The Washington Metrorail Safety Commission

Safety Audit

of the Washington Metropolitan Area Transit Authority

Audit of Roadway Maintenance Machines Program

Final Report:
October 18, 2023

Table of Contents

Executive Summary 1

Background and Scope **3**

Current Organizational Structure 4

Prior WMSC Reviews and Actions 5

Other WMSC Findings and Directives 5

Investigations and Other Oversight 6

Collision, Data Recording 8

Other External Reviews 9

Internal WMATA Reviews 9

Audit Work 11

What the WMSC Found **12**

Positive Practices 12

2020-2021 RMM Audit CAP Assessment 15

Observations Addressed During Audit Work 18

Findings and Minimum Corrective Actions 19

Findings 20

Recommendations 26

Other Observations 32

Next Steps 32

Appendices 33

Appendix A: Personnel Interviewed 34

Appendix B: Site Visits 34

Appendix C: Documents Reviewed 35

Appendix D: Public Transportation Agency Safety Plan (PTASP) Elements Reviewed 44

Correction (10/18/2023): The executive summary (page 2) references “four findings” and should read and list “five findings”. The fifth finding, Metrorail is not reviewing its RMM-related procedures as required, is correctly included on page 25 in the body of the report.

Prepared under the authority of the Washington Metrorail Safety Commission

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Executive Summary

The Washington Metrorail Safety Commission (WMSC) performed this audit of the Washington Metropolitan Area Transit Authority (WMATA) Metrorail's roadway maintenance machine (RMM) inspection, maintenance, engineering, and operations through in-depth interviews, site visits, and document and data reviews primarily conducted in January and February 2023. The scope of this audit includes the assessment of inspection, maintenance, and engineering practices and procedures, and associated training for purposes of compliance with applicable plans, policies, regulations, and industry best practices. This audit also assesses closed corrective action plans that were issued as part of the Roadway Maintenance Machine Audit that was issued on March 9, 2021, such as those related to RMM operations. The WMSC appreciates the cooperation of Metrorail personnel during this audit.

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.

This audit identified positive practices such as Metrorail's identification of and steps to address brake beam failures, improvements to contractor vehicle inspections, and progress toward data logging for RMMs.

The assessment of CAPs related to the prior RMM Audit identified areas that the WMSC will continue to monitor, as well as some areas where Metrorail can further improve as described in the findings and recommendations below.

This audit identified positive practices such as Metrorail's identification of and steps to address brake beam failures, improvements to contractor vehicle inspections, and progress toward data logging for RMMs.

This audit identified 4 findings and 6 recommendations.

Findings:

1. Metrorail does not ensure the use of adequate fall protection when working on or around RMMs.
2. Metrorail is not effectively tracking and mitigating hazards related to RMM maintenance and operations in accordance with its PTASP.
3. Metrorail has not documented its practices regarding adjustments to its contractor RMM inspection procedures.
4. Metrorail does not have a process and assigned resources to inspect and maintain the hi-rail gear on hi-rail vehicles owned by WMATA as required to ensure the vehicles' safe operation.

Recommendations:

1. Metrorail has the opportunity to more effectively collect and proactively utilize reliability data to ensure safe and effective operations.
2. Metrorail can improve safety and reliability by documenting and formalizing a process for starting and checking equipment on a regular basis that is not being regularly used.
3. Metrorail is utilizing back-to-back gauges for RMM wheelsets that it has determined are insufficient to accurately make such a measurement on other rail vehicles.
4. Metrorail has not implemented a documented process for decommissioning RMMs, including a process to ensure that vehicles to be decommissioned are no longer needed to carry out work activities and that those vehicles are properly and safely disposed of.
5. Metrorail can improve the effectiveness of training and available operational manuals by providing a consistent, complete format that documents operational restrictions and allows personnel to identify where to look for such information, and by incorporating these improvements into a recurring troubleshooting training.
6. Metrorail has an opportunity to improve safety through effective interdepartmental coordination to fully utilize available safety data, technology, and contracts.

Metrorail does not ensure the use of adequate fall protection when working on or around RMMs.

Metrorail also addressed observations from the WMSC's on-site activities during the audit work. These related to environmental controls and a lack of hazardous materials signage at the Greenbelt Rail Yard Car Track Equipment Maintenance shop, and to expired hot works permits posted at multiple shops.

WMATA is required to propose a CAP for each finding and to respond to each recommendation no later than 30 days after the issuance of this report.

Background and Scope

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The scope of this audit includes the assessment of Metrorail's roadway maintenance machine inspection, maintenance, engineering, and operations.

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Among other areas, the audit focuses on elements of WMATA's Public Transportation Agency Safety Plan (PTASP), titled the WMATA Transit Agency Safety Plan. Revision 2.0 of Metrorail's PTASP took effect December 31, 2021. Revision 3.0 took effect December 31, 2022, following the WMSC's initial document requests for this audit. Due to the timing of the audit, the audit is based on Revision 2.0.

The specific elements of PTASP Revision 2.0 covered in this audit are listed in Appendix D.

Current Organizational Structure

As described in documents provided by Metrorail for this audit, Car Track Equipment Maintenance (CTEM) is the Metrorail department responsible for inspection, maintenance, and repair of most of Metrorail's Roadway Maintenance Machines, including all maintenance vehicles that are rail-bound. CTEM also maintains other equipment such as torque wrenches, drills, and saws. CTEM reports to Car Maintenance (CMNT), which reports to the Chief Mechanical Officer, Rail (CMOR), who reports to the Senior Vice President of Rail, who reports to the Chief Operations Officer, who reports to the accountable executive, the General Manager. CTEM is led by an Assistant General Superintendent, Superintendent, and two Assistant Superintendents. Supervisors and staff are assigned to each of the five CTEM shop locations: Alexandria Rail Yard, Branch Avenue Rail Yard, Dulles Rail Yard (opened November 2022), Greenbelt Rail Yard, and New Carrollton Rail Yard (day and night shift).

Vehicle Engineering (CENV), which also reports to the Chief Mechanical Officer, Rail, has personnel responsible for Roadway Maintenance Machine engineering who are assigned to CTEM-related tasks.

Maintenance of Way Engineering (MOWE) is responsible for inspection, maintenance, and repair of systems on Metrorail's Track Geometry Vehicle (TGV), other than the underlying vehicle movement systems maintained by CTEM. MOWE accomplishes this via contractors.

RMMs not maintained by CTEM or MOWE, specifically hi-rail vehicles, are maintained by Service Vehicle Maintenance (SVMT). Service Vehicle Maintenance primarily works on elements of the vehicles that are used for highway travel such as engines (elements that also are used for travel on the rails). The Superintendent reports to the Director of Shop Support Services who reports to the Vice President of Bus Maintenance and Engineering. Maintenance of the hi-rail gear is not performed by WMATA personnel (see Finding 4).

Prior to the on-site portion of this audit, including both interviews and site-visits, Metrorail management announced a reorganization. This re-alignment maintained the Chief Mechanical Officer, Rail (CMOR), Car Maintenance (CMNT), Vehicle Engineering (CENV) and Service Vehicle Maintenance (SVMT) units and their immediate reporting structures. MOWE's

reporting relationship was changed to be a part of the Track and Structures Department, reporting to the newly titled Chief Infrastructure Officer.

