

## Tri-State Oversight Committee



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## Triennial Safety and Security Audit of the Washington Metropolitan Area Transit Authority

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### Non-Revenue Vehicle Maintenance and Inspection

### SSPP Elements 15 and 16

**Review Conducted: April 2016**

Draft Report: June 28, 2016

**Final Report: August 17, 2016**

## **Introduction**

Representatives from the Maryland Department of Transportation (MDOT), the District of Columbia Department of Transportation (DDOT), and the Virginia Department of Rail and Public Transportation (DRPT) comprise the Tri-State Oversight Committee (TOC), which provides regular oversight of the Washington Metropolitan Area Transit Authority (WMATA) Metrorail system. To comply with State Safety Oversight Final Rule 49 Code of Federal Regulations Part 659 (Part 659), the Federal Transit Administration (FTA) requires states to designate a State Safety Oversight (SSO) agency to administer safety and security programs for rail transit and fixed guideway systems within their jurisdictions. Specifically, 49 CFR Part 659 requires TOC to conduct an on-site safety review of each element of the WMATA System Safety Program Plan (SSPP) at least once every three years. These audits must assess WMATA's implementation with all 21 elements of its SSPP and seven elements of its Security and Emergency Preparedness Plan (SEPP), along with related plans and procedures TOC splits its Triennial Safety and Security Audit topic areas into separately occurring reviews spread out during a three-year period.

The following report documents the observations and findings of the TOC's audit of WMATA's non-revenue vehicle maintenance. Generally, this review focused on whether WMATA's maintenance program complies with its own written plans as well as industry standards and best practices. These topics are the responsibility of Service Vehicle Maintenance (SVMT), Car Track Equipment Maintenance (CTEM), Operations Management Services (OPMS), and Track and Structures (TRST), with support from Safety and Environmental Management (SAFE). The relevant SSPP elements for this audit were all or part of:

- Element 15: Maintenance Audits/Inspections
- Element 16: Training and Certification

The TOC Program Standard and Procedures defines WMATA requirements for these elements in Section 12 and in Appendix B. Specific requirements are cited further, below.

## **Methodology**

In advance of the on-site audit, the TOC requested and reviewed relevant WMATA plans, procedures, checklists, and reports. The on-site portion of the audit occurred April 26-28, 2016. During the on-site sessions, the audit team interviewed WMATA personnel and reviewed various documents and records to assess compliance with procedures. The auditors also talked with front-line personnel. Persons interviewed (except front-line personnel) and documents reviewed are noted at the end of this report. TOC also inspected various non-revenue vehicles in the Greenbelt Yard and Service & Inspection facility. As the audit progressed, TOC representatives discussed preliminary findings and addressed questions from WMATA personnel. This report

identifies conditions evident during the audit period, regardless of the current progress of potential remediation activities.

Findings refer to instances of WMATA operating out of compliance with an applicable internal or external written requirement, plan, policy, rule, standard, or procedure. A Finding may also refer to a condition whereby WMATA may technically be conducting business in compliance with existing WMATA, TOC, or FTA requirements; however, there may be no relevant written plan, policy, or procedure in place, or the existing plan, policy, or procedure is not in accordance with safe practices.

This review, including all Findings presented in this report, intends to assist WMATA with enhancing system safety throughout Metrorail. The TOC would like to thank WMATA personnel for their time, cooperation, and forthrightness throughout the review process.

### **Current Conditions**

WMATA has two departments responsible for maintaining WMATA-owned non-revenue vehicles: SVMT and CTEM. SVMT is responsible for maintaining rubber-tire, licensed vehicles (approximately 2,200 automobiles, large trucks, etc.) while CTEM is responsible for maintaining rail-bound track maintenance vehicles (approximately 211 heavy machines, such as prime movers, tampers, ballast regulators, etc.) Most rubber-tire vehicles maintained by SVMT are not usable on the fixed-guideway (rails) and consequently outside the scope of this audit, but there are 22 trucks with hi-rail gear that can be used on the rails. TRST is responsible for inspecting and approving contractor-owned hi-rail vehicles for use on WMATA property as well as the hi-rail attachments of WMATA-owned hi-rail vehicles. CTEM management stated that four CTEM's maintenance positions were transferred from CTEM to TRST specifically for inspecting WMATA-owned and contractor-owned hi-rail vehicles.

