# Washington Metrorall Salety Commission

# **Safety Audit**

of the Washington Metropolitan Area Transit Authority

Audit of Roadway Maintenance Machine Inspection, Maintenance and Training



Final Report: March 9, 20<mark>21</mark>

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Prepared under the authority of the Washington Metrorail Safety Commission

Commissioners: Christopher Hart (Chair), Greg Hull (Vice Chair), Debra Farrar-Dyke (Secretary-Treasurer) Robert Bobb, Michael Rush Alternates: Robert Lauby, Suhair Al Khatib

Report produced by WMSC staff led by CEO David L. Mayer, PhD

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### **Executive** Summary

The WMSC is issuing 14 findings requiring Metrorail to develop corrective action plans (CAPs) and one recommendation. The Washington Metrorail Safety Commission (WMSC) conducted this audit of the Washington Metropolitan Area Transit Authority (WMATA) Metrorail's Roadway Maintenance Machine (RMM) inspection, maintenance and training by conducting interviews, document reviews and data reviews in fall 2020. The scope includes all hi-rail or rail-bound machines but excludes shuttle wagons and track maintenance small equipment. Due to the timing of the approval of Metrorail's Public Transportation Agency Safety Plan (PTASP), this audit is focused on Metrorail's System Safety Program Plan (SSPP). The WMSC also reviewed audits and reports conducted in prior years by other entities.

RMMs are the vehicles that move on the rails but that are not designed to carry customers. The vehicles range from the basic, like flatcars used to carry tools, materials or equipment to a work site, to complex equipment such as the heavy-duty tamper used to maintain track geometry.

The WMSC identified several positive practices and a number of areas that require improvement. As a result, the WMSC is issuing 14 findings requiring Metrorail to develop corrective action plans (CAPs) and one recommendation that Metrorail must consider.

This audit finds that Metrorail must improve its implementation of required safety reviews of, and its training on, RMMs, which play a crucial role in the maintenance of the rail system.

Safety certification practices, RMM maintenance and operations training and certification, and a number of rules and procedures must be improved, clarified or actually implemented to resolve these issues.

Among the findings in this audit, WMATA is not performing required safety certification for new RMMs and is not following proper safety approval or engineering change processes for existing RMMs. Safety certification process concerns have been identified in connection to RMMs dating back to at least 2013, and the WMSC has identified other projects where WMATA has also not followed this important process.

In addition, Metrorail is not effectively collecting or utilizing reliability data for its RMMs to identify any safety-related trends or to determine when broader changes are needed.

Training and certification processes related to both the operations and maintenance of RMMs must be improved.

Equipment operators receive only basic initial and recertification training, and are not always fully trained on each type of vehicle they may be directed to operate. To the



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extent that Metrorail monitors an operator's certification on a specific vehicle, that certification never expires and supervisors in the field have no way to confirm whether an operator has proper training for that vehicle.

Given the complexities of certain vehicles that can cause significant damage to track and structures or pose special risks to personnel if proper procedures are not followed and the small number of employees that management has confidence in to operate that equipment, Metrorail risks key safety and maintenance work coming to a halt due to insufficient succession planning and training.

Maintenance of rail-bound RMMs is complicated by WMATA's application of certain passenger railcar maintenance procedures to RMM maintenance, even though RMMs have different features, such as diesel engines.

Mechanics receive only limited training on specific RMMs that would assist them in moving and maintaining RMMs, and do not receive adequate refresher training.

In addition to WMATA-owned RMMs, Metrorail regularly permits contractor-owned RMMs to enter the Metrorail system, however the procedure being used for vehicle inspections is a draft that has not been formally approved.

Employees responsible for maintenance of parts of WMATA-owned hi-rail vehicles are only familiar with the aspects of those vehicles that relate to operations on highways, and are not familiar with the ways that their maintenance work could increase the risk of a derailment or other safety event when the vehicle is operating on the rails.

Metrorail also does not have a single, clear, complete safety procedure for the securement of vehicles using chocks, and a service bulletin that was issued to some departments contradicts Metrorail's rules and procedures.

Safety certification practices, RMM maintenance and operations training and certification, and a number of rules and procedures must be improved, clarified or actually implemented.







## Background and Scope

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#### Scope

The scope of this audit includes training, maintenance, inspection, implementation and operation of all hi-rail or rail-bound machines but excludes shuttle wagons located in vehicle maintenance shops and excludes track maintenance small equipment (e.g. hand tampers and rail drills).

Among other areas, the audit focuses on System Safety Program Plan (SSPP) Implementation, Maintenance and Inspections, and Training and Certification, which are elements 5, 15 and 16 of Metrorail's SSPP. During this audit work, as required by federal regulations, WMATA finalized its first Public Transit Agency Safety Plan (PTASP), titled the WMATA Transit Agency Safety Plan, which replaces the SSPP.

Due to the timing of the PTASP's approval, the PTASP had not yet been implemented at the time of this audit.

#### **Current Conditions**

Metrorail uses Roadway Maintenance Machines (RMMs) to conduct work and to help move tools and materials around the system. These machines—both those owned and operated by WMATA and those owned and operated by contractors—are used on a daily basis to set up work zones, to conduct preventive and corrective maintenance, and for work on capital projects.

Metrorail refers to these vehicles as Class 2 Vehicles (Class 1 Vehicles are those designed to carry customers).

The movement, maintenance and operation of RMMs is different from the movement and use of third-rail powered revenue railcars. Flatcars and some other Metrorail RMMs are moved throughout the system by coupling to a Prime Mover, which is a diesel-powered locomotive. Self-propelled rail-bound RMMs are typically powered by their own diesel engines.

WMATA provided a list of 169 rail-bound RMMs and 16 active hi-rail vehicles (RMMs that can operate both on highways and on tracks) operated by Metrorail. The railbound RMMs were used anywhere from just a few hours in the past year to as much as 2,340 hours, according to WMATA. The WMATA-owned equipment ranges from machines that are a few years old to flatcars that are more than 50 years old.

Maintenance of rail-bound RMMs is the responsibility of Car Track and Equipment Maintenance (CTEM), which falls under Car Maintenance (CMNT). Certain specialized equipment on vehicles such as the Track Geometry Vehicle (TGV) is maintained and calibrated by contractors. RMMs are used on a daily basis to set up work zones, to conduct preventive and corrective maintenance, and for work on capital projects.



Investigations and reviews dating back to 2013 have identified concerns about WMATA practices related to RMMs. Maintenance responsibilities for hi-rail vehicles are divided. Service Vehicle Maintenance (SVMT), which falls under the Metrobus reporting structure, is responsible for maintenance of all highway portions of the vehicle. Each department that uses a hi-rail vehicle is responsible for ensuring an outside contractor inspects and maintains the rail portion of the vehicle.

Contractors bring non-WMATA owned vehicles onto Metrorail property for various projects on a regular basis. The lack of a formally approved procedure for WMATA inspections of those vehicles is addressed later in this report.

When RMMs break down on mainline track, CTEM either provides guidance on how to address the issue or sends mechanics to the location of the RMM. RMMs are most heavily used on mainline tracks outside of revenue hours, so CTEM has a regular staff of three mechanics based at the Alexandria Rail Yard and three mechanics based at the New Carrollton Rail Yard available each night.

The mechanics or supervisor typically attempt to troubleshoot or repair the problem in the field. At minimum, they aim to allow the operator to move the vehicle back to a yard under its own power, but the vehicle may be towed back to a yard if necessary to clear the tracks for revenue service.

Other CTEM mechanics, working on the day shift, do most regular preventive or corrective maintenance work on RMMs.

If a contractor RMM breaks down, the contractor is responsible for repairs. CTEM still responds to breakdowns on mainline track and may provide assistance to allow revenue service to resume as scheduled.

#### History

Investigations and reviews dating back to 2013 have identified concerns about WMATA practices related to RMMs, including that Metrorail was not following proper safety certification or approval practices for new RMMs or for RMM modifications.