Prior WMSC Reviews and Actions

2020-2021 RMM Audit

The WMSC's first audit of Metrorail's Roadway Maintenance Machine program was conducted in fall 2020. An exit conference was held on November 20, 2020 with Metrorail staff, and the WMSC later provided a draft of the audit report to WMATA for technical review and incorporated any corrections as appropriate before the WMSC issued the final audit report on March 9, 2021.

The WMSC identified several positive practices and a number of areas that required improvement. As a result, the WMSC issued 14 findings requiring Metrorail to develop corrective action plans (CAPs) and one recommendation, which Metrorail developed a corrective action plan to address.

This audit found that Metrorail needed to 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 needed to be improved, clarified, or actually implemented to resolve these issues.

As of summer 2023, Metrorail had implemented 13 of its 15 corrective action plans related to this audit. Two remained open with expected completion dates in 2024 and 2025.

C-0084 addresses the finding that Metrorail was not following and did not have effective safety certification and acceptance procedures for new RMMs. The scheduled completion date for the CAP addressing this issue is July 2024. This is also related to CAP C-0118 described below.

C-0098 addresses the finding that Metrorail preventive maintenance instructions do not include acceptable tolerances for required measurements. The improvements are being incorporated during document reviews, which have begun and are scheduled to be completed by June 2025.

The WMSC continues to monitor the implementation and effectiveness of Metrorail CAPs on an ongoing basis through our robust oversight program which includes inspections and record reviews, including assessments during this audit.

The audit's assessments of the closed CAPs that Metrorail designed to address findings of the RMM audit issued in 2021 are provided later in this report.

Other WMSC Findings and Directives

April 2021: RMM Movement in "dark territory"

The WMSC issued a finding on April 30, 2021 related to RMM movement in "dark territory," locations where there are no signals or other automatic train control systems. This finding that Metrorail did not have, provide training on, or otherwise follow specific rules related to

As of summer 2023, Metrorail had implemented 13 of its 15 corrective action plans related to this audit. Two remained open with expected completion dates in 2024 and 2025.

rail vehicle and switch movement in non-signalized territory and provided no controls on or oversight of movement in dark territory was issued following risk-based inspections of WMATA rail yards that were prompted in part by investigations into collisions and red signal overruns that occurred in 2020 and early 2021.

Equipment operators and others told the WMSC as part of inspections and investigations that vehicles were regularly being moved in these non-controlled areas without coordination with the interlocking operator, that hand-thrown switches were regularly being cranked in these areas without coordination with the interlocking operator, and that vehicles were frequently stored in these areas without required spacing between them in order to squeeze more vehicles in. Movement in dark territory without coordination creates a risk that a vehicle could strike a roadway worker or another vehicle. Metrorail rules and procedures related to switch cranking and clamping and Class II (RMM) vehicle movement were not being followed.

To address this April 30, 2021 finding, Metrorail created CAP C-0101. Metrorail is implementing this CAP and expects to complete these safety improvements by May 2024.

August 2021: Safety Certification

The WMSC issued a finding on August 13, 2021 that Metrorail does not consistently follow its safety certification process, which leads to project activation and use without proper hazard identification and mitigation, putting Metrorail customers, personnel and first responders at risk. This finding was issued based on trends the WMSC identified across safety audits, the WMSC's regular oversight activities, and additional investigation conducted in coordination with WMATA's Office of Inspector General. The safety audits that identified these issues included the Roadway Maintenance Machine Audit issued in 2021 described above. When properly carried out, safety certification ensures that new equipment and infrastructure are designed, tested, and placed into revenue use incorporating WMATA's own design criteria, any additional safety requirements, and any other safety mitigations to address hazards identified during project development and implementation.

Metrorail is making progress on implementation of systemic corrective action, including by finalizing a revised Safety and Security Certification Program Plan in March 2023. CAP C-0118 is scheduled for completion in September 2023.

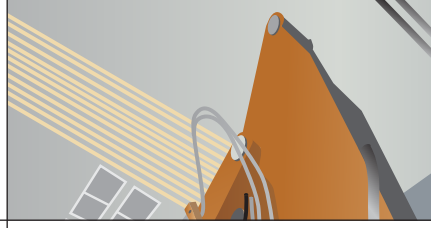
Movement in dark territory without coordination creates a risk that a vehicle could strike a roadway worker or another vehicle.

Investigations and Other oversight

Safety events have also demonstrated opportunities for safety improvement related to RMMs. Several examples are described below.

Runaway RMM

On July 9, 2021, a runaway maintenance vehicle collided with equipment in an area where personnel were working. Prime Mover (PM) 65, rolled, not under the control of an operator, approximately 250 feet down a graded section of track near Southern Ave Station into a location where Metrorail personnel were actively working. The Equipment Operator and the Roadway Worker In-Charge (RWIC) on PM 65 yelled at the workers to get out of the way, and the workers ran out of the way just before the vehicle



reached their location. PM 65 collided with a Geismar Track Torquing Machine that was being used as part of overnight work on switch point and stock rail replacement to properly adjust and secure the running rail. The machine is regularly used to torque rail fasteners. Given its weight, the machine is typically placed on the rails from a flatcar using a crane. Due to the work, third rail power was de-energized in the area at the time of the collision. The work crew did not immediately report this event as required by Metrorail rules and procedures.

While the Equipment Operator was transitioning from the cab operating station to the remote operating station, the RWIC entered the cab and said the vehicle was rolling down the track. PM 65 continued to roll following activation of the emergency stop pushbutton and following activation of the battery disconnect switch. After the collision, the Equipment Operator then attempted to apply the parking brake from the remote station and took their foot off the service brake pedal, and PM 65 started rolling again until the Equipment Operator put their foot back on the service brake pedal. The investigation identified contaminant build up in exhaust valves that led to the valves becoming stuck closed. During this audit, personnel described engineering change work intended to address this issue systemically.

The investigation identified contaminant build up in exhaust valves that led to the valves becoming stuck closed.

As a result of the investigation, Metrorail distributed a personnel notice regarding parking brake verification and testing during pre-trip inspection and during operations. Additionally, a service bulletin was issued related to the application and testing process of parking brakes prior to operating a prime mover.

Metrorail was in the process of implementing CAPs described below related to the 2021 RMM audit issued shortly before this event.

TRIPP Machine Events

On October 1, 2021, an equipment operator operated a Tie Remover and Inserter (TRIPP) Machine above the permitted speed, the vehicle derailed, and the Equipment Operator did not immediately report the derailment to the Rail Operations Control Center (ROCC). The investigation suggested the Equipment Operator was operating the vehicle in 'work mode' rather than 'travel mode', increasing the risk that this type of derailment would occur due to the way the vehicle interacts with the rails in each mode. In work mode, the vehicle is not supposed to be operated at more than 5 mph. TR05 was travelling at approximately 20 mph, 5 mph greater than the maximum permitted speed in a convoy block of 15 mph, when the front end of the unit derailed after departing Deanwood Station. Metrorail rules require the TRIPP Machine be operated at no greater than 15 mph in any circumstance. Other investigations, such as W-0135 of a red signal overrun near Cheverly Station on July 30, 2021 also demonstrated equipment operators exceeding the allowed speed in a convoy block.

