the SSPP review are identified and explained individually for this finding:

- 1.1 Description of the management structure required by 49 CFR § 659.19 (c) in Section C of the SSPP should include an overview of the entire management structure, how the safety function is integrated into the rest of the rail transit organization, and the lines of authority used to manage safety issues. The current SSPP includes an organization chart only for the Safety and Security Department. An organization chart for the entire organization is available and should be included in the SSPP to illustrate integration of the safety function and lines of authority within TriMet.
  
- 1.2 The description of SSPP implementation activities required by 49 CFR § 659.19 (e) in Section E of the SSPP should include the Contracts and Procurement and Human Resources Departments which are identified in the Safety Task Matrix as having primary responsibility for some safety functions.
  
- 1.3 The description of Safety Certification required by 49 CFR § 659.19 (h) in Section H of the SSPP should reference new start projects in addition to extensions. The federal requirement also includes major projects to rehabilitate or modify the existing system or replace vehicles and equipment. Criteria for these project categories should be addressed in the SSPP or a referenced policy on safety certification.
  
- 1.4 Where the SSPP relies on specific detailed processes to explain how SSPP requirements are met, those processes should be referenced by document or SOP# in the SSPP element description. As a specific example, the Accident Investigation Process (J.3) should reference SOP#217 for Urgent Review of Major Safety or Security Incidents. The “Internal Safety Audit Process” is referenced in Section L and a copy was provided. The copy does not indicate that it is an SOP or “controlled” document (the document does not have an identifying date or indication of the organization responsible for the content of the document). References included in the SSPP which contain specific process information required by 49 CFR § 659.19(e) should be to SOP’s or controlled documents with an identifying date and responsible organization to assure configuration control between the process and SSPP.

**2. Finding: SSPP references to corrective action tracking processes should be specific and consistent so as to clearly identify the process being used to satisfy corrective action tracking requirements of the FTA SSO Rule (49 CFR Part 659) and ODOT Program Standards.**

The SSO Rule includes tracking requirements for several processes including hazard management, accident investigation and internal audits. [e.g. 49 CFR §§ 659.27, 659.31 and 659.37(2)(b)]. In addition, programs required to assess compliance with operational and maintenance requirements are linked to the hazard management program. The TriMet SSPP includes several references to corrective action plans and tracking processes in order to meet SSO requirements. Specifically, the SSPP references corrective action plans and tracking processes/logs in sections F.2.1, F.2.4, F.8, J.4, J.5, L(page 39) and N. Specific corrective action/tracking processes used by TriMet which were identified and verified during this review include ACID, the TCRC Follow-Up Action Log, and the Safety All Open Items List.

ACID appears to be well-referenced throughout the SSPP. References to other tracking mechanisms and corrective action plans are less specific. Where corrective action plans/tracking logs are referenced in the SSPP sections identified above, the appropriate log should be identified. This should provide a clearer description of how SSPP elements and responsibilities are integrated into the hazard management process as required by 49 CFR § 659.31.

In addition, the ACID database is identified in SSPP Section I – Information Flow to Safety, as a major source of safety information. The TCRC Follow-Up Action Log and Safety All Open Items List should also be referenced in this section for their role in the analysis and monitoring of safety data and hazards.

**3. Finding: Some completed Internal Audit Checklists did not contain all of the report information required by the SSPP and Internal Safety Audit Process.**

Information required to be included in the Internal Audit Report (as identified in the SSPP) includes the identity of the auditor, audit date, summary of findings and required corrective action. This information should be completed for all audit checklists/reports.

**4. Finding: There does not appear to be an active process to monitor inspection and maintenance procedures and records or integrate identified problems into hazard management as required by 49 CFR § 659.19 (o).**

Although both the Rules Compliance and Facility Safety programs have active processes for monitoring and incorporation of deficiencies into the hazard management program through ACID tracking, facility inspections and Open Items tracking, a similar process for externally monitoring inspection and maintenance programs is not indicated by the SSPP. A process should be described in the SSPP and implemented to externally monitor maintenance and inspection programs and incorporate identified problems into the hazard management program. Typical programs to accomplish this might include performance measuring for completion of inspection and maintenance procedures and correction of defects with reports provided to TCRC for periodic review.

## **Persons Interviewed**

- Shelly Lomax, Operations Support Director
- Tommye Gilbreath, System Safety Manager
- Vicki Barron, Project Delivery Director, Capital Projects & Facilities Division (CP&F)
- Sandy Bradley, Program Management, CP&F
- Kristen Frey Preston, Environmental Compliance Manager, CP&F
- Darlene Gastineau, Internal Audit Manager
- Brian Woodall, Contracts Manager, Procurement & Contracts
- Ron Imondi, Manager of Purchasing Procurement & Contracts
- Dan Stokes, Assistant Manager Rail Transportation
- Dan Caufield, Operations Planning & Development Director

## **Facilities Visited**

- MAX revenue service between International Airport and Rose Quarter
- MAX revenue service between Rose Quarter and Expo Center

- MAX revenue service between Rose Quarter and Cleveland Avenue (Gresham)
- MAX revenue service between Rose Quarter and Hatfield Government Center
- MAX Washington Park station platform, elevators, entrances/exits

## **Documents Reviewed**

- TriMet System Safety Program Plan, December 2007
- TriMet Internal Audit Report No. 05-15, Transit System Safety and Security Plan Review, May 2006
- TriMet Rail maintenance Rule Book, Revised August 1999
- TriMet Organization Chart, September 2008
- TriMet Operator Evaluation, Revised 4/15/00
- Safety Specialist activity logs/reports (8/3, 9/29, 10/10-2008)
- Transit Change Review Committee Agenda & Follow-Up Action Log (June, July, August 2008)
- SOP #001 Transit Change Review Committee Responsibilities 6/19/08
- Rail Transportation Safety Committee Meeting Minutes (6/4, 7/2, 8/6, 9/25-2008)
- Rail MOW Safety Committee Facility Inspection, Ruby West 6/26/08
- Safety Committee Facility Inspection, Elmonica 5/21/08
- Safety Committee Meeting Minutes – Elmonica (3/19, 4/16, 6/18-2008)
- Safety & Security Certification Program for the South Corridor Light Rail Project, March 2008
- TriMet South Corridor Project Preliminary Hazard Analysis Report, June 2005
- TriMet's Construction Safety Program – Capital Projects & Facilities Division 5/06
- South Corridor Safety & Security Task Force Meeting Minutes (5/21, 6/4, 6/11, 7/9, 8/13, 8/20, 9/3-2008)
- Safety Specialist Construction Safety Report 9/26/08
- TriMet Purchase requisition 9/10/08
- South Corridor Light Rail Quality Assurance Program Manual, Rev 2.0, January 2007
- Internal Audit Report No. 05-15 Transit System Safety and Security Program Plan Review, May 2006
- Internal Audit Report No. 06-02 Rail Right of Way Safety Review Hazard Management Program, February 2007
- Internal Audit Report No. 06-13 Capital Projects' Quality Assurance Program Review, November 2007
- Internal Audit Report No. 07-02 Drug and Alcohol Compliance Audit Sherwood Electromotion, Inc., November 2007
- Internal Safety Audit Process
- TriMet Internal Safety Audit Checklists for 2006/07 – elements 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 21, 22
- TriMet Internal Safety Audit Checklists for 2008 – elements 13, 18, 20, 21
- All Open Items CAP List
- SOP #217 Urgent Review of Major Safety or Security Incidents 6/19/08
- SOP #576 Accident / Incident Investigation Revised 9/17/07
- TriMet Accident / Incident Reports (332449, 332817, 33257)
- Supervisor Accident / Incident Reports (332449, 384373)
- Operator Accident / Incident Reports (332449, 334874, 384373)
- Final Accident Reports (11/19/07, 12/10/07)

## **On-line Electronic TriNet Systems Reviewed**

- ACID (Accident / Incident Database)

- **TCRC Follow-Up Action Log**
- **Hazard Communication - MSDS Search**

## System Security and Emergency Preparedness

### Description

The content of TriMet's System Security and Emergency Preparedness Plan (SEPP) document along with its implementation for the MAX Light Rail System was reviewed for compliance with ODOT State Oversight (SSO) requirements for Security and Emergency Preparedness.

### Current Situation

In accordance with State Safety Oversight (SSO) program standards for security and emergency preparedness implemented by ODOT as the SSO Agency, TriMet is required to submit an updated SEPP for ODOT's review and approval when the SEPP is updated and/or revised.