On October 6, 2013, a contractor was killed and two Metrorail employees were injured near Union Station in a safety event linked to an RMM modification that had not gone through the safety certification and training processes required by WMATA procedures such as review by and collaboration with all relevant departments and mitigation of potential hazards. The specifications for a modification to add a welder head to a Prime Mover were not approved by engineering, and the specifications were further modified by TRST without safety approval after WMATA Procurement had accepted the contract. Hydraulic hoses used for welding and grinding were not designed to be used in a high temperature environment and did not have protective sleeves. This led to a fire when hot metal contacted a pressurized hose. An equipment



operator on a different RMM who had been working for five weeks without a day off reacted to the fire by moving that RMM backwards. Investigators concluded that abrupt movement swung a piece of old rail that was being removed, striking the two employees who were injured and the contractor who was killed. This event demonstrates how not following safety certification processes can lead to death and serious injury.

Also in 2013, the FTA issued an urgent safety advisory to all United States rail transit agencies urging a review of procedures for stored, unoccupied vehicles to ensure that wheel chocks and/or derails are used. The advisory followed a Chicago Transit Authority (CTA) runaway train event.

The Federal Transit Administration cited two WMATA RMM "rollaways" where unsecured vehicles rolled for some distance – one in 2014 between the Tenleytown and Van Ness stations and the other in 2015 in the Shady Grove Yard – and a Class 1 vehicle rolling in New Carrollton Yard in 2015 until the operator on board applied a handbrake as triggers for a WMATA Vehicle Securement Investigation completed in 2016. The investigation identified "universal misunderstandings among WMATA employees regarding the agency's rules and procedures for vehicle storage and securement."

Also in 2016, the Tri-State Oversight Committee (TOC) conducted a "Non-Revenue Vehicle Maintenance and Inspection" audit of the RMM program. As detailed later in this report, particularly as it relates to safety certification, WMATA has not yet fully addressed several issues identified in the 2016 TOC audit.

WMATA had accepted 12 new Prime Movers and a new Ballast Vacuum machine in the three years leading up to the 2016 TOC audit. There was no evidence that any of them had gone through WMATA's safety certification process as required by WMATA's Safety and Security Certification Plan. As detailed later in this report, this issue still has not been addressed.

A separate, broader 2016 TOC audit of system modification, safety certification, configuration management and procurement identified other concerns with a lack of safety certification and with SAFE not properly reviewing and approving certain testing plans or engineering modifications.

At the time of the 2016 RMM audit, Metrorail said it was transferring procurement responsibility for RMMs to the chief engineer for vehicles (CENV). During this audit, WMATA told the WMSC that it has just recently followed through on that transfer of responsibility. Safety certification is a part of a well-functioning procurement process.

The TOC's 2016 RMM audit found that CTEM did not have a CTEM-specific maintenance plan, and instead relied on procedures governing maintenance on

In 2016, the Tri-State Oversight Committee (TOC) conducted a "Non-Revenue Vehicle Maintenance and Inspection" audit of the RMM program. WMATA has not yet fully addressed several issues identified in the 2016 TOC audit.



revenue vehicles. The TOC also identified shortfalls in information provided to CTEM in deficiency reports from operators, which created challenges for CTEM mechanics, and the TOC found that on-the-job training requirements for CTEM mechanics on specific vehicles were not documented.

#### **Audit Work**

**Personnel Interviewed** 

Mechanic A (CTEM)

Mechanic Helper

(CTEM)

The WMSC received initial documents related to this audit from WMATA in October, conducted extensive interviews in November, and received follow-up documents and conducted document reviews into December 2020.

An exit conference was held on November 20, 2020 with Metrorail staff to summarize the status of the audit to that point.

The WMSC later provided a draft of this report to WMATA for technical review and incorporated any technical corrections as appropriate.

#### **Car Maintenance Service Vehicle Maintenance of Way** (CMNT) & Vehicle Maintenance (SVMT) Engineering (MOWE) **Engineering (CENV)** Assistant General Manager TGV > Assistant Director of Shop Superintendent **Support Services Operations** & Non-Revenue Superintendent Vehicles Assistant Manager, **CENV Engineering** > Project Coordinator Assistant **Superintendent** Regional Shop **Department of Safety** Track and Structures **Supervisor** and Environmental (TRST) Management (SAFE) Regional Shop **Supervisor** Deputy Chief, Safety > Assistant Certification Superintendent Mechanic AA Lead (Car Track Equipment Safety Certification > Equipment Maintenance (CTEM)) & Engineering **Operator A (2)**

**Technical Skills and Maintenance Training** (TSMT)

**Plant Maintenance** 

(PLNT)

**Superintendent** 

- Equipment **Operator Training** Instructor
- > Car Equipment **Training Instructor**

Manager

> Performance

**Monitoring Manager** 



#### **Documents Reviewed**

- Organization charts
- Lists of RMMs and RMMs owned by department
- Operations Administrative Procedures (includes draft OAP 101.01)
- Preventive Maintenance Manuals
- Operator Manuals
- Permanent Orders
- Standard Operating Procedures
- RMM technical specifications
- List of special tools used to maintain RMM
- 2019 Preventive Maintenance Inspections (PMI) carried out
- Service Vehicle Maintenance Shop PMI Checklist
- List of Equipment Modification Instructions
- Service Bulletins (including related to Chocks SBX-008)
- Equipment Configuration Changes (ECC)
- List of 2019 engineering requests
- CTEM Preventive Maintenance Hours Report
- Safety Events involving RMM from September 1, 2018 to September 1, 2020
- CMNT Shop Safety and Health Inspection Checklists from June 1, 2020 to August 31, 2020
- Safety Committee meeting minutes for CTEM facilities from September 1, 2019 to September 1, 2020
- RMM Training Materials (curricula, syllabi, PowerPoints, schedules, etc.)

- Employee training records
- List of RMM operators
- List of TGV use for 2018 and 2019
- Contractor rail vehicle inspection checklists from April 28, 2020 to May 21, 2020.
- Metrorail Safety Rules and Procedures Handbook, dated August 28, 2020
- > New RMM commissioning checklist/procedure
- > Pick schedules/options
- > Daily Equipment Movement and Request Log
- > Pre-trip inspection sheets
- Synovia RMM Tracking report samples (5/26/2020, 8/11/2020, 10/1/2020, 11/1/2020)
- > CTEM Mechanic checklists
- CTEM RMM Status Report notification recipient list
- CTEM Status Reports (10/30/2020, 11/2/2020)
- CTEM Heavy repair PMI schedule for October 2020
- > CTEM Employee Master Training Matrix
- SAFE Operational Hazard Analysis (OHA) for the Swingmaster Swingloader Crane and related Inspection and Testing Checklist
- Crane car design loading diagram
- Equipment Operator Final Practical Exam forms
- > 2019 System Safety Program Plan
- > 2020 Safety and Security Certification Program Plan



Track Geometry Vehicle (TGV)

## What the **WMSC** Found

### What the WMSC Found

#### **General Assessment**

Metrorail has a number of gaps in the development or implementation of important safety-related processes tied to RMMs that must be mitigated to reduce safety risks.

As described in the findings below, safety certification practices, RMM maintenance and operations training and certification, and a number of rules and procedures must be improved, clarified or actually implemented in order to improve the safety of the Metrorail system.

The WMSC also identified a number of positive practices during this audit work including the enthusiasm of many employees interviewed for their work, training personnel identifying areas where additional training is needed and identifying the need to provide additional support to those who barely pass a test, and the installation and limited use of some features of an RMM tracking system. At least four new vehicle-specific preventive maintenance manuals used by CTEM mechanics were issued in 2020.

CTEM effectively communicates when scheduled maintenance is due on WMATAowned RMMs through a status report that is emailed to dozens of people in departments that operate RMMs. This status report provides information about RMMs undergoing maintenance, marked as out of service, and scheduled for upcoming maintenance. As described below though, there is no way for frontline employees to determine if an RMM they are assigned to use has been marked as unsafe to operate due to overdue maintenance.