On November 15, 2021, the arm of a TRIPP Machine being used for track work in the Shady Grove Rail Yard struck a signal in the yard. The Equipment Operator attempted to switch arm controls from left to right, but when doing so, did not fully retract and lock the right-side

Metrorail evaluated RMM movement procedures and has committed to installing data and video recorders on RMMs.

work head. The work head is an arm that clamps down on the tie being inserted or removed. As a result, both arms were extended when activated, and the right-side arm struck signal A99-146, knocking the signal to the ground. The Equipment Operator reported having very little experience operating the machine and indicated they had not operated this piece of equipment for approximately one month prior to the event. They also stated that similar events had previously occurred and had gone unreported. Metrorail communicated with equipment operators regarding a "bump check" process to ensure the unit's arms are properly secured.

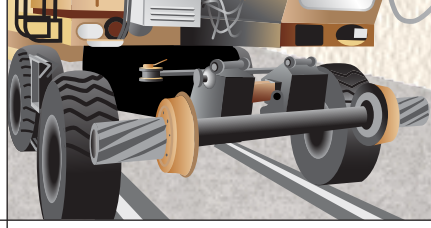
Metrorail was in the process of implementing CAPs described below related to the 2021 RMM audit issued shortly before this event.

Collision, Data Recording

On May 7, 2022, roadway maintenance machines collided in Forest Glen Station during work zone setup activities (investigation W-0179).

There was no recorded communication regarding the move between the RWIC and the Equipment Operator or Flagger, and they did not perform any safety stops that are required by Metrorail procedure. The vehicles continued moving until colliding with Prime Mover 26. When the vehicles collided, the personnel standing on Prime Mover 40 were thrown into each other, into parts of the vehicle, and onto the ground by the force of the collision and sudden stop. Two personnel reported injuries. Contrary to Metrorail policy, after this collision, the Equipment Operator on Prime Mover 40 moved the unit backward several feet before notifying anyone of the collision. Changes made to the accident scene after the collision limited the availability of specific information, such as whether emergency brakes were applied in the final moments before the collision. Metrorail's RMMs generally do not have event recorders or onboard cameras that collect this information. Work schedule data indicated that the Equipment Operator and Flagman were at risk of fatigue-related impairment. Metrorail evaluated RMM movement procedures and has committed to installing data and video recorders on RMMs.

On March 9, 2021, the day that the WMSC's 2021 RMM Audit report was issued, a ballast regulator collided with a tamper vehicle in the storage tracks of the Greenbelt Rail Yard (investigation W-0096). The Equipment Operator who was moving the ballast regulator was attempting to move multiple roadway maintenance machines (RMMs) to reach a different RMM that they needed for their work assignment that night but that was stored behind the other vehicles. The Equipment Operator left the ballast regulator without setting the handbrake as the operator planned to return to the vehicle, and the vehicle continued to move. The ballast regulator rolled approximately two feet into the tamper vehicle. The investigation identified that Metrorail was not following communication procedures for vehicle movement in portions of rail yards that do not have signals or other automatic train control systems. The investigation also identified that Metrorail was not following any safety procedures requiring separation between stored RMMs. Metrorail stated there is an "informal requirement" for 10 feet of separation, but Metrorail does not require that separation or provide supervisory oversight to ensure vehicles are properly positioned in a safe manner. In part, this investigation suggests that the lack of requirements and oversight are due to the high number of vehicles Metrorail attempts to store in the limited space available in storage tracks. The WMSC subsequently issued the finding described above on April 30, 2021 requiring Metrorail to develop a corrective action plan to address uncoordinated movement and storage of RMMs in dark territory.



Other External Reviews

Investigations and reviews dating back to at least 2013 identified concerns about WMATA practices related to RMMs. Examples of these investigations and reviews conducted by the Federal Transit Administration and Tri-State Oversight Committee are summarized in the WMSC's **previous RMM Audit report issued in 2021** including as they relate to Metrorail having not followed safety certification requirements, vehicle securement requirements, and deficiencies in information sharing and specific procedures.

Internal WMATA Reviews

Quality, Internal Compliance and Oversight

Related to RMMs, Metrorail's Quality Assurance, Internal Compliance and Oversight (referred to by Metrorail as QICO at the time, and now being referred to by Metrorail as Quality) most recently conducted an internal safety review of Car Track Equipment Maintenance (CTEM) that led to a final report dated May 12, 2022.

The review identified positive practices related to safety observations by management. The review also identified areas for improvement required to comply with established safety protocols, to implement a fall protection program, to maintain compliance with fire extinguisher inspections, to establish and implement a comprehensive maintenance control plan and standardized manuals for all equipment, to maintain compliance with established shelf-life procedures, and to develop and implement a process to improve work order data capture in Maximo for accuracy and consistency.

During the review, the review team identified and CTEM corrected issues such as a space heater on top of a chemical container and close to aerosol cans, improperly stored and labeled containers, fire extinguishers outside of required inspection intervals, expired items in a first aid kit, and other items.

The review also identified that:

- CTEM did not have a fall protection system in place as required by Occupational Health and Safety Administration regulations and Metrorail's PTASP.
- Metrorail was not effectively following and ensuring compliance with inspection procedures for fire extinguishers on Roadway Maintenance Machines. Extinguishers missing required inspections or with inspections more than 2 years old were identified.
- Metrorail did not have standardized maintenance instruction manuals for all equipment, and documentation and checklists were not available.
- CMNT Shop Safety and Health Inspection Checklists were not being used to identify, document and correct existing hazards. For example, the inspections had not identified an improperly placed space heater, out of compliance fire extinguishers, improperly labeled and stored chemical containers, and other items (The WMSC identified some related concerns during this audit, which Metrorail can address through these internal corrective actions.)

Investigations and reviews dating back to at least 2013 identified concerns about WMATA practices related to RMMs.

- Metrorail was not following CMNT SOP 1.08 (Rev 2.2, June 14, 2019) meant to ensure that materials and components are within shelf-life limitation. CTEM stated it does not perform complete inspections of parts and materials within CTEM storage areas as specified in the SOP and was not inspecting parts and rubber items.
- Metrorail had not assigned deputy environmental compliance officers for each department having an environmentally significant physical presence at a facility.