TriMet's most recent SEPP Revision is dated April 14, 2006 and was prepared to be compliant with the ODOT standards for Security and Emergency Preparedness.

### Evaluation Criteria

The following evaluation criteria were used to review the SEPP:

- ODOT Security Program Standards
- Federal Transit Administration (FTA) State Safety Oversight Regulations
- FTA Guidance document, Public Transportation System Security Emergency Preparedness Planning Guide.

The SEPP itself forms the criteria by which its implementation is evaluated.

### Findings and Observations

*5. Finding: As required by the oversight agency and described in the System Security and Emergency Preparedness checklist, the policy statement should describe the authority that establishes the SEPP, including statutory requirements and the rail transit agency's relationship with the oversight agency.*

While the format of the SEPP follows the FTA guidance, the policy statement has been developed without describing TriMet's relationship with its oversight agency, as required by 49 CFR § 659.23(e).

*6. Finding: TriMet's SEPP is identified as a security sensitive document with limited distribution, however there are no records or "master ledger" describing the distribution and associated handling of this secured document, as required by OAR 741-060-0050(7).*

TriMet's SEPP has been identified as a security sensitive document. (See 49 CFR Part 1520). As a secured document TriMet needs to develop a plan, policy or procedure to identify all copies of this controlled document. The plan, policy, or procedure should include a description of the means to uniquely identify each document, provide a description of the limited distribution, include a positive identification of to whom the document has been issued, identify how copies are to be secured and accounted for within the agency and describe how copies will be retrieved by the agency when necessary, such as when a person terminates employment.

### **Persons Interviewed**

- Shelly Lomax, TriMet Director, Operations Support
- Michael McGuire, Manager Emergency Management
- Vince Jarmer, Commander, Portland Bureau of Police

### **Facilities Visited**

- MAX Ruby Junction Maintenance Facilities
- Boarded and rode numerous Red, Blue and Yellow line trains throughout the rail transit system

### **Documents Reviewed**

- ODOT State Safety Oversight standards
- TriMet System Security Program Plan
- National Incident Management training records
- TriMet Organizational charts for the entire organization and separate charts for the Operations Division, Operations Support and the Transit Police Division
- TriMet Drills and Exercises for the past three years
- After action exercise report from 2008 Rose Festival

## Rail Operations & Field Operations

The Transportation functions of the TriMet MAX light rail system are comprised of two organizational groups: Rail Operations and Field Operations. Together, these two units encompass what is commonly referred to as the service delivery functions, as they relate to the provision of transportation to passengers on the light rail system. Rail Operations, as defined in this topic report, is the administration and supervision of the Rail Operators, as well as Operations Command Center (OCC) functions related to the control of rail vehicles. This function occurs at both the Ruby Junction and Elmonica facilities (with the OCC located at Ruby Junction). The Field Operations group is responsible for the line supervision of the rail system. Field Operations is also responsible for line management and supervision of the TriMet bus operations, although this element of their mission is excluded from this report.

Functions within Rail Operations and Field Operations that were assessed within the on-site review include:

- Rail vehicle operations
- Control Center operations
- Field Supervision of rail transportation
- Direct Management of the above functions.

### Description

Within Rail Operations, employees are divided into the following job classification and positions:

- Director, Transportation Operations. This is the most senior manager responsible for the transportation operations function, overseeing both rail and bus operations. This person reports to the Executive Director of the Operations Division.
- Manager, Rail Operations. This position is responsible for the Rail Operators and the OCC, and reports to the Director of Transportation Operations.
- Two Assistant Managers of the OCC. An AM and a PM Assistant Manager are each responsible for the OCC staff including Controllers and Dispatchers (who monitor and oversee bus operations and are not covered as part of this review).
- Two Assistant Managers for Rail Transportation. Each of these Assistant Managers oversees Rail Operators at the two main reporting locations, Ruby Junction and Elmonica.
- Approximately 143 Rail Operators. These employees are responsible for the operation of the light rail vehicles. The work reporting locations for these Operators are the Rail Centers at Ruby Junction and Elmonica.
- Approximately 14 Controllers, who are responsible for train control on the main line as well as yard movements.

There are also two Station Agents who work at the Elmonica Facility and are responsible for administrative activities at this location. While these two employees work on the rail systems, they are administratively assigned to the Bus division at TriMet.

Within Field Operations (Rail component only, this report does not cover Bus), employees are divided into the following job classification and positions:

- **Manager, Field Operations.** This is the most senior manager responsible for the service delivery function. This person reports to the Director of Transportation Operations.
- **Three Assistant Managers responsible for Field Supervisors.** Six Lead Field Supervisors, responsible for the Rail and Bus Supervisors and Fare Inspectors who are working during their assigned shifts. There is always a lead Field Supervisor on duty. These individuals directly supervise the field supervisors and the on-site management of operational incidents.
- **21 Rail Supervisors.** This group is responsible for the real-time field supervision of the rail line. The Supervisors routinely ride in vehicles along the rail lines and are charged with evaluating operational activities, addressing problems, and monitoring rule compliance. They are normally assigned to cover specific segments of the rail system.
- **7 Fare Inspectors.** This group is responsible for enforcing the TriMet fare policies on both the bus and rail systems. Per discussions with the Manager of Field Operations, as Supervisors are now qualified to enforce TriMet fare policies, the Fare Inspector position is gradually being phased out (there were 18 Fare Inspector positions during the 2005 Triennial Review).

The primary document used to control and safely operate the rail system is the Rail Transportation Rulebook (Revised effective date: April, 2006). In addition, there are Standard Operating Procedures (SOPs), which identify critical operational and technical procedures for Rail Transportation and Field Operations employees. Other operational procedures are disseminated to operating employees through the use of updates to these documents, operating orders, and special instructions.

## Evaluation Criteria

The evaluation criteria utilized to assess the operational safety of the rail transportation / field operations functions are primarily based upon the policies, practices, and procedures identified and promulgated by TriMet. It was the expectation of the ODOT on-site review team that TriMet should be in complete compliance with its own rules and with operational practices it identifies as being critical to its operation.

It was not possible to identify compliance with all operating rules and procedures within the scope of this review; as such, this review is intended to present a “snapshot” of rule compliance. This was accomplished through review team members observing line and Control Center operations; discussions with supervisory personnel; reviews of records, reports, and logs; and assessments of operational incidents.

In addition to compliance with its own rules, team members, where necessary or where TriMet procedures are silent, incorporated “best practices” as used by other similarly situated rail transit systems. This level of criteria was primarily utilized where review team members, using their professional judgment, determined that TriMet could benefit by using a rule or procedure (or a revised rule) to control a particular operational issue. These are identified in the topic report findings.

## Findings and Observations

In summary, the results of our on-site review indicate that TriMet Rail Operations and Field Operations are in general compliance with established rules and procedures. General compliance can be defined as the majority of operational practices complying with TriMet's defined rules and SOPs, as observed by team members, and as indicated in reviews of records. This review is not a certification of conformance with all rules and procedures, due to the relatively limited nature of the review. It is, however, the opinion of the on-site review team that there is general compliance with established rules and procedures.

The issues identified within this section are those which indicate non-compliance with operational rules and/or areas in which operational practices/procedures could be enhanced. The assessments are based upon direct observation of an operational situation, reviews of records, and interviews with operational personnel.

7. *Finding: TriMet Rail Supervisors are not performing five "Check Rides" per "workweek," as specified in TriMet SOP 575.*

According to discussions with TriMet personnel and a review of records, Supervisors generally do not perform the required Check Rides. TriMet should either develop a means to ensure that the current SOP is followed as written, or develop a revised SOP that governs Supervisor as well as Training staff duties related to all operating rule compliance activities and observations in a manner that ensures adequate observation and enforcement of operating rule compliance. Such a policy or procedure would cover not only on-board check rides, but also off-vehicle operational observations in problem areas, and worksite rule and procedure compliance. Such a policy or procedure should also address the trend analysis of the results of operating rule observation and enforcement activities, as required by the SSPP (M.3).

TriMet Field Operations and Rail Transportation Training may wish to formally coordinate operating rule enforcement and observational activity to ensure that all of the provisions of the SSPP (in particular, M.3 and P.7) are fulfilled. This is also noted below in Finding 10.