Inadequate information sharing among departments in some other circumstances is exemplified by operators' pre-trip or post-trip inspection information not being available to the mechanics who work on the vehicles. This suggests there are still opportunities for continued improvement in collaboration among the departments WMATA assigns as "owners" of a vehicle (mainly Track and Structures (TRST), Plant Maintenance (PLNT), and Maintenance of Way Engineering (MOWE)) and the departments WMATA assigns to do maintenance or engineering work on the vehicle (CTEM, CENV, SVMT).

Post-trip inspections are generally not completed, and it is not clear that all pre-trip inspections are properly completed.

Only when more significant repairs are required do equipment operators or their supervisors submit a deficiency report to CTEM. As was identified in the 2016 TOC audit, these forms often contain only limited information about the issue, which can make diagnosing and repairing the issue a more difficult or lengthy process.

Due to the timing of the deficiency reports (usually at the end of an overnight shift when most work is done) and the maintenance work (usually done during the day when RMMs are most likely to be in a yard while the system is open for revenue service)



Safety certification practices, RMM maintenance and operations training and certification, and a number of rules and procedures must be improved, clarified or actually implemented.



Safety certification is intended to ensure that hazards are identified and mitigated by focusing on these issues throughout the entire design, procurement, construction and implementation process. and the information provided, it is difficult for mechanics to follow up with those who submitted the report to get more information. There have been some process improvements since 2016 in the opportunities to convey these deficiency reports to CTEM, including the addition of a QR code that can be scanned with a phone as an additional option for equipment operators to more easily access the deficiency reporting email.

The expected addition of the new Dulles Rail Yard that is under construction as part of the Silver Line Phase 2 extension provides an opportunity for improved RMM maintenance based on the additional yard storage and shop space that will be available for RMMs. This is particularly important since the New Carrollton CTEM facility was intended to be temporary and does not have an overhead crane.

Realizing the benefit of the Dulles Rail Yard will require adequate staffing in the yard and proper planning to ensure that all required equipment is available and that, once the Silver Line extension opens, RMMs are stored in the appropriate locations.

RMM-related departments are facing some challenges due to the threat of COVID-19. These challenges include the need to adjust classroom training and the need to adjust certification practices for equipment operators given limited cab space on Prime Movers. It is important that WMATA carefully ensure that all aspects of safety – both based on social distancing and based on more traditional hazards – are considered in each adjustment to ensure that hazards are not introduced by these adjustments.

Due to COVID-19, RMM-related departments have also faced some minor delays in parts delivery; however, representatives from these departments said these delays have not caused any significant issues.

## No Safety Certification of New RMMs (Finding 1)

Metrorail is not following and does not have effective safety certification and acceptance procedures for new RMMs.

Safety certification is a critical procedure required under WMATA's Safety and Security Certification Program (SSCP) for all rolling stock, as well as many other important activities. The process is intended to ensure that hazards are identified and mitigated by focusing on these issues throughout the entire design, procurement and construction process from the conceptual and specification stages through acceptance and implementation.

Metrorail has designated its Department of Safety and Environmental Management (SAFE) as the department responsible for the safety certification process, but SAFE is not aware of all projects that may require safety certification.



SAFE had not identified which departments were procuring RMMs.

After many years, and a nearly identical finding in the 2016 TOC audit, only recently has Metrorail identified some RMMs for safety certification and, even then, only after they had already arrived on Metrorail property. This action in August 2020 led SAFE to prohibit the use of several Swingmaster Swingloader vehicles until modifications, such as the installation of backup cameras, could be made. In all, the Operational Hazard Analysis developed by SAFE includes 50 items that could require mitigation through measures such as training, physical adjustments to the vehicle or document improvements. The safety certification inspection and testing checklist that was later developed identified more than 150 items that needed to be tested or otherwise verified before the vehicles could be safely put into service. WMATA now expects safety certification on those swingloaders to be completed in winter 2021.

According to SAFE, the last RMM for which the safety certification process was properly completed was the Track Geometry Vehicle. The vehicle was purchased in 2012.

Even after the Tri-State Oversight Committee (TOC) identified at least 12 RMMs in its 2016 audit that had not gone through required safety certification, Metrorail stated during this audit that WMATA has never taken any steps to act on that TOC finding, such as developing an operational hazard analysis (OHA) that would have identified and led to implementation of mitigations for any uncontrolled hazards.

This audit and other WMSC oversight work demonstrate that WMATA was not executing aspects of its safety certification program.

SAFE personnel stated that they assumed that other departments were familiar with details in the SSPP, PTASP or SSCP due to the formal approval of the documents. However, the departments do not follow any safety certification procedures and were not familiar with the process. SAFE employees with responsibility for safety certification do not have access to all relevant internal documents and electronic systems for those departments that they would need to independently identify items such as RMMs requiring safety certification.

The WMSC has identified similar concerns regarding a lack of SAFE awareness of projects requiring reviews during separate inspection and oversight activity related to the development of a 6000-series railcar overhaul program.

In another example of the role safety certification can play, vehicle engineering personnel stated that the standards for RMM weight and capacity, which is capped at 15 tons per axle, is a completely separate determination from what Metrorail's bridges and elevated structures can actually support. As reference, Metrorail's specifications

The last RMM for which the safety certification process was properly completed was the Track Geometry Vehicle. The vehicle was purchased in 2012.



Engineering change procedures are not being followed, which opens opportunities for hazards to be missed.



There is no Metrorailwide safety certification procedure to implement the SSCP. for the 7000 Series, its heaviest railcars, established a maximum axle load of 16 tons. As the WMSC noted in its recently published Elevated Structures Audit, Metrorail does not have weight ratings for its elevated structures. Concerns like potential overloading of structures could be identified and mitigated through a proper safety certification process.

There is no Metrorail-wide safety certification procedure to implement the SSCP. Without such a procedure, safety certification may not occur unless individual departments happen to notify SAFE about projects or equipment acquisition.

Metrorail must implement a unified, specific safety certification procedure and appropriate training to ensure that each Metrorail department understands and implements safety certification requirements so that safety is considered from start to finish for each relevant project.

For those RMMs that did not go through the safety certification processes required at the time of purchase or delivery, including those identified in the 2016 TOC Audit, Metrorail must complete an Operational Hazard Analysis (OHA) on each vehicle to identify hazards, and then, following a safety review process, must implement any identified mitigations for those hazards.

#### RMM Modifications Not Following Safety Approval Process (Findings 2, 3)

Metrorail does not always follow safety certification or safety approval process requirements for modifications to existing RMMs.

SAFE is not adequately notified of engineering changes, preventing appropriate review. Engineering change procedures are not being followed, which opens opportunities for hazards to be missed. Even when SAFE is notified regarding RMM engineering changes, SAFE is not always able to effectively review the changes until after they have already been implemented on an RMM due to the use of engineering procedures that call for a test installation prior to SAFE review.

The concern regarding an installation prior to review is compounded on RMMs compared to railcars since there may only be a single vehicle of that RMM type on WMATA property so an unapproved "test" modification to that vehicle would effectively mean fully implementing the unapproved change.

Part of the challenge with the SAFE reviews could be traced back to engineering improperly using service bulletins to implement RMM modifications.

Per CENV's SOP 5, service bulletins (SBX) are only to be used as a notification that an engineering modification has been completed, while Equipment Configuration

Changes (ECCs) or Engineering Modification Instructions (EMIs) are to be used to actually institute the modifications. However, SBX-001, SBX-002, SBX-003, SBX-005, SBX-006, SBX-007, and SBX-009 each direct modifications to RMMs including the types of parts that are to be used or the maintenance process for a vehicle.

Because service bulletins do not follow the same review process as ECCs or EMIs, other departments such as SAFE do not provide the same level of review or scrutiny and may not have the opportunity to identify that safety certification is needed. A service bulletin also does not include the necessary updated training, revisions to preventive maintenance instructions, or permanent revisions to parts lists that an EMI or ECC would include. Still, CENV has used this practice after taking on additional responsibility for RMM modifications.