WMATA developed internal corrective action plans (iCAPAs) to address the Internal Safety Review findings:

iCAPA	Metrorail status	WMSC audit assessment
QICO-CTEM-22-01 - Implement a fall protection system, which includes approved equipment, documented procedures, training, storage, and preventive maintenance	Closed	See Finding 1 of this audit.
QICO-CTEM-22-02 - Develop and implement a plan to maintain compliance with safety and environmental regulations as it pertains to fire extinguisher inspections	Scheduled completion June 2024.	Implementation was ongoing at time of this audit.
QICO-CTEM-22-03 - Establish and implement a comprehensive maintenance control plan and standardized manuals for all equipment.	Scheduled completion July 2024; Standardized procedures and instructions scheduled December 2023, Maintenance Control Plan scheduled June 2024.	Implementation was ongoing at the time of this audit. See Recommendation 4.
QICO-CTEM-22-04 - Develop a plan to maintain compliance with established shelf life procedures	Previously identified by QICO in April 2017, repeat finding in 2022. Scheduled completion date December 2023.	Implementation was ongoing at the time of this audit.
QICO-CTEM-22-05 - Develop and implement a process to improve work order data capture in Maximo for accuracy and consistency.	Scheduled completion date August 2023.	Implementation was ongoing at the time of this audit.

The WMSC considered Metrorail's progress in these areas under existing plans in determining whether additional findings, recommendations, and corrective action plans were required in this report.

Office of Inspector General

The most recent examples of related reports by WMATA's Office of Inspector General include a **November 17, 2022 report** regarding a 35-ton rail-bound crane that was purchased but never functioned as intended. As the WMSC had previously identified in the

WMSC's RMM Audit report issued in 2021 and in the WMSC's August 13, 2021 finding that Metrorail does not consistently follow its safety certification process, Metrorail's procedural deficiencies allowed equipment that did not meet its safety or operational requirements to be purchased and accepted. The contract for the crane was awarded in September 2010, and Metrorail's Office of Track and Structures stated in January 2016 that the crane was built to specifications and delivered on time, which led to Metrorail accepting the crane, despite documented safety deficiencies beginning in 2013 and continuing until at least 2018. In September 2022, Metrorail's Chief Operating Officer informed the WMATA OIG that the keys to the vehicle would be secured, the vehicle was unusable by WMATA employees, and WMATA would analyze the most cost-effective way to dispose of the crane.

The Office of Inspector General also conducted a **recent review** published on January 26, 2023 related to non-revenue vehicles, which includes some vehicles with both rubber tires for highway travel and hi-rail wheels for rail travel that operate as RMMs in the Metrorail system. Metrorail is progressing new Global Positioning System and driver monitoring tools for this fleet as noted in Recommendation 5.

Metrorail's Office of Inspector General also highlighted the importance of Metrorail's fitness for duty programs in late 2022. OIG issued a Management Alert in response to a hotline complaint alleging a WMATA employee admitted to a non-WMATA employee that they consume alcohol while working and had a current DUI charge. The employee was responsible for operating heavy equipment in a safety-sensitive position. OIG confirmed the employee had been arrested for driving a vehicle while impaired but had not reported it to management.

Metrorail's procedural deficiencies allowed equipment that did not meet its safety or operational requirements to be purchased and accepted.

Audit Work

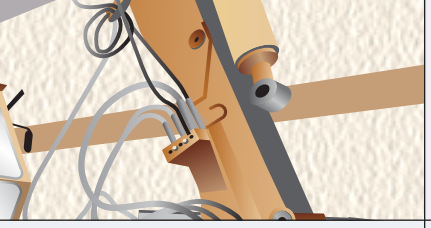
The WMSC received and reviewed initial documents related to this audit from WMATA in December 2022, led an entrance conference in January 2023, and conducted extensive interviews with personnel and conducted site visits in January and February 2023. The WMSC received final follow-up documents, conducted final document reviews, and conducted an exit conference in March 2023.

Lists of documents reviewed, site visit locations and personnel interviewed for this audit are provided in the appendices.

The WMSC raised specific safety issues to Metrorail personnel as they were identified. This included fire protection signage and environmental concerns regarding a lubrication room at the Greenbelt Rail Yard Car Track Equipment Maintenance Shop, work conducted without fall protection, and posted hot works permits in Car Track Equipment Maintenance Shops that were past their expiration dates.

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

What the **WMSC** Found



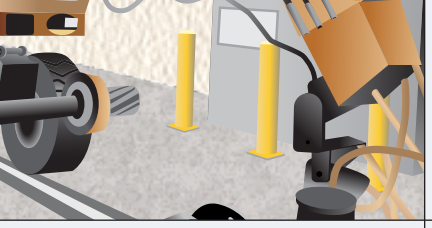
What the **WMSC** Found

Positive Practices

- Metrorail identified in December 2021, and has since been taking steps to address, a safety issue related to brake beams on Plasser RMMs, primarily Prime Movers. Specifically, Metrorail identified a set of failures across approximately 12 units with similar brake beam designs related to a brake torque beam fulcrum block weld joint. Metrorail has been transparent about identifying and providing information about its progress on this issue, and responsible groups have kept various internal Metrorail departments (and the WMSC) up to date over the course of this process. Recent work includes developing a fix for this safety issue through engineering tests and associated communications, ensuring that parts that were delivered that did not meet safety and quality requirements were rejected, continuing to ensure that the RMMs remain out of service until they are safe to operate, and regularly turning on engines on the vehicles that have remained out of service long-term (more than one year at the time of this audit).

Metrorail has improved the information flow to mechanics regarding the defects reported on equipment that is brought in for corrective maintenance.

- Service bulletins SBX 14 and SBX 15 regarding brake inspection and weld failures properly notified personnel of an EMI.
- Good cooperation between CTEM and RMM user departments, TRST and PLNT.
- Good cooperation between CTEM mechanics and supervisors and CTEM engineers.
- Good interactions among CTEM mechanics, supervisors, and managers.
- Metrorail has improved the information flow to mechanics regarding the defects reported on equipment that is brought in for corrective maintenance.
- Engineering requests related to RMMs are submitted, reviewed, and acted upon in response to items identified.
- Have identified need for and have required positive continuous shunting of RMMs to reduce risk of collision.
- SOP 27 governing change management accounts for document and parts updates. However, it is past due for review (see Finding 5).
- Engineers are now involved in RMM procurement and specifications.
- Work is tracked in Maximo and reviewed by supervisors and managers.
- Sampled pre-trip and post trip inspections were complete.
- Metrorail is progressing work to add cameras and event recorders to RMMs in accordance with Recommended Corrective Actions identified through safety event investigations (CENV_003, CMNT_004).
- Metrorail is making efforts to keep training courses up to date.
- CTEM personnel have access to maintenance and repair manuals.
- Metrorail restored its contracts for TGV equipment maintenance and training of TGV personnel.
- CTEM and SVMT personnel participate in local facility safety committees.
- Metrorail is making progress toward data loggers for RMM, beginning with prototypes, that will improve investigations and available data to allow for continuous safety improvement.
- Metrorail has tools checklists for personnel.
- CTEM tracks training requirements for its personnel.
- Metrorail has taken systemic action to address an issue identified in an investigation. Following the July 9, 2021 runaway RMM described above, and similar steps on that make of RMM, Metrorail evaluated other vehicles with similar designs and at the time of this audit was finalizing an engineering change for more than 20 additional RMM to replace quick release valves with relay valves to improve safety.