The WMATA service vehicle maintenance program consists of three elements: inspection, corrective maintenance, and preventive maintenance. SVMT preventive and corrective maintenance is governed by Department of Bus services SOP 1.1.a, Preventive/Corrective Maintenance Service Vehicle Fleet. CTEM's maintenance program is governed in part by Car Maintenance (CMNT) policies and procedures as well as OAP-200-3, Preventive Maintenance on Revenue Vehicles and Wayside Equipment. It appears that CTEM does not have a CTEM-specific maintenance plan.

CTEM management stated that there are 47 mechanics that maintain heavy and small track maintenance equipment. However, TOC found that there has been no assessment performed to determine if CTEM's staffing is sufficient to completely conduct high-quality inspections and corrective maintenance for all heavy and small track equipment maintained.

Inspections before equipment is used are primarily the responsibility of the user group (typically TRST). TRST personnel conduct pre-trip inspections of WMATA-owned

vehicles before use and report any deficiencies to SVMT or CTEM, depending on the type of defect and associated responsibility. Dedicated personnel also conduct pre-trip inspections of contractor vehicles, and deficiencies found are reported to the contractor. In these situations, the contractor is responsible for repairs and must provide proof of the repairs before the vehicle can be put in service.

### Preventive Maintenance Inspection (PMI)

SVMT has three shop facilities (Alexandria, Bladensburg, and Landover) where hi-rail vehicles can be serviced. The PMI is scheduled based on mileage traveled (7,500 miles) or time (one year) since the last PMI, as defined in the SVMT Preventative Maintenance procedures (SOP 1.1a Rev. 7 Preventive/Corrective Maintenance Service Fleet). This includes engine and chassis maintenance that is common to most rubber-tired vehicles. In addition, SVMT is responsible for the licensing and insurance of all rubber-tired non-revenue service vehicles and to confirm that the vehicles are provided with all of the necessary documents. SVMT is not responsible for maintaining the hi-rail gear or any other auxiliary equipment (cranes, lifts, vacuums, etc.) that may be on a hi-rail. The auxiliary equipment is maintained by the vendors/manufacturers of that equipment or by another contractor if needed. WMATA requires a PM inspection of hi-rail gear every six months (similar to the FRA requirements), so a qualified contractor provides that inspection on site for every WMATA-owned hi-rail vehicle (all at once) every six months. A six-month sticker is placed on each vehicle validating the PM inspection. Repairs to the auxiliary equipment are on an as-needed basis and may be provided by the vendor off-site.

SVMT is using “Fleet Watch” software to manage vehicles’ PMIs. SVMT provides e-mails to the users whenever a PMI is due for a vehicle and the user is responsible to schedule the vehicle for shop inspection.

CTEM has four shop facilities (New Carrollton, Greenbelt, Branch Avenue, and Alexandria). With over 200 heavy machines to maintain, CTEM has a different procedure and checklist for each type of machine. Heavy machines are scheduled for PMI based on calendar days (60, 90 or 120 days). CTEM notifies the user 60 days in advance so that the user can schedule the machine for maintenance. If the user does not deliver the machine for service, CTEM reports that it can order the machine out of service until the PMI is completed.

CTEM mechanics perform PMIs based on procedures and record the results on checklists. The mechanic must record the date and the results on the checklist and sign for the items that he completes. One PMI can be completed by multiple mechanics depending on the complexity of the vehicle and the number of days required to complete the PMI. All PMI checklists are reviewed by CTEM supervisors. In addition to routine reviews of PM checklists, CTEM management stated that they request each shop supervisor conduct a more in-depth, hands-on review of at least two completed PMIs a month for quality control. The CTEM Superintendent is responsible for

confirming that these audits are completed. The PMI checklist and the supervisor's audit are scanned and stored in Maximo to document that the PMI was completed.