The WMSC has identified similar concerns regarding a lack of SAFE awareness of projects requiring reviews during separate inspection and oversight activity related to the development of a 6000-series railcar overhaul program.

Failing to follow proper review procedures can lead to unsafe changes, as demonstrated by the 2013 contractor fatality near Union Station.

These findings are similar to 2016 TOC findings, including findings in the TOC System Modification, Safety Certification, Configuration Management, and Procurement Audit.

Metrorail must follow its documentation procedures and processes for RMM modifications, including required reviews by all appropriate departments of each modification and training and instructions to employees.

Metrorail must also ensure that adequate processes are in place through a unified, specific safety certification procedure across engineering, safety, procurement and any other appropriate departments to ensure that safety certification or approval requirements are properly completed for each engineering modification or other change, including SAFE's full participation in the approval process for modifications.

#### **Reliability Data Not Fully Collected or Utilized (Finding 4)**

Metrorail is not utilizing reliability data for its RMMs, including not tracking the specific nature of failures, which prevents WMATA from realizing the safety benefits of a complete, ongoing analysis and improvement program as described in the SSPP is required to ensure the quality and reliability of equipment and to identify and analyze hazards.

Trends in RMM failures are not regularly analyzed or considered to reduce the risk of recurring failures and safety events, and operations engineers are not notified of RMM breakdowns.



Trends in RMM failures are not regularly analyzed or considered to reduce the risk of recurring failures and safety events, and operations engineers are not notified of RMM breakdowns.

CTEM mechanics or supervisors might notice some trends if they happen to work on the same vehicle or vehicle type multiple times; however, more systematic utilization of RMM reliability data is needed.

Tracking and analysis of breakdowns would help proactively identify safety hazards, identify parts that may require replacement or redesign, identify areas for engineering improvements, and identify vehicles that require additional maintenance or replacement. Since even different types of RMMs can share certain similar characteristics, the data can also be used to trigger closer reviews of similar parts on other types of vehicles that have not yet failed, or to identify vehicles or parts that may be performing particularly well and practices that should be replicated.

Metrorail has taken the first steps toward some limited RMM tracking data by installing a fleet management tool, but the system's only current practical use is to identify the physical location of an RMM. That is a significant improvement for both safety-related RMM maintenance and RMM operations purposes, but Metrorail should continue efforts to address issues with current installation and to consider expanding



Event recorders and other current data collection systems on WMATA RMMs are not adequate to identify the causes of safety events, breakdowns or other crucial information. the telemetry data gathered from this system while ensuring that all appropriate departments take advantage of that data.

Event recorders and other current data collection systems on WMATA RMMs are not adequate to identify the causes of safety events, breakdowns or other crucial information. WMATA personnel interviewed for this audit acknowledged this deficiency, with one person describing the information available from RMMs as "very primitive." Without specific, accurate data on failures, beyond just the hours between failures, it is not possible to identify or to develop solutions to prevent recurring or emerging problems.

CTEM also appears to have two different records of vehicle deficiencies. Although the official maintenance database is Maximo, which contains work orders and maintenance history for each vehicle, multiple CTEM employees told WMSC interviewers that they are also required to enter information into a second log maintained on the department's internal shared drive that also separately logs vehicle deficiencies. When the WMSC requested the document in a follow-up request, WMATA management stated that no such log exists. This redundant work and the disconnect between employees and management risks the existence of conflicting information in different Metrorail systems. In response to the draft version of this report, the Office of the Chief Mechanical Officer, Rail (CMOR) stated that the use of the log outside of Maximo was supposed to have stopped in 2019.

WMATA must establish a robust, official, coordinated reliability tracking and assessment process for RMMs to identify and mitigate safety risks proactively. As part of this process, WMATA must determine what improvements are required for data collection, data recording, analysis or other systems and implement the identified improvements.

#### **Equipment Operator Training, Certification (Finding 5, 6)**

Metrorail equipment operators are not fully trained on each type of vehicle they may be directed to operate, and at least some of their training has not included sufficient hands-on experience. Different vehicles require different knowledge and experience to operate, including knowledge of the controls and how to use each type of vehicle in the field.

As part of their initial certification required to work as an equipment operator, those employees receive basic initial operations and movement training with a focus on signals and communication and basic vehicle movement. This training uses a Prime Mover, Swingmaster and a Pettibone hi-rail vehicle that includes a crane. The training includes some classroom time and some field time. Operators may or may not receive





There are opportunities for WMATA to provide this training efficiently if it is carefully developed and planned, such as through "differences" training.



There is no way for anyone in the field to identify whether an operator is certified to use a particular piece of equipment. additional hands-on field training on how to actually use specific vehicles in a work zone.

A refresher on the material covered in this basic class is required every two years to recertify as an equipment operator.

Additionally, WMATA requires equipment operators to be separately trained and qualified to operate each specific type of RMM prior to operating that specific type of RMM. Each type of equipment requires separate training and understanding for an operator to be qualified and competent to use that equipment. Operators will not be trained on all equipment in the system, but must be trained on all equipment that they use or may be directed to use in the course of their work.

However, to the extent that Metrorail monitors certification on specific RMMs, those certifications never expire, so an operator could be technically certified to use a vehicle despite not using, seeing or being trained on that vehicle in a decade or longer.

The WMSC has identified related issues in recent safety events that demonstrated a need to improve the certification standards and to require recertification. The equipment operator involved in a collision in the New Carrollton Rail Yard on February 11, 2020 was certified as an equipment operator but was not recently trained on the use of the TGV. The operator allowed the vehicle to drift back, and then inadvertently accelerated the TGV into stationary flat cars. A similar event (described in more detail below) involving a mechanic led to a collision in the Branch Avenue Rail Yard on April 6, 2020.

Even some initial training courses that are provided for specific vehicles are insufficient, such as a recent two-week class described during interviews that was offered on a tamper. The training would normally take at least 3 months elsewhere in the industry when factoring in both initial classroom training and a significant amount of time using the equipment in the field alongside an instructor.

WMATA must institute sufficient, specific, specialized certification training and standards to operate each type of RMM, and must provide that training and certification to each equipment operator for the type(s) of RMM that operator uses. All aspects of this training, including the required seat-time, on-the-job training (OJT) and vehicle-type specific certification status of each equipment operator, must be documented.

There are opportunities for WMATA to provide this training efficiently if it is carefully developed and planned, such as through "differences" training focused on providing those operators already proficient on one vehicle with training on the similarities

and differences in the operation of a different vehicle that has certain variations in equipment or performance.

Metrorail could also improve the familiarization and OJT process with more structured practices for supervisors to provide adequate seat time and assistance to equipment operators on different equipment.

After the initial training, Metrorail must require sufficient, specific, specialized, standardized refresher training and recertification on each type of equipment at appropriate intervals, which may be more frequent if operators have not regularly used a specific type of equipment, and develop a process to ensure equipment operators have frequent exposure to any equipment they may use. All aspects of this training and recertification must be documented.

#### Verifying Equipment Operator Certification (Finding 7)

Supervisors or others have no way of confirming while in the field whether an operator is properly trained to operate a specific RMM.

Although identification cards provide information about basic equipment operator certification and Roadway Worker Protection training status, there is no way for anyone in the field to identify whether an operator is certified to use a particular piece of equipment. There is also no way for an operator to demonstrate to a supervisor whether they are or – if they were ever to be directed to operate a vehicle they are not fully trained on – are not certified to operate specific equipment.

WMATA must establish a process requiring regular supervisory checks of certifications.

For example, Metrorail could institute a process to verify at each employee job assignment pick<sup>1</sup> (and any time that a new employee or new machine returns to or is added to a yard, shift or crew) that operators have the certifications required for each piece of equipment available for their positions, and provide any additional training that is required. Coupled with automatic notifications when certifications are expiring, this could help ensure that equipment is operated only by operators who are certified to operate that particular RMM.