2020-2021 RMM Audit CAP Assessment

C-0085 (Closed)

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

Metrorail has established new processes. Documentation for RMMs reviewed for this audit was inconsistent, some of which pre-dated the CAP closure. This included gaps in documentation for E-Clipper Unit 2 (EC-02) and Unit 1 (EC-01) with inconsistent machine information and some missing action log items. Metrorail also experienced problems with new Swingmasters, including a collision in New Carrollton Rail Yard on January 11, 2023. Multiple personnel expressed that there are repeated problems with these vehicles. Documentation provided was missing test results for SM-08 and SM-09 for example. Metrorail stated as part of this audit it had not accepted any RMMs since November 2020, but provided what appeared to be represented as Certifiable Items Lists (CIL) for several vehicles completed in that period. Metrorail is still implementing a broader safety certification corrective action plan, C-0118.

C-0086 (Closed)

Metrorail is not following its engineering change procedures.

Metrorail provided evidence during this audit of engineering changes following its processes.

C-0087 (Closed)

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.

See Recommendation 1.

Metrorail is not accurately counting the number of personnel certified on each vehicle, with some recertified personnel being double counted.

C-0088 (Closed)

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.

Metrorail has established these requirements and made other significant progress. Not all classes have yet been offered to the number of personnel Metrorail has determined are necessary for its operations. Metrorail is not accurately counting the number of personnel certified on each vehicle, with some recertified personnel being double counted. The WMSC will continue to monitor Metrorail's progress in this area.

C-0089 (Closed)

Equipment operator certifications for specific vehicles do not expire or require recertification.

Metrorail has established these requirements. Documents provided for this audit indicated Metrorail is tracking operators who recertify twice in the number of operators required to meet the requirements Metrorail has determined are necessary for its operations, and that there are vehicles where no personnel are currently trained due to being past due on recertification or classes not having been taught. The WMSC will continue to monitor Metrorail's progress in this area.

C-0090 (Closed)

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

This CAP was closed after the initiation of this audit. The WMSC will continue to monitor Metrorail's progress in this area.

C-0091 (Closed)

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

This CAP was closed after the initiation of this audit. The WMSC will continue to monitor Metrorail's progress in this area.

C-0092 (Closed)

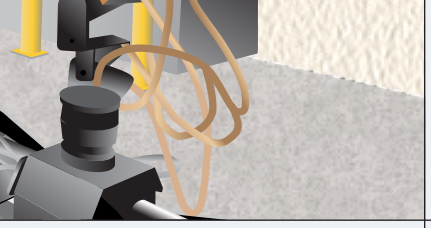
Metrorail does not have a procedure for the inspection of contractor hi-rail vehicles.

Metrorail has established this inspection program and is ensuring that non-WMATA RMMs are inspected prior to use in the WMATA Rail System, providing a significant benefit to safety. See Finding 3 for some elements of implementation that do not match the written procedure.

C-0093 (Closed)

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.

The WMSC did not identify any deficiencies in this area.



Metrorail has introduced specific procedures for RMM maintenance that address differences from third-rail powered vehicles.

C-0094 (Closed)

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

Metrorail has introduced specific procedures for RMM maintenance that address differences from third-rail powered vehicles.

C-0095 (Closed)

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.

Metrorail has established these requirements and begun offering these classes. Not all classes have yet been offered. The WMSC will continue to monitor Metrorail's progress in this area.

C-0096 (Closed)

There is no clear way for field personnel to identify WMATA owned RMMs that have been inspected and deemed safe for use, and there is no way for field personnel to identify any safety restrictions that maybe required for non-WMATA owned RMMs that have been allowed into the Metrorail system.

The WMSC identified progress related to non-WMATA owned RMM inspections, and did not identify any deficiencies in this area.

C-0097 (Closed)

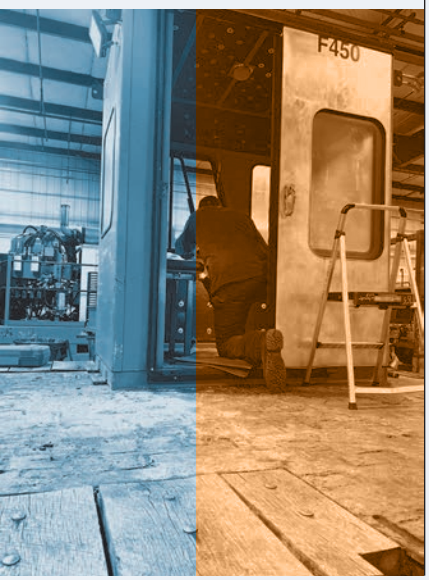
Metrorail does not have a single, clear, complete safety procedure for the securement of vehicles using chocks.

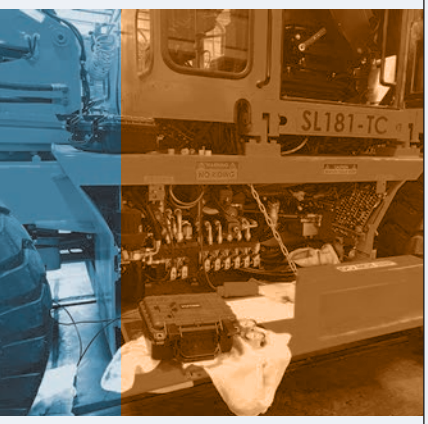
Metrorail has established this procedure. This audit did not identify any deficiencies in this area.

C-0098 (Scheduled completion June 2025)

Several Metrorail preventive maintenance instructions do not include acceptable tolerances for required measurements.

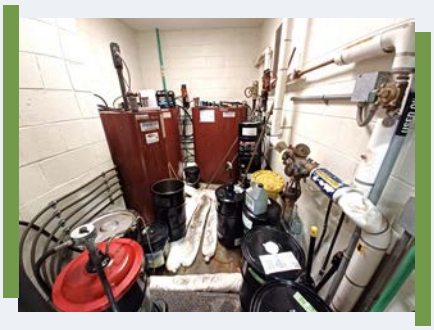
Metrorail is in the process of implementing these improvements through ongoing revision processes.





Observations Addressed During Audit Work

- **Environmental controls and National Fire Protection Association (NFPA) hazardous materials signage**



WMSC personnel at the Greenbelt CTEM shop observed a water and oil mixture on the floor of Room F-105 (labelled Lube Room). It appeared that this water and oil mixture was the result of an ongoing leak. This room has a drain, and a posted sign indicated that the room drains to an oil skimmer. This room contains engine oil (275-gallon capacity tank), hydraulic oil (275-gallon capacity tank), transmission fluid (275-gallon capacity tank), grease, and a water leak from the non-potable water line. There were supplies in the room that appeared to be temporary mitigations due to the leaks. There were also materials in the room that were not on spill pallets. The WMSC also observed deficiencies in safety signage, including NFPA signage. When the WMSC brought these hazards to the attention of Metrorail, Metrorail corrected these safety issues over the following weeks by placing drums on spill pallets, cleaning the room, replacing a broken door handle, creating a work order to replace a leaking seal on the backflow preventer, and adding the necessary NFPA diamond signage to indicate to first responders the hazardous materials in the room.