If any corrective maintenance (CM) is required as a result of PMI, a CM work order is opened in Maximo and is completed before the PMI is finished. When a CM work order is completed, it is closed with a description of the actual work.

CTEM also maintains a WMATA track geometry vehicle (TGV). Although the TGV was put in service approximately two years ago, a PMI procedure for the machine is still in a draft form. The FTA conducted a separate, full assessment of TGV maintenance and use in April 2016.

### Corrective Maintenance

If SVMT or CTEM identifies any deficiencies during a PMI or if any deficiencies were reported by the user, SVMT or CTEM is responsible to create a work order for the CM and to complete the repair work, either in one of its shops or with a contractor. If the deficiency reported by the user is severe and safety-critical, the vehicle can be removed from service and brought to a maintenance facility or retrieved by SVMT or. In some cases, when the reported deficiency is minor, the deficiency may be repaired during the next PMI.

CTEM requires the users to complete an Equipment Deficiency Report form when reporting problems. TOC confirmed that in most cases the Equipment Deficiency Report form is not completed by the users or, if completed, very little information is provided to describe the problem.

CTEM provides support to the users around the clock. If a user reports a deficiency, a CTEM technician may respond immediately if the deficiency is severe or if it interferes with the current needs of the user.

### Maintenance Management Information System (MMIS)

SVMT and CTEM, like most other WMATA departments, use Maximo to open, close, and track work orders. Work orders are issued to document preventative and corrective maintenance on all vehicles. The work orders for preventative maintenance are issued in advance according to pre-assigned intervals based on time or mileage for each type of vehicle. SVMT and CTEM send notices to the users (up to 60 days in advance of the required date) to schedule a vehicle in for preventative maintenance.

The mechanics record the PMI and CM activities on a paper form during the work in the shop. Once the work is completed, the work orders are closed in Maximo for each completed activity and the paper document is scanned and saved in Maximo as well.

### Training

Operations Management Service (OPMS) has primary responsibility for administering and delivering vehicle maintenance training. SVMT and CTEM have some similar training needs, but there are some significant differences.

SVMT technicians require a variety of basic mechanic skills, such as heating-ventilation-air conditioning (HVAC), hydraulics, and pneumatics, for routine automotive maintenance. In addition, some of the technicians are provided with additional training for heavy trucks.

CTEM technicians require some of the same basic safety and equipment operator training as SVMT and CMNT mechanics, but must also have Roadway Worker Protection and yard movement training, as well as machine-specific training. The initial training is provided by a combination of CTEM technicians and the OPMS trainer (depending on the course). One OPMS instructor is assigned to CTEM to conduct all basic training classes for CTEM new-hired personnel. The basic training for new CTEM mechanics includes number of prescribed classes that that each mechanic needs to complete during the one year after the mechanic is hired.

Machine-specific training is typically provided by the vendors when a new machine is delivered. The vendor provides an initial training for a limited number of mechanics. A WMATA training instructor might attend the vendor's training to be able to provide machine-specific training to CTEM mechanics that were not able to attend the vendor's class (train-the-trainer). CTEM technicians also may receive informal on-the-job training (OJT) for machine operation and for the particular components of a machine, if they did not attend the vendor provided training. However, CTEM's OJT process (requirements and curriculum) is not documented. It is not clear which mechanics were trained on which machines and on what machines he/she is qualified to perform maintenance. CTEM supervisors stated that they assign mechanics to maintain certain machines based on supervisor's knowledge of each employee's abilities, experience, and training.

A one-day training class is available for operation of hi-rail vehicles. Three TRST mechanics are currently trained in operation of hi-rail vehicles. It was stated that in future, more employees will be trained in operation of hi-rail vehicles.

#### Modifications & New Vehicle Testing and Acceptance

CTEM is part of CMNT and is responsible for complying with all CMNT policies and procedures including those for managing changes to equipment. Any changes to CTEM-maintained equipment are supposed to be documented by issuing Engineering Modification Instructions (EMI) or Maintenance Service Instruction (MSI).