Certain vehicles can cause more significant damage to track and structures or pose special risks to personnel if proper procedures are not followed.



<sup>&</sup>lt;sup>1</sup>Metrorail assigns union employees to shift times, reporting locations and responsibilities using a schedule "pick" where employees select available assignments based on their job title or classification and seniority. The picks are typically held so that changes take effect in late June and late December, but special picks can occur at other times due to schedule changes or service adjustments.



Metrorail needs to develop more of the highly trained operators. At a minimum, the vehicle type-specific certification status of those operators who may operate the most complex equipment such as the TGV, continuous welded rail train, heavy-duty (currently METRO 4x4) tamper, ballast regulator and vacuum train must be available in some way in the field to supervisors, so that they may provide appropriate oversight and control of personnel who operate these vehicles that can cause significant damage to track and structures or pose special risks to personnel if proper procedures are not followed.

The TGV is a unique, technically advanced vehicle used to take measurements of and automatically identify concerns with track layout, rail integrity, platform levels and other safety-related parameters. It has controls and features that are significantly different from other vehicles used in the Metrorail system.

The continuous welded rail train is a lengthy consist that usually includes multiple Prime Movers and other RMMs. It is used to move long pieces of continuous welded rail to or from locations across the system. This requires special expertise due to the differences in braking distance and other safety-related issues compared to operating a single Prime Mover.

The heavy-duty tamper includes automatic computer-controlled systems and multiple arms and tools that swing out and away from the vehicle, which can put other people or the track infrastructure at risk of serious harm if the vehicle is not operated properly.

Similarly, a ballast regulator is a piece of heavy equipment that typically runs with a tamper to correctly distribute the ballast throughout the rail ties. The vacuum train removes ballast and must be operated with significant care to ensure that the proper type and amount of ballast remains.

#### **Succession Planning Needed (Finding 8)**

Metrorail risks key safety and maintenance work coming to a halt due to insufficient succession planning and training.

Metrorail managers only have confidence in a few specific employees to operate complex equipment such as the heavy-duty tamper, and training for other employees on that equipment has been superficial. Metrorail needs to develop more of the highly trained operators.

These risks have been realized in ways that demonstrate safety concerns. For example, key members of the tamping crew picked out of their roles and into other positions in the midst of the summer 2020 Orange and Silver Line shutdown following a proposed change to the tamper crew's work schedule. There was no backup option. Metrorail quickly reversed the schedule change, and the crew members returned. Metrorail faces similar demonstrated risks to this safety-critical work that could be



realized due to vacation, illness or other leave, or personal decisions by employees to leave the agency.

Interviews identified a similar reliance on just one or two operators for major tasks performed using certain other complex equipment such as the ballast regulator, the continuous welded rail train, and vacuum train.

Due to WMATA's current limited practices related to qualification on specific equipment, some of the operators who managers have confidence in are not listed on the training report provided to the WMSC as qualified to operate the complex machines that supervisors apparently believe these operators have the most expertise in. Other individuals who are listed as qualified appear to lack the training that would be required to safely and competently operate the machines. WMATA provided lists of equipment operator job assignments, a list of operators who just went through tamper training, and lists of all equipment operator Enterprise Learning Management (ELM) records, but the ELM lists did not include all individuals that were listed as having job assignments, and some individuals on the tamper training list were not listed at all in the ELM records.

In addition to demonstrating the issues with equipment operator certification on specific equipment that were noted above, this also demonstrates the need for adequate rotation of responsibilities to keep a number of operators fully up to speed Metrorail is relying on a document that has not been approved or signed.



on crucial, complex vehicles so that work can continue if an operator is sick, on vacation or retires.

Metrorail must conduct an analysis to determine the necessary number of fully trained and certified operators on each type of RMM for safe operations and continued safety-related maintenance or construction work. The analysis must also determine, for at least the most complex equipment (noted above), the seat time each operator must have on an ongoing basis to remain competent on each piece of equipment.

Based on that analysis, Metrorail must train, certify, and maintain at least the required number of operators for each piece of equipment and must maintain and monitor operator certification expiration for each piece of equipment to ensure that the minimum number of trained operators continues to be met.

#### **Contractor Vehicle Inspection Procedure** (Finding 9)

Metrorail does not have an approved procedure for the inspection of contractor hi-rail vehicles that enter the Metrorail system.

Metrorail personnel stated that they are relying on a document that has not been approved or signed. The document provided to the WMSC was created as a "draft" OAP 101-01 on September 9, 2020. The previous OAP that was controlled by TRST is no longer in effect and did not lead to proper documentation. As identified in investigation W-0046 into a February 10, 2020 hi-rail derailment and collision in the Alexandria Rail Yard, Metrorail did not previously have adequate procedures for the dynamic testing of contractor RMMs.

Metrorail appears to be using other documents that continue to be marked as draft as well, such as a new certifiable items list identified for the vehicles Metrorail only identified as requiring safety certification after the vehicles were already in use on Metrorail property and a draft SOP 202-14 regarding maintaining, revising and updating periodic inspection and preventive maintenance procedures. WMATA cited the draft version of SOP 202-14 as the basis for CENV's recently expanded responsibilities for RMM preventive maintenance instructions.

Metrorail must formally establish a sufficient procedure for the inspection of non-WMATA RMMs before they are used on Metrorail property.

Metrorail also must identify any other draft procedures that are being relied upon and replace those with procedures that are fully vetted and approved by all appropriate departments.

Changes made to tires can disrupt the weight distribution to the hi-rail wheels.





#### **Hi-Rail Vehicle Maintenance Training** (Finding 10)

Employees responsible for maintenance of certain components and systems of WMATA-owned hi-rail vehicles are not trained on how their maintenance work could affect the hi-rail systems or operations, increasing the risk of a derailment or other safety event.

Metrorail assigns the maintenance of rubber-tired vehicles to SVMT, a group that falls under bus maintenance. Specifically, SVMT maintains all aspects of the vehicle that relate to operations on a highway, but SVMT employees have no experience with or training on hi-rail vehicles. This creates a risk that changes or repairs to the vehicles could be made that inadvertently cause a problem when the vehicle is on the rails.

For example, changes made to tires can disrupt the weight distribution to the hi-rail wheels when the vehicle is placed onto the tracks, making a derailment more likely.

The rail portion of the vehicle is inspected and maintained separately (on a different schedule from the SVMT maintenance) by contractors who report to other departments that "own" the vehicle. Other specialized aspects of the vehicles, such as cranes, are also checked separately.

In interviews, CTEM staff stated they had recently been asked to provide assistance with the inspection of a few WMATA-owned hi-rail vehicles, although there is no process in place for that and CTEM mechanics currently have no hi-rail training requirements.

All employees responsible for the inspection and maintenance of systems and components of hi-rail vehicles must be trained to have a holistic understanding of the potential effect of maintenance work or lack thereof on how the vehicle operates both on rubber tires and on the rails.

## Rail-bound RMM Maintenance Rules & Procedures (Finding 11)

Metrorail requires RMM maintenance and engineering to follow certain railcar rules that create unnecessary complications or contradictions.

Multiple rules or procedures are based on assumptions that Class 1 railcars and RMMs are the same. However, Class 1 railcars operate on electric third rail power, but RMMs generally operate on diesel power or are not powered at all. For example, procedures calling for using a stinger to power a railcar so it can move out of a shop do not have any relevance to RMM maintenance, because the vehicle's engine can be used to move it in or out of a shop. Multiple rules or procedures are based on assumptions that Class 1 railcars and RMMs are the same.



Improvements can reduce the risk of practical drift away from written procedures by addressing concerns from a number of RMM maintenance employees that current processes or procedures are unnecessarily long. RMM maintenance also involves many more makes and models of equipment than WMATA Class 1 railcar maintenance does.