## Persons Interviewed

- Peggy Hanson – Director, Transportation Operations
- Don Allison, Manager, Rail Operations
- Jay Jackson, Manager, Field Operations
- Dan Stokes, Assistant Manager, Rail Transportation
- Several Rail Supervisors and Controllers
- Mike DeCrisco, Rail Operator

## Facilities Visited

- Ruby Junction Rail Facility
- Various Light Rail Stations and Transit Centers

## **Documents Reviewed**

- TriMet Rail Transportation Rule Book
- TriMet Rail Transportation Standard Operating Procedures
- TriMet Control Center Log and Reports
- Sample of employee files

## Operations Training

Training for rail transportation and field operations employees is a critical aspect of rail operations. Because of the highly technical nature of rail transit operations, the type of training which new employees receive, along with on-going refresher training, is a key factor in overall operational safety. As such, this review included an assessment of both the new training and on-going training activities provided by TriMet to its employees in the Rail Operations and Field Operations Departments. The training of Rail Operators, Rail Supervisors, and Rail Controllers are the primary employee classifications included within the transportation training review.

### Description

The training requirements for all three positions reviewed include an initial training program, incorporating class room as well as OJT sessions, and annual recertification training.

The initial program of instruction for Rail Operators includes a seven-week instruction program, segmented into four weeks of classroom instruction, one week of line operation with Instructors during the graveyard shift, and two weeks with specially qualified Line Instructors. Recertification training is given to rail operators once a year, and refresher training is required for any operator absent for more than 30 days.

All Rail Supervisors must have been a rail operator for at least six months prior to becoming a Supervisor and must maintain their rail operator qualifications. Initial training for supervisors consists of a six-week instruction program, segmented into four weeks of classroom instruction and two weeks of OJT with another supervisor. In addition, supervisors must attend annual supervisor refresher training as well as annual train operator recertification training.

All Rail Controllers must have been a rail operator for at least six months prior to becoming a controller. The initial training for controllers consists of an eleven-week instruction program, segmented into six weeks of classroom instruction and five weeks of OJT with another controller. In addition, controllers must attend annual controller refresher training as well as annual operator recertification training.

Operators, Supervisors, and Controllers are all subject to a series of tests and quizzes throughout the training process, and must pass a final examination at the end of both the initial and recertification training.

With the rapid expansion of the light rail system, TriMet appears to have appropriate plans in place to train Operators, Supervisors, and Controllers on the new extensions.

## Evaluation Criteria

The evaluation criteria utilized to assess the training of rail transportation employees is primarily based upon the practices and procedures identified and promulgated by TriMet. It was the expectation of the ODOT on-site review team that TriMet should be in complete compliance with its own operational training policies and practices it identifies as being critical to its operation. The training manuals, course syllabi, and other documents used in this training comprise these criteria.

It was not possible to identify all training procedures or compliance with procedures due to the limited scope of this review. This review is intended to present a “snapshot” of compliance. This was accomplished through review team staff interviews with training personnel and reviews of records/ reports.

In addition to compliance with its own rules, team members, where necessary or where TriMet procedures are silent, incorporated “best practices” as used by other similarly situated rail transit systems. This level of criteria was primarily utilized wherein review team members, using their professional judgment, determined that TriMet should be using a training practice or policy to meet a particular training issue. These are identified in the topic report Findings and Observations below.

## Findings and Observations

In summary, the results of the on-site review indicate that the initial training provided to Rail Operations and Field Operations employees is adequate and in general compliance with its established procedures. General compliance can be defined as the majority of operational practices comporting with TriMet’s defined policies and rules, as indicated in reviews of records. This review is not a certification of conformance with all rules and procedures, due to the relatively limited nature of the review. It is, however, the opinion of the on-site review team that there is general compliance with established training policies and procedures.

The following issues identified within this section are those that indicate non-compliance with training procedures and/or areas in which training practices/procedures could be enhanced. In most cases, the areas noted for enhancement were observed as being deficient in some manner, or in which existing practices were not sufficient. The assessments are based upon reviews of records and interviews with training and operational personnel.

**8. Finding: Not all Rail Operators received their required annual operations safety checks, as required in the SSPP.**

Based on a review of a sample of employee records, not all Operators received their annual operations safety check or “Observation Ride”, as required by the SSPP (M.2.2., M.3, P.7). As this annual check is the responsibility of Training Supervisors and Training Assistants, TriMet Rail Transportation Training should work to ensure that all Operators are subject to the required number of checks.

TriMet Field Operations and Rail Transportation Training may wish to formally coordinate operating rule enforcement and observational activity to ensure that all of the provisions of the SSPP (in particular, M.3 and P.7) are fulfilled. This is also noted above in Finding 9.

**9. Finding: Not all of the reviewed examinations appeared to be graded on an objective or consistent basis.**

The reviewers found several grading discrepancies, which, once explained by TriMet Rail Transportation Training staff, appeared to make sense. However, TriMet does not have a formal written policy that guides exam grading. TriMet should formalize its grading system. Such a policy or procedure could be as simple as a written indication on each test question (or group of question) explaining the grading criteria (e.g., “This question is worth ten points total; each of the five parts of the question are worth two points each,” “partial credit will be awarded for partially correct answers,” etc.) so that grading will be consistent between test questions and between graders.

**10. Finding: Not all TriMet Operators, Supervisors, and Controllers received their annual operator recertification during the period from 2006- 2007, as required in the SSPP.**

Although it appeared that TriMet Training staff was on course to recertify all Operators, Supervisors, and Controllers for 2008 and thus correct the previous year’s backlog, TriMet should continue to work to ensure that all Operators, Supervisors, and Controllers are recertified annually as required, to ensure that they remain qualified to perform their duties.

**Persons Interviewed**

- Marla Madeira – Lead Command Center
- Ron Jagow – Lead Command Center
- Jim Strickland – Assistant Manager, Rail Transportation Training
- Various Rail Training Supervisors, Temporary Rail Training Assistants

**Facilities Visited**

- Ruby Junction Rail Facility

**Documents Reviewed**

- Training syllabi and outlines
- Training course materials
- Sample of employee training records 2006, 2007, 2008

## Employee Fitness for Duty

### Description

Employee Fitness-For-Duty (FFD) encompasses all programs, procedures, and policies enacted by TriMet to ensure that safety-sensitive employees are mentally and physically prepared to carry out their assigned responsibilities. The term “safety-sensitive” generally refers to those transit system employees who are directly responsible for the safety of others, the maintenance of revenue (passenger) vehicles, or the direct supervision of safety-sensitive employees, and those who are required to carry firearms as part of their job duties [Note: TriMet does not directly employ any individuals licensed to carry firearms as part of their job responsibilities]. Elements assessed within employee FFD for this triennial review include:

- Compliance with FTA Substance Abuse testing regulations
- Ability of TriMet to assess employee FFD when they report for duty and during work hours
- Requirements or rules related to the governance of employee work and rest times

### Current Situation

#### FTA Drug and Alcohol Testing

Substance abuse testing programs are key elements in enhancing operational safety, and as such, have been assessed within this triennial review. In addition, ODOT, as the designated State Safety Oversight agency, is specifically granted the authority to review substance abuse policies and records under the Federal Transit Administration (FTA) regulations. The functional elements evaluated within this topic area are the testing program requirements as mandated under FTA regulations (49 CFR Parts 40 and 655). The types of testing required under the FTA regulations are:

- Pre-Employment
- Random
- Post-Accident
- Reasonable Suspicion
- Return to duty / Follow-up

The TriMet Anti-Drug and Alcohol Misuse Policy indicates which TriMet jobs are defined as “Safety-Sensitive” and are therefore subject to FTA and DOT drug and alcohol testing requirements. The most recent version of the TriMet Anti-Drug and Alcohol Misuse Policy took effect on September 24, 2008. This revision reflects changes to FTA criteria for refusal to participate in the collection process and increased observation requirements for return-to-work and follow-up collections after a positive test to ensure the integrity of the collection process. The revised regulations took effect or will take effect on August 25, 2008, and November 1, 2008, respectively.

Tom Schmitgall, the Drug & Alcohol Program Administrator, oversees the program on a day-to-day basis. Gail Reis, the Drug & Alcohol Program Specialist, is the other TriMet employee whose full-time responsibilities are assigned to the Drug & Alcohol Program. The Drug & Alcohol Program is organizationally included in Operations support and administers both the

FTA mandated program, along with an independent TriMet substance abuse testing program, which operates outside of FTA jurisdiction.