- **Expired hot works permits posted at multiple shops**

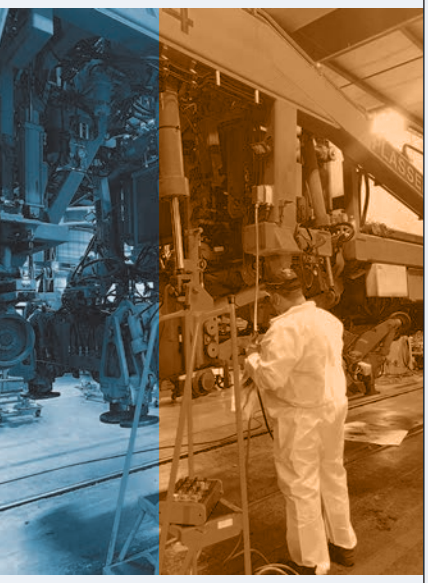
Metrorail personnel at the New Carrollton Car Track & Equipment Maintenance (New Carrollton CTEM Shop) Shop decided to use a plasma cutter for work on a flat car and began preparations to conduct hot work utilizing the plasma cutter. After receiving additional guidance from their manager to ensure that all safety processes were followed, and after conducting the majority of preparations for the work, the manager returned and directed them not to utilize the plasma cutter due to the shop's posted hot works permit having expired. A hot works permit is Metrorail's verification that appropriate safety precautions are available and will be applied for work such as plasma cutting or welding that creates the risk of fire or burns. The workers later used a different tool. The posted hot works permit expired October 31, 2022, but hot work had continued for months past that date. The WMSC has observed similar expired permits elsewhere. After the WMSC brought these safety issues to Metrorail's attention, Metrorail stated that the permits had been extended via email, even though no updated permits had been provided or posted. Metrorail provided a schedule to conduct inspections necessary to issue these permits in the future on a consolidated basis with annual facility inspections, and confirmed that current hot works permits continue to be a requirement. The WMSC continues to monitor this issue through inspections and other oversight activities.

The posted hot works permit expired October 31, 2022, but hot work had continued for months past that date.

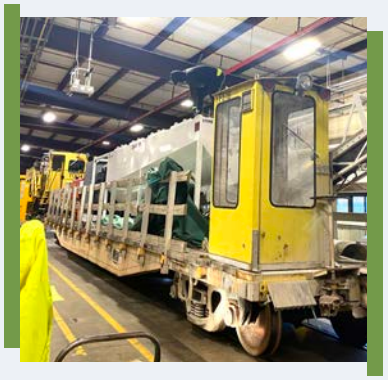
Findings and **Minimum** Corrective Actions

Findings and Minimum Corrective Actions

Findings



▶ Finding 1. Metrorail does not ensure the use of adequate fall protection when working on or around RMM.



During on-site observations for this audit in the New Carrollton CTEM shop, a Metrorail employee who appeared to be part of the Track and Structures Department entered the CTEM shop and climbed on top of the concrete plant on RMM F516 without fall protection[1]. It appeared that the individual was checking the amount of aggregate in the machine, as they needed to quickly prepare this machine for use that night. Car Track & Equipment Maintenance (CTEM) shops recently obtained portable fall protection systems for the first time that are intended for use when personnel work on top of vehicles, but this system was not used in this case. Metrorail had obtained the portable fall protection systems, a positive step, following a finding in a Quality Assurance, Internal Compliance and Oversight Internal Safety Review that the safety equipment is required by Occupational Health and Safety Administration regulations and Metrorail's PTASP. Metrorail closed this iCAPA in October 2022 based on the equipment, procedures for CTEM personnel, training of CTEM personnel, and preventive maintenance plan for the equipment. The observed actions during this audit demonstrate that the hazard is not just for CTEM personnel and that Metrorail personnel are regularly operating without the required safety protections.

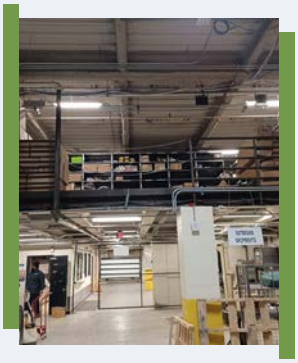
The WMSC raised this safety concern to Metrorail during the audit process. Metrorail responded that personnel receive fall protection training.

These protections are not being carried out in practice.

In response to further follow-up questions, Metrorail's Office of Occupational Safety and Health (OSH) acknowledged that the work observed by the WMSC did not comply with OSHA regulations or with WMATA's fall protection standards.

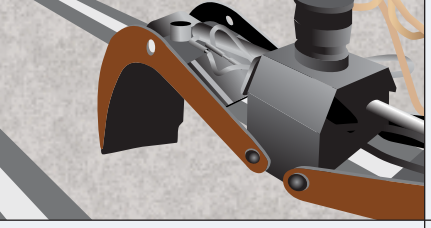
Metrorail's Office of Occupational Safety and Health (OSH) acknowledged that the work observed by the WMSC did not comply with OSHA regulations or with WMATA's fall protection standards.

At the time of this audit, Metrorail's Office of Occupational Safety and Health stated they were drafting a new WMATA Fall Protection Program. Metrorail expected to begin rolling out that program to departmental-level procedures on an incremental basis starting in late 2023, and to provide training to Safety Department oversight personnel on the Fall Protection Program.



Metrorail has also had fall protection issues outside of this audit. For example, the WMSC observed, and Metrorail then corrected, missing fall protection barriers in the Alexandria Rail Yard storeroom in February 2023, and Metrorail has experienced serious injuries, such as due to improper or a lack of fall protection such as a serious injury at the Queenstown Road Repair and Maintenance Supply Storage Facility on April 25, 2022 (W-0176).

[1] Fall protection means any equipment, device, or system that prevents an employee from falling from an elevation or mitigates the effect of such a fall.



Metrorail stated that RMM deficiency reports submitted by equipment operators are not maintained and could not be provided.

◆ Minimum Corrective Action:

Metrorail must complete development of and implement a comprehensive fall protection program. This must include Metrorail conducting safety promotion activities to ensure that personnel working on and around RMMs (from departments including CTEM, TRST, PLNT) understand the hazard of falls from height and the necessary mitigations to keep themselves and their colleagues safe.

▶ Finding 2. Metrorail is not effectively tracking and mitigating hazards related to RMM maintenance and operations in accordance with its PTASP.

Metrorail does not systematically identify, track, and mitigate hazards related to its RMM program, and has not yet implemented its safety management system approach in a way that includes RMM maintenance and operations.

In response to a request for hazard logs related to this audit, Metrorail did not provide any documents and stated that CTEM does not have a hazard log. No other response related to other departments was provided.

Metrorail has assigned a safety risk coordinator (SRC) for CTEM; however, this is an additional task for this individual beyond their regular duties, which have not changed (and remains a significant workload).

Without systematic hazard identification, tracking, mitigation, and assessment of the effectiveness of those mitigations as specified in Metrorail's agency safety plan, Metrorail cannot assure itself that it is operating and maintaining its system in the safest practicable manner.

RMM Deficiencies Not Tracked

Metrorail only documents items that directly require corrective maintenance and therefore lead to a corrective maintenance work order.