WMATA has made some steps to address some of these procedural issues since the TOC identified a similar concern in 2016, including the new SOP 17 issued April 3, 2020 to separate the procedure for the movement of diesel-powered RMMs in shops from the procedures for the movement of electrically powered railcars, but additional steps are needed to simplify processes and address proper terminology, maintenance and operations for RMMs.

The additional improvements can reduce the risk of practical drift away from written procedures by addressing concerns from a number of RMM maintenance employees that current processes or procedures are unnecessarily long due to the mixing of steps relevant to RMM and steps relevant to third-rail powered railcars.

Metrorail must evaluate engineering and maintenance policies or procedures that relate to RMMs in departments including CMNT, CENV and CTEM and update them as needed to provide for improved safety and adequate reviews.

## Rail-bound RMM Maintenance Training (Finding 12)

CTEM mechanics only receive limited training on specific vehicles that would assist them in moving and maintaining RMMs, and do not receive adequate refresher training.



CTEM mechanics do not always get training on the specific vehicles they work on even though they can go more than a year between seeing certain vehicles, and generally receive limited training on how the machines they maintain actually operate in the field.

In addition to basic maintenance and movement challenges, this can make it more difficult for mechanics to understand why certain fixes or maintenance are needed, why operators may report something as a deficiency, how to make sure the RMM is properly functioning, or where to look for safety issues.

In some cases, those interviewed said this necessitated "learning as we go" on certain vehicle maintenance and movement.

Less experienced mechanics may receive some on the job training from more senior mechanics, but CTEM employees do not get recurring familiarization training on specific RMM types.

One vehicle type where CTEM's assigned trainer has identified a specific need for this type of familiarization training is the hybrid tamper. The training department stated that it is in the procurement process for this training which is intended to focus on maintenance, troubleshooting and diagnostics, and to include an explanation of how and why the tamper is used in the field to ensure proper track geometry.

The 2016 TOC audit identified a similar concern that CTEM's on-the-job training requirements and curriculum were not documented, and that it was not clear which mechanics were properly trained to perform maintenance on which machines or how WMATA ensured that those who were trained were the only ones working on a particular machine.

The concerns about refresher training and familiarization with specific vehicles also extend to proper movement of some RMMs, as demonstrated by an April 6, 2020 collision in the Branch Avenue Rail Yard. An acting CTEM supervisor attempted to move the Track Geometry Vehicle (TGV) in order to clear a path for other equipment to be moved into the shop. Instead, the TGV struck a Prime Mover that was parked approximately 150 feet away from the TGV's starting position. The CTEM employee had not been trained to operate the TGV since 2013, yet decided to move the vehicle. The employee described attempts to activate brakes after the vehicle began rolling, but the employee did not pull the emergency brake handle. The TGV continued rolling into the shop and struck a Prime Mover, causing minor damage to the TGV anti-climber and to the Prime Mover coupler. While further investigation showed the brakes may not have activated even if the operator had properly pulled the emergency brake handle, a lack of training meant that the operator did not try to use it.



Metrorail does not apply inspection stickers to its own RMMs or provide another easily accessible way for operators to know whether the RMM they are operating has been properly inspected and maintained. There is not uniform agreement on the direction on the use of chocks across different departments. Yard moves training for CTEM employees focuses on communication with the tower and identifying signals, but it does not focus on how to actually operate the wide range of RMM types.

Metrorail must establish and document completion of vehicle training requirements for CTEM staff and must identify and provide adequate maintenance and movement training on each vehicle that a mechanic may work on, including any appropriate initial, refresher and recurring training on each type of RMM a mechanic works with.

## Identifying RMM Inspections, Safety in Field (Finding 13)

There is no clear way for field personnel to identify WMATA-owned RMMs that have been inspected and deemed safe for use.

Because Metrorail does not apply inspection stickers to its own RMMs or provide another easily accessible way for operators to know whether the RMM they are operating has been properly inspected and maintained, there is no way to ensure that equipment marked in computer-based tracking systems as unsafe or beyond required inspection and maintenance dates is being kept out of service. The email notice of equipment status goes only to supervisors, and there is no indication available to operators before they begin to use a vehicle.



There is also no way for field personnel to identify any safety restrictions that may be required for non-WMATA-owned RMMs that have been allowed into the Metrorail system.

Only contractor-owned vehicles have WMATA inspection stickers applied to note inspection expiration dates, and contractor-owned RMMs that are approved with restrictions get the same sticker as those that are approved for all mainline use. Those restrictions can include important limitations such as requiring a large vehicle to operate only on above-ground tracks due to clearance concerns.

Metrorail must provide a way for operators, supervisors and inspectors in the field to readily identify the inspection and maintenance status of an RMM and any restrictions on the use of that RMM, whether owned by WMATA or a contractor.

#### RMM Securement (Finding 14)

Metrorail does not have a single, clear, complete safety procedure for the securement of vehicles using chocks.

Metrorail Safety Rules and Procedures Handbook (MSRPH) Rule 3.126 states that, for storage of RMMs, operators must set parking brakes on all units in the consist, apply wheel stops or chocks to both sides of one wheel on one axle of each truck in the consist, and must perform a walk-around inspection to ensure brakes are properly applied, chocks or stops are in place, and no equipment is fouling any other tracks.

MSRPH Rule 3.105 requiring chocks on any work cars that are cut away from a work train at a work site and Rule 3.114 requiring the vehicle flag person to assist in placing wheel chocks to secure a vehicle at a work site also apply on mainline tracks.

However, CTEM wheel chock service bulletin SBX-008 says chocks are not required when a vehicle is parked on a grade. This conflicts with the above MSRPH rules that call for using chocks regardless of grade to properly secure vehicles.

According to the Metrorail Safety Rules and Procedures Handbook (MSRPH), a service bulletin is not an approved way to change a WMATA rule. In several interviews it became clear that there is not uniform agreement on the direction on the use of chocks across different departments such as TRST and CTEM. The service bulletin also does not state that it applies to PLNT and MOWE.

Employees had mixed awareness of new non-metal chocks and of procedures for chocking a vehicle on mainline track, demonstrating that Metrorail has not clearly established and communicated safety-based standards for the securement of equipment and suggesting that WMATA has not conducted adequate internal







Without tolerances that are achievable, frontline personnel may ignore the instructions as unrealistic or apply their own informal tolerances that may or may not be safe.



oversight or compliance checks related to vehicle securement. An engineer stated that the new service bulletin is based on the manufacturer instructions for the new polyurethane chocks that were purchased to reduce the hazard posed by metal chocks near an electrified third rail. This does not alter the fact that the bulletin conflicts with the MSRPH rules.

Metrorail must set and follow safety-based standards for the use of chocks and clearly convey those standards to all personnel.

The proper procedures must be communicated for situations and combinations of situations based on the presence or absence of third rail and the presence or absence of grades. If the grade is a factor in the use of chocks, the procedures must provide for how personnel would identify the grade. Metrorail must implement the safety-based standards, and ensure compliance with the securement rules.

#### Lack of Maintenance Tolerances (Recommendation)

Several Metrorail preventive maintenance instructions, such as those for the Kershaw Ballast Regulator and Core Drilling Flat Car, specify only a precise value for pressure and some other measurements and do not include acceptable tolerances. Without tolerances that are achievable and within the measurement capabilities of available tools, frontline personnel may ignore the instructions as unrealistic or apply their own informal tolerances that may or may not be safe.

Including proper tolerances is a good practice, but not one that is necessarily technically required, so the WMSC is offering this as a recommendation to WMATA.

Per the WMSC Program Standard, Metrorail must determine whether adopting tolerances and making the associated changes to these manuals and/or to available tools are required. If WMATA determines that a corrective action plan is necessary based on this recommendation, these changes could be achieved by consulting with original equipment manufacturers to identify the acceptable tolerances for each measurement, by ensuring that all necessary tools are available to achieve those requirements, and by updating maintenance manuals and instructions.