It is important to note that while the ODOT review team has conducted a general evaluation of TriMet's implementation of the FTA rules, this is not intended as a comprehensive examination, or an assessment of all aspects of the rule. As noted above, the FTA under its own statutory authority conducts audits of grantees substance abuse testing programs, which by design are more exhaustive. The primary purpose of this review is to assess compliance with the rules as they relate to rail fixed guideway operations. In addition, the FTA audits would generally include a comprehensive review of collection site practices, which were not conducted during this on-site audit.

Under the FTA regulations, TriMet is required to certify on an annual basis to the FTA that it and any designated contractors are in compliance with the regulations. As such, the ODOT review team has utilized the FTA regulations and the TriMet Policy as the base evaluation standard for this substance abuse testing assessment.

It is important to note that the FTA, and not ODOT, is ultimately responsible for determining compliance with its rules. If additional clarification regarding compliance with FTA rules is necessary, then TriMet should seek such guidance from the FTA.

### **Fitness for Duty (FFD) Evaluations**

At TriMet, Rail Operators generally report in to work at either Ruby Junction or Elmonica. At Ruby Junction, Operators must sign in at the Control Center, where one of the Controllers on duty is responsible for making a FFD evaluation. At Elmonica, the Operators must also sign in and be observed for fitness for duty by either a Supervisor or the Station Agent, depending on the time of day.

Relief Operators on the Red Line who begin their shifts at Beaverton Transit Center, and on the Yellow Line at the downtown loop, are not subject to any direct observation or interaction with a Supervisor or other individual qualified to determine their FFD. To begin their shift, these Relief Operators sign on using a process known as the "Remote Terminal Sign-in," where employees log onto a computer to get the latest schedule and system updates. This system does not account for the evaluation of employee FFD and was noted as such during the 2005 Review.

A pilot program designed for assessing FFD for operators coming on duty at the Beaverton Transit Center was initiated by TriMet in response to the 2005 finding. The pilot program was to run through calendar year 2007, and then be evaluated for continuation. It appears that evaluation and continuation of the program has not been done, and the pilot program has lapsed. As a result, it is again noted as a Finding below.

## Evaluation Criteria

The evaluation criteria used to assess TriMet compliance with FTA Substance Abuse Testing requirements are:

- FTA 49 CFR Parts 40 and 655
- TriMet Drug and Alcohol testing program, September 24, 2008
- Oregon Administrative Rule 741-060-0100 (Hours of Service Rule for Rail Fixed Guideway Systems)

## Findings and Observations

**11. Finding: MAX Red and Yellow Line Relief Operators who start their shifts at Beaverton Transit Center and the downtown loop are not subject to FFD checks at the start of their shifts.**

MAX Operators reporting to Ruby Junction and Elmonica are evaluated at the start of their shifts. At Ruby Junction, reporting Operators are evaluated by a Controller, and at Elmonica, reporting operators are evaluated by a Supervisor or a Station Agent, depending on the time of day. "Fit for Duty" is an item that is required to be initialed on the Operator radio sign-out sheet, thus indicating that such an evaluation is TriMet's policy. TriMet should develop a corrective action to ensure that all Operators who start their shifts at any point on the system are subject to direct FFD observation by a TriMet employee qualified to make such a determination. TriMet should ensure that all Operators are subject to the same FFD evaluation requirements to help protect the safe operation of the light rail system.

**12. Finding: TriMet must ensure that its Hours of Service Policy is interpreted correctly and applied consistently to all employees and departments subject to Hours of Service requirements, as required by OAR 741-060-0100**

TriMet's existing Hours of Service (HOS) policy requires that: employees have seven consecutive hours off during a 24-hour "service day;" the number of consecutive days worked not exceed thirteen; and the total number of hours worked during a seven day period does not exceed seventy (with some exceptions for emergencies). This language is subject to various interpretations and appears to be applied differently in different departments. The result is that some employees exceed the maximum hours worked under the policy. TriMet must develop and articulate a HOS policy that prevents misinterpretation and violations. While state and federal law do not currently dictate a maximum number of hours allowed for rail transit safety sensitive employees, Oregon law does require that transit agencies comply with their own policies.

The new Rail Safety Improvement Act of 2008, H.R. 2095, contains revisions to Hours of Service policies for certain rail operators. This legislation may provide TriMet with examples of language and policies that could be used to implement its own policies. Also, APTA is working on developing an Hours of Service standard that might also provide valuable information for developing such policies.

## Persons interviewed

- Tom Schmitgall, TriMet Drug & Alcohol Program Administrator
- Tommye Gilbreath, TriMet System Safety Manager
- Don Allison, Manager, Operations Command Center

## Facilities Visited

- TriMet Drug & Alcohol Clinic Passport Form
- TriMet Ruby Junction Rail Maintenance Facility
- TriMet Administrative Offices

## Documents Reviewed

- TriMet Anti-Drug and Alcohol Misuse Policy, September 24, 2008
- TriMet Anti-Drug and Alcohol Misuse Policy, May 23, 2007
- TriMet System Safety Program Plan, May 23, 2007
- Employee Drug & Alcohol Testing Records for 30 TriMet Rail Safety-Sensitive Employees
- Sample Follow-Up Test Plan Worksheet
- Sample Discipline and Return-to-Work Conditions Following Positive Drug Test Letter
- Multiple Selection Worksheet, for determining size of monthly random drug & alcohol testing pool
- Drug & Alcohol Program Page Printout from TriNet
- Drug and Alcohol Test Records Awaiting Final Documentation, cover sheet for employee D&A testing files
- Sample Safety-Sensitive Employee – Prescription Drug Use Form
- TriMet Prescription and Over-the-Counter Drug Use Policy
- Sample USDOT Alcohol Testing Chain-of-Custody Form
- Sample MetroLab Federal Drug Testing Custody and Control Form
- Sample TriMet Pre-Employment Applicant Consent Form to Release of Prior Drug & Alcohol Testing Records for Safety-Sensitive Employees
- Sample TriMet Supervisor’s DOT Post-Accident Decision Model for Drug and Alcohol Testing (commonly referred to as the “decision tree”), with attached sample wallet-sized decision tree card
- Sample TriMet Reasonable Cause/Suspicion Evaluation Incident Report, with attached sample Supervisor’s Guide card with reasonable suspicion signs and criteria
- Applicant/New Hire Checklist

## Facilities & Employee Safety

### Description

TriMet appears to be serious about industrial and worker safety. Location safety committees perform quarterly location inspections. Supervisors perform weekly walk-through inspections. Maintenance groups hold shift meetings at the start of each shift, and safety is discussed at each of these meetings.

The review team conducted a walk-through inspection of the Elmonica and Ruby Junction complexes with a representative from TriMet System Safety. At Elmonica the inspection included the railcar shop, the stores area, the Facilities maintenance area, and the railcar cleaning staging building. At Ruby Junction the inspection included the railcar shop, the stores area, the railcar body shop, the railcar paint shop, and the MOW shop.

Items observed included the following:

#### **Work Practices**

- Employee dress
- Smoking rules
- Use of Personal Protective Equipment
- Horseplay/proper conduct
- Equipment guards
- Use of tools and equipment
- Storage of flammables
- Closure of wash tanks

#### **Fire Prevention**

- Fire doors
- Exit markings and maps
- Fire extinguishers

#### **Health and Sanitation**

- Cleanliness of work areas
- Cleanliness of washrooms
- Noise levels
- Lighting levels
- Ventilation
- First aid kits
- Eye wash stations

#### **Machines, Equipment, and Tools**

- Machine guards
- Hoists, cranes, and jacks
- Spray booths and hoods

In general, the conditions in TriMet facilities were found to be excellent. The conditions and practices appeared to be safe.

## Evaluation Criteria

- TriMet System Safety Program Plan December 2007
- SOP #902—LRV Shop Electrical/Mechanical Lockout/Tagout Procedures – LRV Mechanics and OCS Maintenance
- System Safety Policy: Eye Protection Policy

## Findings and Observations

*13. Observation: LRV shop mezzanines in some cases service two tracks, one of which may have energized catenary while the other does not.*

If both tracks served by one mezzanine are occupied with one catenary energized while the other is not, it is possible that a worker might go on top of the car with the energized catenary by mistake. The reviewer recommends that TriMet review its logout/tagout procedures and determine how best to mitigate this risk.