Metrorail stated that RMM deficiency reports submitted by equipment operators are not maintained and could not be provided. These deficiency reports capture issues identified by RMM operators ranging from items such as unusual or uncomfortable ride quality or other general hazards that may not lead to a corrective maintenance work order to immediately repairable items such as a broken tail light that would lead to a corrective maintenance work order.

Personnel responsible for operating equipment told the WMSC that, for example, they have reported more general hazards related to the operation of the TRIPP Machine for several years regarding operation on mainline when travelling from one location to another that would not lead to a corrective maintenance work order.

By not reviewing these employee safety reports in a manner that allows for tracking and trending of this safety information, Metrorail is unable to develop effective operational, engineering, or maintenance mitigations.

Metrorail did not provide a basis for ignoring the safety information, and Metrorail had not previously identified this issue until the WMSC's site visit.

TRIPP Machines, for example, have been involved in several derailments or collisions in recent years. On October 1, 2021 (W-0148), an operator operated the vehicle above the permitted speed limit and in work mode rather than travel mode. Post-incident inspections and analysis demonstrated the vehicle, TR05, had multiple deficiencies including a missing gripper pin that is used to help hold parts of the vehicle in place to ensure safe movement. On April 29, 2021 (W-0109), a TRIPP Machine being operated by an individual not trained to use it, was operated above the permitted speed limit and in work mode rather than travel mode and derailed between Foggy Bottom and Farragut West stations. The vehicle was also not in the proper condition for operation, with an unapproved spike used to replace a gripper pin and apparent suspension issues. On November 15, 2021 (W-0149), the arm of a TRIPP Machine, TR06, struck signal A99-146 in Shady Grove Yard, knocking the signal to the ground.

The investigations into the April and November 2021 events have led Metrorail to take some steps to address safety issues, but not all have been implemented yet. Equipment configuration change 2203004 created to address broken gripper pins had not been finalized at the time of this audit. In response to a draft of this report, Metrorail stated that this was in the signature approval process as of early October 2023.

Safety warning label disregarded

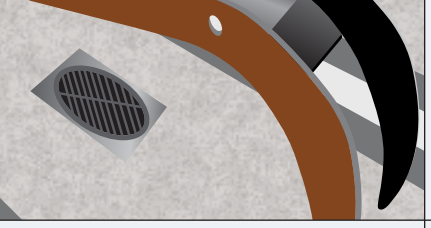
In another example of Metrorail not identifying and managing hazards, during site visits for this audit, The WMSC observed a propane tank on a Prime Mover inside the Greenbelt CTEM shop that was labeled "FOR OUTDOOR USE ONLY" and "DO NOT USE OR STORE CYLINDER IN A BUILDING, GARAGE OR ENCLOSED AREA." The WMSC raised this to Metrorail as a potential safety concern, and Metrorail responded, "The label on white propane cylinders identifying "FOR OUTDOOR USE ONLY" and "DO NOT USE OR STORE CYLINDER IN A BUILDING, GARAGE OR ENCLOSED AREA" is a non-code-compliant label installed by the gas manufacturer.

The equipment manufacturer that Metrorail procured the cylinder from affixed the warning label. Metrorail did not provide a basis for ignoring the safety information, and Metrorail had not previously identified this issue until the WMSC's site visit.

Inconsistent Local Safety Committee Documentation

Metrorail provided documentation that some local safety committees are identifying and tracking facility-specific issues, which is positive, however the documentation and issue tracking and follow up are not consistent across the Metrorail system.

At Alexandria Rail Yard, minutes and associated spreadsheets demonstrate that there are issues being identified and tracked. However, minutes from the New Carrollton Rail Yard show that not all topics raised as new issues are addressed or carried over to the next month. At Greenbelt and Branch Ave rail yards, there are inconsistent or no records of attendance. Overall, there are a limited number of hazards identified at these committees.



As demonstrated above in the WMSC's observations of safety deficiencies in the Lube Room at the Greenbelt Rail Yard, hazards are not being consistently identified by frontline personnel, supervisory personnel, departmental compliance, environmental compliance, or other Metrorail personnel.

Differences in the documentation practices for the safety committee at each facility also pose a potential barrier to Metrorail incorporating the information that is identified in a standardized fashion into its safety management system.

Checklists not providing opportunity to track, trend

Checklists such as Kershaw Ballast regulator, BR04 checklist do not link discrepancies and corrective action items to the associated checklist item, preventing clear identification of what went wrong, what was repaired, and how to track and trend that information.

Other examples include the Swingmaster Checklist, NTS-01 Checklist, and Pettibone PB-15 checklist.

Without a connection between any notes and the elements of the checklists that are deficient, identifying and addressing that specific issue and any systemic issues does not occur.

◆ Minimum Corrective Action:

Metrorail must train personnel to implement safety management systems principles such as hazard identification, tracking mitigation and monitoring, and must develop, implement, and monitor procedures to ensure that hazards are properly identified and assessed as specified in Metrorail requirements such as the WMATA Transit Agency Safety Plan.

Metrorail personnel during this audit described and demonstrated that they were not conducting track tests specified in their procedures if the vehicle being examined had previously been used in the Metrorail system.

▶ Finding 3. Metrorail has not documented its practices regarding adjustments to its contractor RMM inspection procedures.

The WMSC observed multiple significant improvements in Metrorail's inspection and qualification of non-WMATA RMMs prior to use in the Metrorail system. This includes consistent inspection and the identification of safety issues and barring vehicles from use in the WMATA Rail System until those issues are addressed.

However, Metrorail personnel during this audit described and demonstrated that they were not conducting track tests specified in their procedures if the vehicle being examined had previously been used in the Metrorail system. This was also observed in inspection records, such as Rail Grinder (RG) 123 (April 2022, October 2022) which included notes stating that a track test was not required. Inspection records showed Kiewit rail carts CR7704, 23, 24, 30 (April 22) were not checked due to similar vehicles having previously passed a track test. The track test is designed to verify that the vehicle can safely move through the Metrorail system, and is required by Metrorail's contractor vehicle inspection procedure.

Metrorail records showed that hi-rail gear inspections were past due for WMATA-owned hi-rail vehicles, in several cases by two years or more.

SOP 101.1 specifies the approval requires both a shop inspection and track test, and the completion of the Contractor Rail Vehicle Inspection Checklist (CMOR form 30.952). OAP 101.01 requires all contractor rail vehicles to be inspected to ensure they meet WMATA Contractor Vehicle Requirements and any regulatory or OEM documentation. RQM.001 contractor vehicle requirements also specifies the track test requirements.

Metrorail procedure does not provide for personnel to skip track tests for contractor vehicles being considered for use in the Metrorail system.

Without conducting this test, Metrorail cannot verify that the vehicle has not changed since the last inspection (either due to adjustments made intentionally or due to accidental changes due to wear and tear or accidents).

◆ Minimum Corrective Action:

Metrorail must implement a process to follow its contractor RMM inspection procedure or must make safety-based updates to the procedure to reflect actual practice and then implement that practice.

▶ Finding 4. Metrorail does not have a process and assigned resources to inspect and maintain the hi-rail gear on hi-rail vehicles owned by WMATA as required to ensure the vehicles' safe operation.