**Findings** and Corrective Actions

### Findings and Corrective Actions

Metrorail is not following and does not have effective safety certification and acceptance procedures for new RMMs. There is no Metrorail-wide safety certification procedure to implement the SSCP. Without such a procedure, safety certification may not occur unless individual departments happen to notify SAFE about projects or equipment acquisition. Safety certification is required for all rail vehicles. Only recently has Metrorail identified some RMMs for safety certification, and, even then, only after several of those vehicles were on WMATA property. This has led to the removal from service of several vehicles that were already in use. The Department of Safety and Environmental Management (SAFE) had not identified which departments were procuring RMMs. Safety certification requires review throughout the process from design through installation and implementation. SAFE personnel stated that they assumed departments were familiar with details in the SSPP, PTASP or SSCP, but the departments do not follow any safety certification procedures and were not familiar with the process. SAFE employees with responsibility for safety certification do not have access to all relevant internal documents and electronic systems for those departments. Even after the Tri-State Oversight Committee (TOC) identified at least 12 RMMs in 2016 that had not gone through required safety certification, Metrorail stated during this audit that WMATA has never taken any steps to act on that finding, such as developing an operational hazard analysis (OHA) that would have identified and led to implementation of mitigations for any uncontrolled hazards. There is also no Metrorail-wide safety certification procedure, so individual departments are left to their own discretion to notify SAFE (or not). The WMSC has identified similar concerns regarding a lack of SAFE awareness of items requiring reviews during separate inspection and oversight activity related to the development of a 6000-series railcar overhaul program.

Minimum Corrective Action: Metrorail must implement a unified, specific safety certification procedure and develop and implement appropriate training to ensure that each Metrorail department understands and implements safety certification requirements so that safety is considered from start to finish for each relevant project. Metrorail must establish and demonstrate that it is following effective safety certification and acceptance procedures and specific processes for all RMMs from the specification or design phase through acceptance and use. For those RMMs that did not go through the safety certification processes required at the time of purchase or delivery, including those identified in the 2016 TOC Audit, Metrorail must complete an Operational Hazard Analysis (OHA) on each vehicle to identify hazards, and then, following a safety review process, must implement any identified mitigations for those hazards.



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Metrorail does not always follow safety certification or safety approval process requirements for modifications to existing RMMs. SAFE is not being adequately notified of engineering changes to RMMs. Even when SAFE is notified, SAFE is not able to effectively review the changes until after they have already been implemented due to engineering procedures that call for a test installation prior to SAFE review even though there may only be one of those vehicles on WMATA property. The WMSC has identified similar concerns regarding a lack of SAFE awareness of items requiring reviews during separate inspection and oversight activity related to the development of a 6000-series railcar overhaul program.

Minimum Corrective Action: Metrorail must ensure that adequate processes are in place through a unified, specific safety certification procedure across engineering, safety, procurement and any other appropriate departments to ensure that safety certification or approval requirements are properly completed for each engineering modification or other change, including SAFE's full participation in the approval process for modifications. This must include Metrorail ensuring that SAFE identifies and is adequately notified of engineering changes to RMMs and that SAFE reviews the changes prior to implementation.

#### Metrorail is not following its engineering change procedures.

Service bulletins are improperly being used to implement RMM engineering modifications. Per CENV's SOP 5, service bulletins (SBX) should only be used as a notification tool to let all stakeholders know that an engineering modification was completed, and Equipment Configuration Changes (ECCs) or Engineering Modification Instructions (EMIs) are to be used to actually institute the modifications. However, SBX-001, SBX-002, SBX-003, SBX-005, SBX-006, SBX-007, and SBX-009 each direct modifications to RMMs including the types of parts that are used and process, but did not go through the required modification and training development and approval process.

Minimum Corrective Action: Metrorail must follow its documentation procedures and processes for RMM modifications, including required reviews by all appropriate departments of each modification and training and instructions to employees. Metrorail must also ensure that adequate processes and a unified, specific procedure are in place across engineering, safety, procurement and any other appropriate departments to ensure that safety certification or safety approval requirements are properly completed for each engineering modifications and ceasing the use of service bulletins to implement modifications.





Metrorail is not utilizing reliability data for its RMMs, including the specific nature of any failure, which prevents WMATA from realizing the safety benefits of a complete, ongoing analysis program. Trends in RMM failures are not regularly analyzed or considered in order to reduce the risk of recurring failures and safety events, and operations engineers are not notified of RMM breakdowns. CTEM mechanics or supervisors might notice some trends if they happen to work on the same vehicle or vehicle type multiple times; however, more systematic utilization of RMM reliability data is needed. Metrorail has taken the first steps toward some limited location tracking data, but event recorders and other data collection systems installed on WMATA RMMs are not adequate to identify the causes of safety events, breakdowns or other crucial information. Without specific, accurate data on failures, beyond just the hours between failures, it is not possible to identify or to develop solutions to prevent recurring or developing problems.

Minimum Corrective Action: Metrorail must establish a robust, coordinated reliability tracking and assessment process for RMMs to proactively identify and mitigate safety risks. As part of this process, WMATA must determine what improvements are required for data collection, data recording, analysis or other systems and implement the identified improvements.

Equipment operators are not fully trained on each type of vehicle they may be directed to operate. Some training has not included sufficient hands-on experience. Equipment operators receive only initial training on basic vehicles (currently a Prime Mover, Pettibone and Swingmaster), with a focus on signals and communication, and then may or may not receive additional hands-on training on how to actually use specific vehicles in a work zone. Some initial training courses provided for specific vehicles are also insufficient to be fully certified to operate those vehicles, such as a two-week class that was offered on a tamper that would take at least than 3 months elsewhere in the industry to fully master through both the classroom session and experience using the equipment alongside an instructor.

Minimum Corrective Action: Metrorail must institute sufficient, specific, specialized certification training and standards to operate each type of RMM, and must provide that training and certification to each equipment operator for the type(s) of RMM that operator uses. All aspects of this training, including the required classroom, seat-time, OJT and vehicle-type specific certification status of each equipment operator, must be documented.



Equipment operator certifications for specific vehicles do not expire or require recertification. Metrorail permits equipment operators to remain qualified on specific equipment indefinitely, even if they have not seen or used that piece of equipment in years and have not had any recent practice time or OJT. The WMSC has identified related issues in recent safety events that demonstrated a need to improve the certification standards and to require recertification. The equipment operator involved in a collision in the New Carrollton Rail Yard on February 11, 2020 was certified as an equipment operator but was not recently trained on the use of the TGV. On April 6, 2020, a mechanic who was not trained to operate the TGV attempted to move the vehicle, leading to a collision in the Branch Avenue Rail Yard.

Minimum Corrective Action: Metrorail must require sufficient, specific, specialized, standardized refresher training and recertification on each type of equipment at appropriate intervals, which may be more frequent if operators have not regularly used a specific type of equipment, and develop a process to ensure equipment operators have frequent exposure to any equipment they may use. All aspects of this training and recertification must be documented.

#### Supervisors or others have no way of confirming while in the field whether an operator is properly trained to operate

a specific RMM. Although identification cards provide information about basic equipment operator certification and Roadway Worker Protection training status, there is no way for anyone in the field to identify whether an operator is certified to use a particular type of equipment. There is also no way for an operator to demonstrate to a supervisor whether they are or – if they were ever to be directed to operate a vehicle they are not fully trained on – are not certified to operate specific equipment. The lack of clear documentation of equipment type qualification limits regular qualification checks, which can lead to the movement of vehicles by those not currently qualified to do so.

Minimum Corrective Action: Metrorail must establish a process requiring regular supervisory checks of certifications, which may include checks during the pick process and automatic notifications of expiring certifications. Vehicle-type specific certification status of each individual who may operate, at a minimum, the most complex equipment such as the TGV, continuous welded rail train, heavy-duty (currently METRO 4x4) tamper, ballast regulator and vacuum train must be available in some way in the field to supervisors, so that they may provide appropriate oversight and control of personnel.