*14. Observation: One worker was observed using a grinding machine without wearing safety glasses.*

After talking to the review team, the worker obtained and put on his safety glasses before returning to work. It is recommended that TriMet review with its employees and ensure enforcement of its own rules regarding safe work practices.

## Persons Interviewed

- Craig Black

## Facilities Visited

- Elmonica railcar shop, stores area, facilities shop, and car cleaning storage/staging building
- Ruby Junction railcar shop, stores area, railcar body and paint shops, and MOW shop

## Documents Reviewed

- TriMet System Safety Program Plan, December 2007
- SOP #902—LRV Shop Electrical/Mechanical Lockout/Tagout Procedures – LRV Mechanics and OCS Maintenance
- System Safety Policy: Eye Protection Policy

## Light Rail Vehicles

### Description

The TriMet MAX fleet consists of 26 LRVs (Type 1) built by Bombardier in 1986, 52 Siemens SD-600 cars (Type 2) built in 1996, and 27 Siemens SD-660 cars (Type 3) built in 2002 for a total of 105 cars. Type 1 are high-floor cars while Type 2 and 3 are low-floor cars. Type 1 are single-articulates while Type 2 and 3 are double-articulated. Type 1 are 87' long versus 92' for Type 2 and 3. All cars have an operating cab at each end; they powered from an overhead wire via one pantograph per car. Each car is fitted with four pairs of plug doors per side.

The power trucks are the end trucks on all car types; Type 1 cars are equipped with one d.c. traction motor per powered truck while Type 2 and 3 cars feature two a.c. traction motors per powered truck. Type 1 cars use resistance control while Types 2 and 3 are run using inverter control. All cars use dynamic braking on the motor trucks; Types 2 and 3 also feature regeneration. In addition to dynamic braking, all types use friction brakes (spring applied/hydraulically released on the Type 1 cars and hydraulically applied on the Type 2 and 3 cars) and track brakes. All wheels have friction braking; there are two track brakes per truck. Maximum acceleration and service braking rates are 3.0 mphps.

In addition, TriMet has received eight (of an order of 22) type 4 cars. These cars are not yet in service. They are Siemens S70 cars. The main difference between the type 4 cars and the earlier type 2 and type 3 cars is that the new cars have an operator's compartment at only one end; they will always run in married pairs. Other differences are a more rounded front end and a few feet of additional length on the newer cars.

Revenue vehicles are maintained at Ruby Junction and Elmonica. The Ruby Junction shop dates from the startup of the MAX system in 1986. It was modified somewhat and the body and paint shops were moved to a new building in 2002. Elmonica was opened in 1998.

The present Ruby Junction shop includes eleven car spaces, five of which are located over pits and one of which is equipped with a wheel truing machine. It also houses a truck shop, a rebuild shop for various components, and a few other miscellaneous areas including offices. Adjacent to the main building are an enclosed blow-down pit, an enclosed wash bay, and an open inspection pit. The new building, Ruby Junction MOW South, includes one car space each in the body and paint shops.

The Elmonica shop includes six maintenance car spaces (three tracks), four of which are located over pits and one of which is equipped with a hoist. A fourth track is equipped with a wheel truing machine. Outside the main shop are a single-car blow-down pit and a wash bay. Included in the shop are a work area for pantograph and air conditioning repair and rebuild and miscellaneous areas including offices.

Individual cars are not assigned to one shop or the other. Preventive maintenance (PM) and repairs are performed at the shop where the car happens to be located when the maintenance is needed. All heavy repairs, such as truck work, are performed at Ruby Junction.

The review began with a preparatory review of the PM tasks and task frequencies; tasks appeared appropriate, and frequencies appeared to be a normal range. The review also included

the observation of a partial PM Inspection of one LRV. The tasks observed included inspection and tests of the door system. Conversation with the inspectors indicated that they are quite familiar with the car and well trained in their tasks. Another part of the review consisted of the review of PM inspection records to check for (1) a proper interval between inspection, (2) the proper sequence of inspections, and (3) proper recording of inspection information. Configuration management of railcars was addressed by reviewing the Modification Status report for each series of cars. These reports list all outstanding modifications and indicate on which LRVs each modification has been completed. Calibration of tools and equipment was addressed by reviewing the calibration vendor's documentation.

## Evaluation Criteria

- TriMet System Safety Program Plan December 2007
- TriMet LRV preventive maintenance inspection program
- Type 1 LRV Preventive Maintenance Inspection Procedure
- Type 2 LRV Preventive Maintenance Inspection Procedure
- Type 3 LRV Preventive Maintenance Inspection Procedure
- APTA Manual of Standards and Recommended Practices for Rail Transit Systems—Volume 1, Vehicle Maintenance and Inspection

## Findings and Observations

15. *Finding: The actual mileage at inspection is not being entered on the inspection forms.*

The first bullet in section E.2.1.1 of the SSPP states in part, "Required policies, plans, rules, and procedures for safe operations and maintenance are developed by the Rail Operations Department and the Rail Maintenance Department, respectively, and approved by the Manager, System Safety Programs and RCRC." As approved forms, the PM inspection forms should be filled out completely with the proper information in each field.

16. *Observation: The mileage between inspections exceeded the maximum permissible in 37 % of the cases reviewed.*

The inspection procedures are approved documents (see SSPP reference above), and they specify a PM inspection interval of 4500 miles. A 10% deviation is usually allowed; that results in a maximum of 4950 miles. Over a third of the cases reviewed exceeded the maximum permissible.

However, this statistic does not result from TriMet's performing insufficient PM inspections, but rather because inspections are scheduled based on a theoretical inspection schedule rather than on the mileage at the last inspection. Thus, by the present method, if a vehicle is inspected at an interval of 4900 miles twice, the scheduling program will say that it is 800 miles behind schedule. If the next 10 PM inspections are performed at 4500-mile intervals, the program will still say that each inspection is late. The scheduling program essentially tries to get the inspections back on the theoretical schedule. In fact, however, there is little value in being on a theoretical schedule as opposed to scheduling each inspection 4500 miles after the previous one.

In the present situation, PM inspections are not performed until weeks after they are scheduled. In combination with the fact that there is variation in the number of miles vehicles run each week, this delay results in a wide variation in the number of miles between inspections. Despite the fact that 37% of the sample inspection intervals exceed 4950 miles, the average size of the

sample inspection interval was 4451 miles. Thus, it appears that a sufficient number of inspections were performed in 2008-to-date (the time period of the sample).

If TriMet conducts its PMs on the proper schedule, either by complying with its existing policy or by modifying the policy to incorporate what actually is being done, consistency will improve.

*17. Observation: The Modification Status reports list many modifications that are several years old.*

The reviewer recommends that modifications that are completed or superseded be removed from the lists after a reasonable interval. The reviewer also recommends that all remaining modifications be scheduled for completion in a reasonable time frame. This will minimize the number of outstanding modifications as well as confusion in vehicle maintenance.

*18. Observation: A list of tools and equipment requiring calibration with each piece's status was not available.*

The reviewer recommends that TriMet keep a current list of tools and equipment requiring calibrations with each piece's status or identify a method of assuring calibrations are being done as required.

## **Persons Interviewed**

- Dan Blair, Maint. Manager, Rail Equipment Maintenance
- Jim Bledsoe, Supervisor Equipment Maintenance
- David Harvey, Journeyman Mechanic
- Juris Beitlers, Journeyman Mechanic

## **Facilities Visited**

- Ruby Junction Shop
- Elmonica Shop

## **Documents Reviewed**

- TriMet System Safety Program Plan December 2007
- TriMet LRV preventive maintenance inspection program
- Type 1 LRV Preventive Maintenance Inspection Procedure
- Type 2 LRV Preventive Maintenance Inspection Procedure
- Type 3 LRV Preventive Maintenance Inspection Procedure
- Maintenance records for cars 108, 118, 208, 218, and 308 for the year 2008
- Rail Equipment Maintenance Modification Status LRV Type 1
- Rail Equipment Maintenance Modification Status LRV Type 2
- Rail Equipment Maintenance Modification Status LRV Type 3
- Sample of tool calibrations documentation

## Structures

### Description

TriMet's MAX system includes 31 bridges, 19 on the West side, 11 on the East side including the Airport Line, and one on the Interstate Line. Additional structures are the Washington Tunnel, the box tunnel leading to the median of I-84, and various retaining walls. The bridges are of various types of construction, mainly concrete but also steel, cable, and timber.