WMATA does not generate modifications for hi-rail vehicles. If necessary, WMATA contracts the vendor to complete appropriate changes. In order to initiate a change to a rail-bound maintenance machine, first an Engineering Request will be issued. If the Engineering Request is approved, CENV will create and implement an Engineering Test

Plan (ETP). After ETP is successfully implemented, an Engineering Modification Instruction/Modification Service Instruction will be developed.

Until recently, TRST personnel prepared technical specifications, led acceptance testing, and performed the role of Contractor Officer Technical Representative (COTR) for the procurement of new track maintenance machines. The Office of Chief Engineer – Vehicles (CENV) recently was assigned to take over those responsibilities and was, at the time of this audit, preparing procedures to document them.

When an Office of Procurement (PRMT) quality officer agrees to technical specifications provided by the COTR, the specifications are then added to the Request for Proposals (RFP) after counsel signs off. Specifications also include boilerplate contract sections for provision of maintenance manuals, parts manuals, and training for new equipment. Based on the technical specifications, the manufacturer creates the test procedures, and then WMATA approves them. Acceptance testing occurs with participation by both PRMT and the COTR.

In the future, CENV personnel will prepare specifications for new track maintenance equipment for inclusion in the RFP and appoint a COTR. In accordance with OAP 205-07, Procurement of All Fixed Rail and Non-Highway Use Rail Equipment, a CENV representative will be appointed as a COTR for all track maintenance equipment acquisitions. However, responsibilities of acceptance testing of new heavy track maintenance equipment are not defined in the OAP 205-07.

WMATA accepted 12 new Prime Movers and put them in service in the last three years. A new Ballast Vacuum machine (BV01) was recently accepted by WMATA and is on site at Greenbelt Yard. The manufacturer of the BV01 is on site working on problems as they arise. TOC could not find any evidence that these new machines went through the WMATA safety certification process and that Certificates of Compliance were issued by SAFE for them. The WMATA Safety and Security Certification Plan requires all new rail rolling stock to be safety-certified. Also in accordance with WMATA OAP 205-07, SAFE is assigned with responsibility to participate in all aspects of new track maintenance equipment acquisitions to assure that all requirements described in the WMATA SSPP are implemented.

## **Findings**

**Finding 1: There is no complete CTEM maintenance plan for roadway maintenance machines as required by 49 CFR Part 659.**

CTEM provided an informal overview of CTEM processes that is used for inter-departmental outreach and as an orientation guide for new personnel. However, the WMATA SSPP or a referenced maintenance plan must contain, according to 49 CFR Part 659.19(o), “A description of the maintenance audits and inspections program including identification of the affected facilities and equipment, maintenance cycles,

documentation required, and the process for integrating identified problems into the hazard management process.”

**Finding 2: A version of the Department of Rail Car Maintenance Employee Reference Guide used by CTEM personnel contains SOPs that are redlined, in draft form, or are from the 1990s and may be outdated.**

A copy of the binder in CTEM’s Greenbelt Yard shop contained the above-referenced conditions. CTEM provided another copy of the binder that contained no marked up or draft SOPs, though some were still old. CTEM should ensure it is complying with global WMATA configuration management requirements and ensures SOPs are dated, reviewed regularly, revised as necessary, and distributed only when finalized.

**Finding 3: CTEM has not conducted a manpower assessment.**

Even though CTEM is reporting meeting PMI on-time completion requirements, management cannot know whether the mechanics are given enough time to complete their work. In absence of PMI procedures describing how much time should be allocated for each PMI, CTEM management cannot assess how much manpower is needed to complete all PMIs and if enough time is allocated to complete each PMI with the expected quality. Lack of appropriate time can result in cutting corners to keep up with maintenance volume.

CTEM should compile time needed to conduct all required PMIs in one year, time used for CM in the same year (average time for CM can be determined based on CM done during previous years), and training requirements. This can be compared to time available based on current manpower in order to determine whether the number of maintenance mechanics is adequate or needs to be expanded.