### Metrorail risks key safety and maintenance work coming to a halt due to insufficient succession planning and

**training.** Managers have confidence in only a few employees to operate complex tamping equipment, and training for other employees on that equipment has been superficial. For example, key members of the tamping crew picked out of their roles and into other positions in the midst of the summer 2020 Orange and Silver Line shutdown following a proposed change to the tamper crew's work schedule. There was no backup option. Metrorail had to quickly reverse the schedule change, and the crew members returned. Metrorail faces similar demonstrated risks to this safety-critical work that could be realized due to vacation, illness or other leave, or personal decisions by employees to leave the agency, which creates a risk that important track geometry or renewal work could come to a halt. Interviews identified similar concerns related to the continuous welded rail train and vacuum train.

Minimum Corrective Action: Metrorail must conduct an analysis to determine the necessary number of fully trained and certified operators on each type of RMM for safe operations and continued safety-related maintenance or construction work. The analysis must also determine, for at least the most complex equipment (Track Geometry Vehicle, Continuous Welded Rail Train, heavy-duty tamper, ballast regulator, vacuum train), the seat time each must have on an ongoing basis to remain competent on each piece of equipment. Based on that analysis, Metrorail must train, certify, and maintain at least the required number of operators for each piece of equipment and must maintain and monitor operator certification expiration for each piece of equipment to ensure that the minimum number of trained operators continues to be met.

Metrorail does not have a procedure for the inspection of contractor hi-rail vehicles. Metrorail personnel stated that they are relying on a document that has not been approved or signed. The document was created as a "draft" OAP 101-01 on September 9, 2020. The previous OAP that was controlled by TRST is no longer in effect and did not lead to proper documentation. As identified in investigation W-0046 into a February 10, 2020 hi-rail derailment and collision in the Alexandria Rail Yard, Metrorail did not have adequate procedures for the dynamic testing of contractor RMMs. Metrorail appears to be using other documents that continue to be marked draft as well, such as a new certifiable items list identified for the vehicles that Metrorail only identified as requiring safety certification after the vehicles were already in use on WMATA property.

Minimum Corrective Action: Metrorail must establish a sufficient procedure for the inspection of non-WMATA RMMs before they are used on Metrorail property. Metrorail also must identify any other draft procedures that are being relied upon and replace those with procedures that are fully vetted and approved by all appropriate departments.



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Employees responsible for maintenance of certain components and systems of WMATA-owned hi-rail vehicles are not trained on how their maintenance work could affect the hi-rail systems or operations. Metrorail assigns the maintenance of all aspects of rubber-tired vehicles related to operations on a highway to SVMT, a group with no experience with or training on hi-rail vehicles. This creates a risk that changes or repairs to the vehicles could be made that inadvertently cause a safety event when the vehicle is on the rails. For example, changes made to tires on a hirail vehicle can disrupt the weight distribution to the hi-rail wheels when the vehicle is placed onto the tracks, making a derailment more likely. The hi-rail portion of the vehicle is inspected and maintained separately (on a different schedule from the SVMT maintenance) by contractors who report to other departments that "own" the vehicle. CTEM has also recently been asked to look at some hi-rail vehicles, although there is no process in place for that.

Minimum Corrective Action: All employees responsible for the inspection and maintenance of systems and components of hi-rail vehicles must be trained to have a holistic understanding of the potential effect of maintenance work or lack thereof on how the vehicle operates both on rubber tires and on the rails. For example, the employees must understand the importance of rubber tire maintenance and the potential relationship of that maintenance to hi-rail derailment risk.

Metrorail applies certain railcar rules to RMM maintenance and engineering that create unnecessary complications or contradictions. Multiple rules or procedures are based on assumptions that railcars and RMMs are the same. WMATA has made some steps to address this since the Tri-State Oversight Committee identified a similar concern in 2016, including the new SOP 17, but additional steps are needed to simplify processes and address proper terminology, maintenance and operations for RMMs. RMMs operate differently from third-rail powered railcars and there is a wider variety of RMMs than railcars in the Metrorail system.

Minimum Corrective Action: Metrorail must evaluate engineering and maintenance policies or procedures that relate to RMMs in departments including CMNT, CENV and CTEM and update them as needed to provide for improved safety and adequate reviews.

CTEM mechanics get only limited training on specific vehicles that would assist them in moving and maintaining RMMs, and do not get adequate refresher training. CTEM mechanics generally get limited training on how the machines they maintain actually operate in the field, which makes it more difficult to understand why certain things are needed, why operators may report something as a deficiency, how to make sure the RMM is properly functioning, or where to look for safety issues. While they may get on the job training on certain vehicles from more senior mechanics, CTEM mechanics do not get recurring familiarization training with specific RMM types. For example, CTEM's assigned trainer has identified a need and is in the procurement process for hybrid tamper training. Yard moves training focuses on communication with the tower and identifying signals, but does not focus on how to actually operate individual vehicles.

Minimum Corrective Action: Metrorail must establish and document completion of vehicle training requirements for CTEM staff and must identify and provide adequate maintenance and movement training on each vehicle that a mechanic may work on, including any appropriate initial, refresher and recurring training on each type of RMM a mechanic works with.

There is no clear way for field personnel to identify WMATAowned RMMs that have been inspected and deemed safe for use, and there is no way for field personnel to identify any safety restrictions that may be required for non-WMATAowned RMMs that have been allowed into the Metrorail system. Only contractor-owned vehicles have WMATA inspection stickers put on them to note inspection expiration dates, and contractor-owned RMMs that are approved with restrictions get the same sticker as those that are approved for all mainline use. Since Metrorail does not put inspection stickers on its own RMMs or provide another easily accessible way for operators to know whether the RMM they are operating has been properly inspected and maintained, there is no way to ensure that equipment marked as unsafe or beyond required inspection and maintenance dates is being kept out of service.

Minimum Corrective Action: Metrorail must provide a way for operators, supervisors and inspectors in the field to readily identify the inspection and maintenance status of an RMM and any restrictions on the use of that RMM, whether owned by WMATA or a contractor.

### Metrorail does not have a single, clear, complete safety procedure for the securement of vehicles using chocks. A

CTEM wheel chock service bulletin, SBX-008, says no chocks can be used while a vehicle is on a grade, however this conflicts with MSRPH Rule 3.126, 3.105 and 3.114. In several interviews it became clear that there is not uniform agreement across different departments such as TRST and CTEM. The service bulletin also does not state that it applies to PLNT and MOWE and is not an accepted process to change a WMATA rule. Employees had mixed awareness of new non-metal chocks and of procedures for chocking a vehicle on mainline track.



Minimum Corrective Action: Metrorail must set safety-based standards for the use of chocks and clearly convey those standards to all personnel. The proper procedures must be communicated for situations and combinations of situations based on the presence or absence of third rail and the presence or absence of grades. If the grade is a factor in the use of chocks, the procedures must provide for how personnel would identify the grade. Metrorail must implement the safety-based standards, and ensure compliance with the securement rules.

#### **Recommendation:**

Several Metrorail preventive maintenance instructions do not include acceptable tolerances for required measurements. Some Metrorail instructions give specific values, rather than tolerances that are within acceptable ranges or that are within the measurement capabilities of available tools. This risks frontline personnel ignoring the instructions because the instructions could be unrealistic.

**Possible Corrective Action:** Metrorail could consult with original equipment manufacturers to identify the acceptable tolerances for each measurement, with particular consideration given to the available or necessary tools that employees use to achieve these requirements, then update each instruction or manual.

### Next Steps

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WMATA is required to propose CAPs for each finding and to submit a CAP or conclusions letter regarding the recommendation no later than 45 days after the issuance of this report. Each proposed CAP must include specific and achievable planned actions to remediate the deficiency, the person responsible for implementation, and the estimated date of completion. Each proposed CAP must be approved by the WMSC prior to WMATA implementation.





750 First St. NE • Ste. 900 • Washington, D.C. 20002 • 202-384-1520

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