TriMet owns most of the bridges on which it runs, and it contracts for inspection of those bridges. However, TriMet runs over several bridges owned by ODOT as well as the Steel Bridge owned by the UP, and TriMet receives copies of the inspection reports for those bridges. Three exceptions are the bridge over the downtown mall food court and the two bridges over I-405. TriMet does not now receive inspection reports for bridges over the MAX right-of-way.

TriMet has in place a five-year inspection contract for all of its owned bridges and the Washington Park Tunnel. The bridges will be inspected at two-year intervals as required by the American Association of State Highway and Transportation Officials Manual for Inspection of Bridges. The current contract requires the contractor to recommend an interval for future tunnel inspections.

Inspection records for the tunnel and four bridges were reviewed. No serious defects have been found in the tunnel. The most recent inspection record for each bridge shows minor deficiencies but none that interferes with the ability to carry MAX trains in normal service.

### Evaluation Criteria

- TriMet System Safety Program Plan, December 2007
- American Association of State Highway and Transportation Officials Manual for Inspection of Bridges

### Findings and Observations

19. Observation: TriMet does not receive copies of bridge inspection records for three bridges over which MAX runs.

TriMet should obtain those records in order to ensure that those bridges are safe for MAX operation.

20. Observation: TriMet does not receive copies of inspection records for bridges over the MAX right-of-way.

TriMet should obtain those records in order to ensure that it is safe for MAX to run under those bridges.

## **Persons Interviewed**

- Richard Kindig, MOW Engineer

## **Facilities Visited**

- Washington Park Tunnel
- Sunset Transportation Center Pedestrian Bridge
- I-405 bridges

## **Documents Reviewed**

- TriMet System Safety Program Plan, December 2007
- Scope of Services for TriMet Bridge and Tunnel Inspection Contract
- Intergovernmental Agreement, Bridge Inspections TriMet/ODOT
- TriMet Portland Bridge Inspection Log [including estimated costs of recommended repairs]

## Passenger Stations

### Description

The TriMet MAX system currently includes 68 stations, 16 in the central Fairless Square, 15 on the East Side, 21 on the West Side, 4 on the Airport Line, and 10 on the Interstate Line. All stations service two-car trains. With one exception, Washington Park in the Sunset Tunnel, all stations incorporate open-air platforms. A majority of the stations are at grade while some, such as the Sunset Transportation Center and those along I-84, are below grade. A few stations are equipped with elevators, but there are no escalators in the system. All open stations are protected by roofed areas. Stations have protected waiting areas—either one or more shelters or brick-walled areas. The variety of paving materials includes bricks, tiles, and concrete. All platforms are covered with tactile surfaces at the trackside edges.

Because all MAX vehicles are equipped with low doors, station platforms are less than a foot above the top of the rail. Thus, only short ramps are needed for height transitions at station entrance areas. No entrance barriers are necessary because there is no platform fare collection. Ticket vending and validation machines are located on station platforms.

Each station is scheduled for an inspection every four months. Work orders for all stations are generated at the beginning of each four-month period, and the inspections are performed as time permits. In addition, stations are cleaned and trash is removed every day, and platforms are power-washed every month. Also, repairs (e.g., lighting replacement) are made as necessary when defects are reported.

Visits to a number of stations revealed stations in generally good repair with only a few exceptions as noted below.

### Evaluation Criteria

- TriMet System Safety Program Plan, December 2007
- Completed Inspection Work Orders for eight stations
- TriMet Facility Platform Inspections checklist

### Findings and Observations

*21. Observation: Some stations have some minor problems such as deteriorating grout on platforms, e.g., ruby Junction , some tiles falling off platform edges, e.g., sunset, and missing screws on platform vault covers, e.g., Lloyd Center.*

While none of the items mentioned is hazardous at this time, they should be addressed before they become hazardous.

*22. Observation: Warning signs at the ends of platforms are placed inconsistently.*

In Washington Park Station the signs are placed high on the wall while in the Sunset Transit Center they are placed on the end gates. The latter placement can hardly be missed by anyone thinking of passing the gate. TriMet should consider developing a standard for sign placement.

## **Persons Interviewed**

- Rockchild Scott, Director of Facilities Management

## **Facilities Visited**

- Washington Park Station
- Sunset Transit Center
- NE 7<sup>th</sup> Avenue Station
- Elmonica Station
- Hatfield Government Center Station
- Lloyd Center/NE 11<sup>th</sup> Avenue Station
- Portland International Airport Station
- Ruby Junction/E 187<sup>th</sup> Avenue Station

## **Documents Reviewed:**

- TriMet System Safety Program Plan, December 2007
- Completed Inspection Work Orders for eight stations
- TriMet Facility Platform Inspections checklist

## Elevators

### Description

Elevators service Washington Park Station (two elevators at each end of the platform), Sunset Transit Center (one elevator on each side platform), Hollywood/NE 42<sup>nd</sup> Avenue Station, NE 60<sup>th</sup> Avenue Station, and NE 82<sup>nd</sup> Avenue Station (one elevator on the center platform of each station). (There is also one elevator in each of Gresham and Sunset parking garages and elevators at the Elmonica, Ruby Junction, Ruby South, Merlo, and Administration facilities, and the records for these elevators were included in the review.) The required semi-monthly inspections are performed by a contractor; the contract is monitored by an elevator consultant who also performs an annual evaluation of each elevator.

TriMet retains a contractor for maintenance and repair of its elevators. The contract specifies that each elevator will receive maintenance twice each month. In addition, the contractor is on call for repairs as needed. TriMet also retains an elevator consultant to oversee the contractor's work and to perform the yearly inspections required by state code.

During the first nine months of 2008, TriMet experienced 63 elevator incidents—including 7 entrapments.

In order to increase elevator reliability, TriMet, over the last several months, spent over \$150,000 for improvements to its elevators; over half was spent on the four Washington Park elevators. The improvements were those recommended by the contractor and the consultant. TriMet expects that these improvements will reduce the number of incidents in the future.

During a stations tour, the reviewer inspected visually and rode elevators and found no discrepancies.

### Evaluation Criteria

- TriMet System Safety Program Plan December 2007
- ASME A17.1 2004 Safety code for elevators and Escalators with Oregon Amendments

### Findings and Observations

*23. Observation: TriMet does not have a good database of elevator incidents including trouble reported and defect found.*

While TriMet has multiple sources of information on incidents, including two in-house reports and a voluminous monthly consultant report, none is in an electronic database format that ensures that the trouble reported, the defect found, and the repair made are included and coded for data manipulation. The reviewer recommends that TriMet put the elevator information on such a database. Then TriMet will be able to analyze the data carefully and institute specific strategies to improve the performance of its elevators.

### Persons Interviewed

- Rockchild Scott, Director of Facilities Management
- Judy Munro, Facility Systems Manager

## **Facilities Visited**

- Washington Park Station
- Sunset Transit Center
- Administration building
- Elmonica facility

## **Documents Reviewed:**

- TriMet System Safety Program Plan, December 2007
- Consultant monthly reports for 2008
- ACID Results—Elevator Incidents March 2008 – September 2008
- Elevator Incidents 3-2008 to 9-26-2008
- Elevator Entrapments Report [January – September 2008
- List of Elevator Work as Recommended by Kone & Elevator Consulting Service

## Maintenance of Way

### Description

TriMet's MAX light rail system includes a number of fixed infrastructure elements that are critical to its operation. These include track structure and related right-of-way, signals and grade crossing warning devices, the overhead catenary system, and traction power substations. TriMet's Rail Maintenance of Way (MOW) department is responsible for inspection and maintenance of these and other safety-critical, fixed assets.

MOW is headed by a Manager, MOW Operations. Each of the major technical areas – track, signals, overhead catenary system (OCS), and substation – has its own Maintenance of Way Supervisor. Each of these areas also has two Assistant Supervisors. MOW is located at three locations. Principal offices are at Ruby Junction, with secondary offices at Elmonica, and a newly-established field office at Portland Streetcar's maintenance and operations base. Generally, Ruby Junction personnel cover Gresham to Rose Quarter, the Red Line, and the Yellow Line. Elmonica personnel cover Goose Hollow to Government Center. Portland Streetcar-based personnel cover equipment between Goose Hollow and Rose Quarter, plus the areas that TriMet inspects and maintains for Portland Streetcar (not part of this assessment).

The Signals, OCS, Substations, and Track sections (capitalized herein when referred to as a work group) have various shifts and coverage. Overall there is 24/7 coverage for MOW concerns and repairs on the MAX light rail system.