**Finding 4: There are no WMATA PMI procedures for all roadway maintenance machines.**

CTEM personnel rely on manufacturers’ manuals for reference during maintenance. There are checklists but no PMI procedures developed and approved by WMATA for every type of equipment. PMI procedures should be created to ensure consistency and include time needed to complete the PMI.

**Finding 5: There is no TRST checklist associated with the SOP for inspecting contractor hi-rail vehicles.**

There is a written procedure for conducting inspections of contractor equipment (OAP 208-04), but no document to record the results of the inspection. This can result in some items unintentionally being skipped.

**Finding 6: When reporting a maintenance machine defect, the TRST user sometimes submits only a vague or incomplete Equipment Deficiency Report, and CTEM personnel do not consistently complete their portion of the forms.**

A lack of Equipment Deficiency Report form completion by users leads to a lack of information for CTEM to resolve the problem. Also, lack of CTEM completion of its portion of the Equipment Deficiency Report form leaves it unclear whether problems have been completely resolved and what was completed. Of the 12 reports that TOC reviewed, examples of issues contained within the reports include the following:

- “Report Delivered Date and Time” is indicated on only two the 12 submittals
- Name of Mechanic Notified is not always indicated. If there are circumstances that preclude notification of a mechanic, there should be an indication of why notification was not necessary
- Three of the documents have no signatures or Maximo work order numbers
- Failure time format is inconsistent (24-hour or 12-hour)
- There is no area for description of the work performed to remedy the concern/deficiency.

TRST and CTEM should ensure that existing and new mechanics/operators are properly trained on the vehicle inspection SOP, including the procedure to complete an Equipment Deficiency Report.

**Finding 7: There is no unifying CTEM training plan to formally define how OJT, vendor-provided training, and OPMS-provided training ensure that personnel are qualified to work on certain equipment.**

Training for CTEM personnel is a mix of organized, vendor-provided, machine-specific training and on-the-job training. After the audit, OPMS submitted matrices showing the training courses and OJT that should occur for each level of mechanic. However, this training does not always occur (and as noted previously, OJT is not documented); there is no documented process to describe how CTEM and OPMS ensure that a mechanic not trained to work on a certain machine is not assigned to work on that machine. Further, as OPMS stated in its response, there are no training prerequisites to be promoted from one level of mechanic to another; as such, it is unclear how the referenced training matrices could be implemented. A training plan should tie together the overlap of formal training and on-the-job training to ensure that only qualified personnel are assigned to maintain equipment. The plan should define training curricula and methodologies, including pre-requisites for promotional testing, as well as the practical portion of promotional testing. This also inherently requires that the OJT program be formally covered in the plan and OJT completion be documented. Part of the CAP for this finding may coincide with existing CAPs that resulted from the OPMS training gap analysis and the FTA Safety Management Inspection.

**Finding 8: SVMT does not have ongoing maintenance training/education for its personnel.**

It was reported that mechanics sometimes are unfamiliar with some components (i.e. electrical) they do not often work on. New technologies and diagnostics may arise that the technicians may not be exposed to in the absence of refresher training; therefore, maintaining Automotive Service Excellence (ASE) certification may meet this need.

**Finding 9: The CTEM training spreadsheet at the time of this audit indicated that training for many of the mechanics was out-of-date, as required by SOP 2.04.**

Many of the training classes require an annual renewal, but in some cases the renewals were shown as overdue or may have never been completed. After the TOC published a draft of this report, WMATA provided an updated spreadsheet showing that mechanics were in compliance. It is unclear why the spreadsheet was not accurate at the time of the audit. Sections 3.5.2 through 3.5.9 of SOP 2.04 describe specific tracking tasks for the Training Coordinator to track these renewals, but it appears that they may not all be occurring regularly due to resource constraints and current technological capabilities. Full implementation of the Electronic Learning Management system may help with setbacks in tracking training.