Signals' equipment includes a wide variety of train control and grade crossing warning devices. Street-running areas on MAX utilize bar-light and LRV-exclusive signals which are integrated with in-street call loops and traffic timing. Private right-of-way sections utilize block signals and interlockings (as well as some line-of-sight, non-signaled sections). TriMet's signalized switch machines include some traditional cam and contact-based and some electronically-controlled Union Switch & Signal M23s with latchout (runthrough) protection in private right-of-way interlockings. Hanning & Kahl switches are in many paved track locations. Union Switch non-powered switch machines are utilized in non-interlocked locations where switch position needs to be assured.

The MAX system's highway-rail grade crossings also utilize a number of different protection configurations. Many MAX crossings with automobile traffic are governed by local traffic lights, as is the case in downtown Portland and on much of the eastern (Burnside) Blue Line alignment. The MAX system also has a number of traditional railroad-style grade crossings, which typically include gates, flashers, warning bells, pavement markings, and signs.

TriMet's track systems are also varied through the system. Track structure includes ballasted track, concrete-embedded track (in paved/street sections), and direct-fixation track sections. Track fixation and ties vary throughout the MAX system, and include wood ties, concrete ties, traditional railroad cut spikes, track clips, and rubber/elastomer boot embedded track.

MAX light rail trains are powered by an overhead catenary system (or OCS), which is fed from traction power substations along the system. The substations are fed from a single incoming alternating-current feed from the local utility. East Side/Gresham line substations are the earliest vintage, and are housed in metallic bungalows. Substations on the West Side/Hillsboro, Airport, and Interstate (West Blue, Red, and Yellow) lines are generally in masonry and metal structures, and contain newer switchgear and control elements. There are some differences between these newer three types, but can be considered as one general group in comparison to the older Gresham substations. Most substations have two outgoing direct current feeders that supply the nearby OCS. The newer substations run at a slightly higher voltage than do the ones from the original Gresham line.

TriMet's OCS delivers power to MAX LRVs' pantographs. As with the rest of the MAX system, a wide variety of hardware and systems go into the OCS. Downtown areas are generally trolley-wire construction, tied to independent poles and to some shared poles and fixation devices. The downtown area also features overhead crossings where MAX and Portland Streetcar contact wires cross. The rest of the MAX system utilizes full catenary, with messenger wire and contact wire construction, in most areas. Depending on the construction, some areas use section insulators, while others use air gaps to separate feeder sections.

There are also a number of special OCS sections in tunnels (i.e., on the Airport line, in the West Hills tunnel, and in the Sunset Tunnel) that use mining-style fixation hardware, wherein a catenary arm is directly fastened to the tunnel ceiling. Most of the MAX system uses variable-tension, weighted catenary construction. The OCS group is also responsible for sectionalizing switches (generally pole-mounted switches), used to de-energize specific feeder sections along the MAX system.

## **Current Situation**

MOW uses TriMet's MMIS database to schedule preventive maintenance and inspection work, and to track work accomplished, open issues, and maintenance items. The following is a very general summary of that process:

1. Preventive maintenance, inspections, and other scheduled activities are reviewed, prioritized, and assigned by Supervisors and Assistant Supervisors in each technical area.
2. The Supervisors give the MMIS ticket to Technicians and/or post the open tickets in the Technicians' work areas for completion.
3. Technicians complete the test, inspection, or other task, and return the MMIS ticket (as well as other information about the completed task, when appropriate) to the department Assistant Supervisor.

4. The Assistant Supervisor (in some cases the Supervisor) reviews and approves completed work.
5. An MMIS Clerk enters the completed work into the MMIS system and closes out the original ticket. If necessary, follow-up MMIS work orders are opened to track repairs or additional tasks that come out of the original inspection.

Supervisors and the MOW Manager track both completed and open work through regular reports. Completed preventive maintenance and inspection work is tracked through a monthly PM compliance report, though personnel have not been available to produce this report in recent weeks. Supervisors also produce monthly lists of open work orders and MMIS items, which are submitted to the manager for review.

The Signals section of TriMet's MOW group uses testing, as prescribed by its May 2001 *TriMet Rail Maintenance: Signals and Train Control Maintenance Standards* document, as a major driver of department activities. This document –and much of Signals' activities – concentrates on weekly grade crossing tests and inspections, monthly and quarterly switch tests and maintenance, longer-term (semi-annual and annual) interlocking tests, and quadrennial vital relay testing.

The Track section's major inspection activities include a semi-monthly walking inspection of all track segments, monthly turnout/switch inspection (typically performed jointly with Signals personnel), and biennial ultrasonic rail inspection. Inspection tolerances and track standards are contained in the March 2001 *TriMet Light Rail: Track & ROW Maintenance Standards Handbook*.

Substations activities are predicated on both preventive maintenance and inspections. The base shorter-term inspection is a monthly check of housekeeping, equipment readiness, and meter readings. Longer-term inspections, including quarterlies, semi-annuals, and annuals include these activities plus more extensive tear-down preventive maintenance tasks. Substations section activities are spelled out on the instruction and data sheets for each of these intervals, and also rely on substation manufacturers' guidelines and instructions.

The OCS maintenance group conducts two types of monthly inspections. One is a walking, daylight inspection that concentrates on overhead geometry issues, poles, interference or encroachment from outside forces (e.g., trees and other agencies' utilities), pantograph tracking, and hardware issues such as insulators, clips, and arms, all as seen by inspectors on the ground. OCS crews also conduct a rolling monthly inspection from a high-rail vehicle. These rolling monthly inspections concentrate on preventive maintenance activities, and in particular section insulator maintenance. They also can catch certain types of overhead wire issues that are less apparent from the ground.

OCS also completes a biennial inspection and preventive maintenance, wherein crews on a high-rail vehicle perform a comprehensive check of hardware, wire wear and condition, and geometry, and rectify (or open work orders for) defects. A 2008 draft *Overhead Contact System*

*Maintenance* was obtained after the field and records portions of this review were completed. This document, when finalized, seems as if it will be a comprehensive and valuable guideline. After the on-site review, it was reviewed relative to current practice. As the instructions and guidelines found on OCS checklists and maintenance documentation were readily available during the on-site review, though, these were taken as the authoritative guidelines.

TriMet MOW also has a small, dedicated training staff that addresses Track, Signals, Substations, and OCS personnel and positions. TriMet's MOW training programs are comprehensive when compared to most rail transit agency operations, and feature fairly extensive and detailed outlines for training requirements. The training programs feature formal testing and quizzes, as well as solid programs to quantify and qualify on-the-job training and performance testing elements.

MOW equipment conditions are generally good. No major issues on the MAX light rail system itself were noted during this review and its field inspections. MOW activities overall are in keeping with established plans and procedures, though some exceptions are noted in this report. MOW also engages in a number of very good practices beyond what is required by procedure, such as Supervisors and Assistants regularly reviewing and initialing/signing completed inspection documentation. The Supervisors and Assistant Supervisors are also closely tied into the work order and MMIS process, which helps them stay abreast of current conditions and completed work. Additional positive practices include very good switch inspection practices (by both Track and Signals personnel), very good monthly OCS walking inspection records, and very good MOW training support.

## Evaluation Criteria

The TriMet Maintenance of Way department's safety-critical inspection and maintenance activities were assessed using the following criteria:

- TriMet's current System Safety Program Plan and the following maintenance procedures referenced therein formed the primary review criteria:
  - *TriMet Rail Maintenance: Signals and Train Control Maintenance Standards (2001)*;
  - *TriMet Light Rail: Track & ROW Maintenance Standards Handbook (2001)*;
  - Substation maintenance and inspection instructions and checksheets for monthly, quarterly, semi-annual, and annual activities; and
  - Overhead catenary system maintenance and inspection instructions and checksheets for monthly walking, monthly rolling, and biennial activities.
- External guidelines were utilized where TriMet's existing programs were either silent or substantially different from typical rail transit industry practice.
- The reviewer's professional judgment was used as a last resort where TriMet MOW's particular situation is not addressed by the other two criteria above.

## Findings and Observations

24. *Finding: Grade crossing data sheets do not indicate regular quarterly or annual inspections.*

TriMet's grade crossing inspection practices and associated data sheets show a quarterly and an annual inspection. Weekly, monthly, quarterly, and annual inspections are cumulative, i.e., quarterlies include all monthly and weekly elements. The same checksheet is used for all frequencies of inspections. Of approximately 330 grade crossing records reviewed, one was clearly marked as a quarterly inspection. None were marked as annual inspections. It is not clear if this is a paperwork issue or a procedural problem.