**Finding 10: The new CENV track equipment review and acceptance procedure to comply with OAP 205-07 has not yet been finalized.**

Recently issued OAP 205-007, Procurement of All Fixed Rail and Non-Highway Use Rail Equipment, defines roles and responsibilities of all WMATA departments involved in the new equipment acquisition process. CENV planned to develop a procedure for its role in the process but had not at the time of this audit since it was recently assigned to this role. This procedure should be completed and also include the necessary tie-in for safety certification requirements when applicable.

**Finding 11: There are no documented steps to confirm that there was completion and distribution of revised maintenance procedures, parts manuals, and drawings in concert with publication of an Engineering Modification Instruction (EMI).**

It is necessary to confirm completion of these important steps of the EMI process. This could be done through additional boxes on the EMI cover sheet and by attaching important documents as one package.

**Finding 12: There are inconsistent methods (none documented) for the revised maintenance procedures and parts manuals to be distributed to CTEM and TRST mechanics following EMI publication.**

It was reported that updated materials are sometimes provided during toolbox meetings, other times through e-mail, or through other methods. This inconsistent process may result in some mechanics not receiving this crucial information. This finding applies to CTEM and TRST.

**Finding 13: The checklist associated with EMI creation is not consistently completed.**

TOC reviewed documentation for six EMIs; three EMIs had completed checklists, while two were included but not completed and one was missing the checklist entirely. CENV should ensure it has written procedures and quality control processes to require completion of the EMI checklist for each modification.

**Personnel Interviewed**

- [REDACTED] SVMT
- [REDACTED] CENV
- [REDACTED] SAFE
- [REDACTED] CTEM
- [REDACTED] OPMS
- [REDACTED] CTEM
- [REDACTED] Procurement
- [REDACTED] OPMS
- [REDACTED] TSSM/TRST
- [REDACTED] CTEM
- [REDACTED] TRST
- [REDACTED] CTEM
- [REDACTED] Procurement
- [REDACTED] TSMT
- *Mechanics (names withheld)*

**Documents Reviewed**

- CTEM - Car Track Equipment Maintenance Program for Maintenance Services
- CTEM New Employee Manual
- CTEM ER Workflow Tracking Report (ECRB Meeting on April 11, 2016)
- CTEM STATUS REPORTs for the month of April 2016
- CTEM Mechanic Training Plan
- CTEM FORKLIFT Certification Log
- CTEM HVAC Certification Log
- CTEM Greenbelt Calibration Report. (report ran on 4-27-16)
- CTEM April 2016 Small Equipment PM Status
- CTEM Equipment Quality Inspection Form for various vehicles
- CTEM Organizational Chart, no document date
- Spreadsheet of CTEM Employee Training last edited March 2, 2016
- CMNT SOP 2.04 (Training Requirements)
- PRMT Document FQ12093\_BASE Ballast Vacuum Purchasing Documents

- PRMT Document FQ11142\_CONF Prime Mover Purchasing Documents
- SVMT Non-Revenue Vehicle Acceptance-1-2.19-2-04-3-20140729-4-
- OPMS Audit Logs for CTEM Mechanics
- TRST Equipment Operator Training Plan
- TRST Prior to Use Inspection Forms (completed)
- TRST Deficiency Reports (completed)
- TRST List of WMATA HI Rail Vehicles with inspection dates
- TRST SOP 1.01 (Roadway Maintenance Machines Unusual Occurrence(s) and or Equipment Malfunctions)
- Preventive, Corrective Maintenance Service Vehicle Fleet-1-1.1a-2-07-3-20140729-4
- Approved CENV Engineering Documents in Documentum (April 22, 2016)
- OAP 205-07 Procurement of All Fixed Rail and Non-Highway Use Rail Equipment 112315 – November 23, 2015
- Various PMI Records for non-revenue vehicles, Calendar Year 2015
- Various PMI procedure manuals for non-revenue vehicles
- Documentation (drawings, procedures, checklists, engineering requests) for a number of CTEM EMIs.
- MH0604 Track Geometry Vehicle EM-100U Maintenance Manual, Parts 1, 2 & 3, July 7, 2013
- Maximo work order process flow: corrective maintenance (entered by maintenance managers)
- Maximo work order process flow: defects (entered by service writer)