**25. Finding: Monthly and quarterly switch inspection sheets are sometimes not completed in a consistent fashion.**

Switch inspection sheets have both monthly and quarterly columns. The quarterly columns are two separate tests: *switch circuit controller* and *fouling circuit test*. For a number of yard and non-yard switches on West Side/Elmonica-based inspections, one column may be checked for one quarterly inspection, and then the other column checked a quarter later. This reviewer believes that only one of the two inspections actually applies to some of these switches, and that the errors result from Signal Maintainer paperwork error. If this is the problem, TriMet might be able to rectify the issue by blocking out the columns that don't apply for switches where only one of the two tests should be performed.

**26. Finding: Substation preventive maintenance and inspection documentation shows significant deviation from monthly and annual schedule requirements, as dictated by TriMet's internal documentation.**

A review of approximately 144 inspection intervals for six substations resulted in more than 60 monthly inspections missing from the files. At least two annuals were missing, while an additional four annuals had significant portions of the inspections shown as incomplete.

It should also be noted that those annual substation inspections that were reviewed typically take months to complete. TriMet should examine whether or not individual annual inspection elements – e.g., AC breaker tests, rectifier maintenance, etc. – are actually being conducted annually. It may be that the long time span for annual inspections affects the amount of time between inspections for particular elements. TriMet may benefit from splitting the annual elements into smaller inspections, e.g., performing transformer inspections every May, so that the annual timing is preserved for each substation subsystem.

TriMet should develop a written policy as opposed to the informal procedures they use now.

**27. Finding: OCS Rolling Monthly inspections are not consistently performed, as required by TriMet's internal documentation.**

OCS rolling monthly inspections are not performed on a monthly basis according to records for six OCS segments. Of the 90 monthly OCS intervals reviewed, 18 monthly rolling inspections were shown in the records.

28. *Finding: According to a review of completed walking track inspection documentation for West Side shows that TriMet is not completing all of the inspections specified by its maintenance program.*

Elmonica-based track inspections are broken down into 17 segments on MMIS speed sheets. This review examined completed speed sheets for June through September 2008. TriMet personnel marked as deferred 37 track segments of a total 102 reviewed. The ODOT review team is not aware of any tolerance for deferred inspections, and as such, 100% compliance is expected. TriMet should work to complete all of the inspections that are required by the maintenance program.

29. *Observation: TriMet's current track standards do not clearly delineate track inspection frequency and scope.*

TriMet's *Track & ROW Maintenance Standards Handbook*, 2001 revision, does not delineate clearly the frequency of current track inspection practices. Current practices include semi-monthly walking track inspection and biennial ultrasonic rail inspection. These practices are not clearly set out in the current document and should be included.

30. *Observation: Walking track inspection frequency is significantly less than (non-binding) comparable practices from the American Public Transportation Association and (non-binding) regulations from the Federal Railroad Administration.*

The American Public Transportation Association's (APTA) guideline for track inspection (APTA RT-S-FS-002-02, *Standard for Rail Transit Track Inspection and Maintenance*, §3.1a) recommends a weekly walking inspection. The Federal Railroad Administration's (FRA) *Track Safety Standards* (49 CFR § 213.233; TriMet would be comparable to passenger class 3 track) dictate a minimum once-weekly track inspection for comparable railroad track. Transit industry practice is typically once or twice per week for walking inspections.

TriMet's current walking track inspection is twice per month, at best half the frequency of recommended (but not legally binding) practices from APTA and the FRA. While it may take a significant effort for TriMet to ramp up from its current track inspection frequency, the agency may wish to start planning for such an increase. Planning ahead in this way might make transition to more frequent inspections easier, and facilitate necessary departmental changes.

TriMet may want to take into consideration the number and type of defects found when determining the frequency of the track inspections.

31. *Observation: The current track standards and practices do not include regular track geometry inspections.*

TriMet does not currently conduct track geometry inspections. APTA's track guidelines (APTA RT-S-FS-002-02, *Standard for Rail Transit Track Inspection and Maintenance*, §3.4), which are not binding on TriMet, recommend annual track geometry testing. Federal Railroad Administration regulations for railroads are similar.

TriMet may want to take into consideration the number and type of defects found when determining the frequency of track geometry inspections.

*32. Observation: Track inspection documentation could be improved to better facilitate reporting of ongoing maintenance items that do not rise to the level of defects.*

The Track section should consider more detailed walking inspection documentation that encourages inspection personnel to record more detailed information about track conditions in the field. TriMet's current documentation for walking track inspection concentrates on MMIS *speed sheets* that list multiple track segments and the dates they are due for inspection. Any defects or (less serious) maintenance items typically are recorded in an informal manner in the field, then transferred to small defect slips, which are turned into MOW Supervisors. The current open-item list for track (rightly) concentrates on these defects.

As TriMet's track structure ages, however, open track maintenance items and issues will increase in number. TriMet should consider preparing for this increase by transitioning to more detailed and descriptive track inspection documentation. Keeping more detailed documentation will allow the Track Supervisor and Assistant Supervisors to keep better track of those maintenance items that might over time deteriorate into, or combine to form, track defects. Further, a detailed record of defects and other maintenance issues will allow for the determination of patterns that should be addressed. It is also important to transition to this more detailed documentation at a time when it may be less urgently needed. Personnel – both inspectors and managers – should be afforded an opportunity to develop a more detailed maintenance item tracking system without the immediate pressure of mounting track defect lists.

*33. Observation: OCS and Substation inspection activities do not seem to be governed by an overall plan or schedule.*

OCS and Substation section activities do not seem to have overall guidelines or plans describing departmental activities. The schedule set out in the TriMet signal test document might be a good model for both electrical functions. This review team appreciates that many activities are predicated on manufacturer recommendations and as-built prints, and the intention is not that all this information should be recreated in an inspection standard. References to appropriate procedures or documentation would be sufficient. Still, both OCS and Substations should have an overall schedule and at least a brief description of departmental expectations for testing, inspections, and preventive maintenance.

*34. Observation: MOW should resume and continue the publication of the monthly PM compliance report.*

The monthly PM compliance report, which shows percentages of MOW preventive maintenance and inspection activities, seems to be a valuable tool. It is no longer published due to manpower issues. TriMet should resume and continue publication of that report so that management can more easily determine schedule compliance.

## List of persons interviewed

- Roger Bell, MOW Assistant Supervisor
- Keith Bounds, MOW Supervisor
- Chris Galan, MMIS Clerk
- Roland Henson, Manager, MOW Operations
- Kevin McCaughey, MOW Supervisor
- Bill Skellenger, MMIS Clerk
- Tim Snyder, MOW Assistant Supervisor

## List of facilities visited/records perused, etc.

- Grade crossing inspection sheets for approximately 330 weekly inspections, Schottkey, 170<sup>th</sup>, Orenco, Government Center, and Kelly crossings
- Interlocking inspection sheets for approximately 150 tests at 1<sup>st</sup> & Holladay, 11<sup>th</sup> & Holladay, 11<sup>th</sup> & Morrison entrance, 11<sup>th</sup> & Morrison exit, Steel Bridge, Interstate/Rose Quarter, Expo Center, Delta Park, Broadway, Quatama, Hawthorne Farms, Merlo, and Sunset
- Substation monthly, quarterly, and annual inspections, total approximately 144, for Lloyd Center, 181<sup>st</sup>, Gresham City Hall, East Portal, Sunset, and 185<sup>th</sup>
- Catenary monthly inspections, approximately 90 total, including 15 monthly intervals over six OCS sections – COL4CW, COL3DS, COL3BW, COL3AE, COL1BW, and COLYARD; biennials for same sections
- Monthly and quarterly switch test documentation for 13 months, West Side/Elmonica-based switches, 17 switch locations each
- Government Center station and track area
- 28<sup>th</sup> Avenue grade crossing
- Orenco substation and OCS
- Downtown and Galleria area OCS
- Gateway Interlocking switch inspection and preventive maintenance, with Track and Signals personnel
- Training outlines, requirements, tests, and documentation for Signals, Track, Substation, and OCS training programs, including training models and goals, completed tests, and complete personnel files for two recently-graduated Journeymen