Metrorail records showed that hi-rail gear inspections were past due for WMATA-owned hi-rail vehicles, in several cases by two years or more.

Personnel interviewed for this audit provided varying responses regarding the individual or department with responsibility for ensuring that these inspections occur prior to use or ensuring that the inspections and maintenance are conducted properly, and Metrorail stated that there was no current or past contract for maintaining hi-rail equipment.

Despite this, Metrorail also provided Maximo summary records indicating that contractors had performed some hi-rail gear inspections. For example, vehicle SV017801 had hi-rail inspections recorded as corrective maintenance (not preventive maintenance) in November 2016, May 2017, May 2018, February 2019, and August 2020, but had not had this annual inspection in the more than 2.5 years between August 2020 and the time in March 2023 that the WMSC requested records of hi-rail gear maintenance on specific vehicles. Similarly, other vehicles such as SV020511, SV021587, SV021588, SV021589, SV021594, SV022501, SV022504, SV022529, and SV022599 had summary records indicating their last hi-rail gear inspection was also in August 2020.

Metrorail requires annual hi-rail gear safety inspections. Each of these vehicles were more than 1.5 years past due for these safety inspections.

Annual hi-rail gear safety inspections are an industry best practice to provide for the safety of personnel and equipment. The Federal Railroad Administration, for example, requires hi-rail gear of all hi-rail vehicles to be inspected for safety at least annually and with no more than 14 months between inspections, with inspections including the measurement of and any necessary adjustments to tram, wheel wear, and gage based on documented safety criteria.

Metrorail provided procedures for this audit that were past due for review.

Metrorail stated that a contract was out for solicitation in March 2023 that would cover those vehicles.

◆ Minimum Corrective Action:

Metrorail must assign responsibility for maintenance and inspection of WMATA-owned hi-rail gear and establish and carry out a process to ensure that maintenance and inspections are carried out by qualified individuals on the required recurring basis.

▶ Finding 5. Metrorail is not reviewing its RMM-related procedures as required.

Metrorail provided procedures for this audit that were past due for review. The due dates for review were listed on each procedure.

The RMM-related procedures past due for review and any necessary updates at the time of this audit include:

- SOP 1.02, Management of Torque Indicating Devices, (Rev. 4, 1/5/2015)
  - Review was due February 11, 2021
- SOP 2.05, Life Cycle Planning and Execution for Class 1 and 2 Rail Vehicle Assets (Rev. 2.3, 6/24/2019)
  - Review was due June 24, 2021
- SOP 6.01, Procedures for Controlling Shop Tools and Mandatory Personnel Tools (Rev. 1, 1/16/2019)
  - Review was due January 16, 2021
- SOP 3.07, Lockout/Tagout Procedures (Rev. 4, 6/3/2019)
  - Review was due June 3, 2021
- SOP 27, Configuration Management (Rev. 0, 3/11/2019)
  - Review was due March 11, 2021
- SOP 401.2 , Procedures for Recording Work Order(s) for Class 2 Rail Vehicle(s) and Small Equipment(s) (Rev. 3, 11/20/2020)
  - Review was due November 20, 2022
- SOP 301.10, Rail Vehicle Retirement and Disposition Procedures (Rev. 3, 10/21/2020)
  - Review was due October 1, 2022

◆ Minimum Corrective Action:

Metrorail must review, and as necessary update, the identified procedures. Metrorail must determine whether any other procedures are past due for review or nearing their required review dates, and must review and, as necessary, update those procedures. Metrorail must ensure that it implements an effective process to review and update RMM-related documents in a timely fashion in accordance with its requirements on an ongoing basis.

Recommendations

1. Metrorail has the opportunity to more effectively collect and proactively utilize reliability data to ensure safe and effective operations.

Metrorail has made progress since the WMSC's last RMM Audit in creating and distributing reliability reports, however as described in interviews for this audit and demonstrated by Metrorail documents, Metrorail has not yet implemented steps to make the reports meaningful and effective. This would also support Metrorail's work to implement a data-driven safety management system, including as noted in Finding 2.

Metrorail personnel described during the audit steps that were just getting underway to improve this process, including better grouping and tracking component codes in Metrorail's maintenance management system, Maximo, and by documenting more specific details in Maximo work orders. The new component code list that CTEM was moving toward at the time of this audit is intended to improve the accuracy of data entry and allow for improved tracking and trending of data. Personnel interviewed provided examples such as reducing the number of component codes from nearly 2,000 to about 150, with engine issues being entered under a single code under the new function-based system. Metrorail was also considering dividing RMM types into groups such as prime movers, tampers, and tie equipment.

These planned adjustments are part of Metrorail's corrective actions to address QICO-CTEM-22-05, to develop and implement a process to improve work order data capture in Maximo for accuracy and consistency (scheduled completion date at the time of this audit July/August 2023), which builds on the corrective action plan Metrorail implemented as a result of the WMSC's RMM Audit issued in 2021. Metrorail can continue to build on this to more effectively utilize reliability data to ensure safe and effective operations.

To this point, Metrorail has not consistently documented and tracked underlying causes of parts or systems failures. Reliability reports provided for RMMs were based on available RMM vehicles, not on mileage or use. The reports also stated what was done over a given past time period but did not consider whether proactive steps should be taken to address an issue. Metrorail does not track mileage or other usage statistics for RMMs on a regular basis, but instead records the information upon a failure or at scheduled long-term preventive maintenance intervals, making it challenging to document trends of properly functioning equipment or trends that may be seasonal based on usage.

Because different RMMs are used (or not) in different ways at different times, evaluation of failures based on the passage of time is not necessarily meaningful, however Metrorail does not have a straightforward way of extracting information related to hours of use on a fleetwide basis for RMMs. Personnel interviewed for this audit stated that runtime is not reliably captured in a fleet monitoring service that is primarily used to document the location of the vehicles.

The vehicle teams note repeat failures that they notice, but do not have a systematic approach to ensure such issues are identified and addressed. Most commonly, this relies on a single person, the assistant superintendent, identifying these during manual work order review.

Reliability reviews have already assisted with improvements to Maximo work order information and can help further improve safety and reliability if Metrorail is more effective in data collection and utilization.

Documents provided for this audit, for example, listed only three items under RCMP RPA P 08 00 Section 3.24, identified failures during preventive maintenance, in September and October 2022. This suggests a gap in process to ensure items are properly entered in Maximo and recorded to ensure they are tracked as required by the procedure and to ensure that preventive maintenance procedures are correct and trends are identified.

◆ Recommended Corrective Action:

Metrorail may implement improvements to the RMM reliability tracking and reporting process and utilize these improvements to more effectively collect and proactively utilize reliability data to ensure safe and effective operations.

▶ 2. Metrorail can improve safety and reliability by documenting and formalizing a process for starting and checking equipment on a regular basis that is not being regularly used.

Metrorail personnel stated they had begun the positive practice of starting on a regular basis the Plasser units that have been out of service for many months due to brake beam issues. However, this procedure is not documented.

These units, and other seldom used RMMs, can be better maintained and kept available for necessary maintenance and repair work by regularly starting, checking, and maintaining them.

For example, Metrorail's track stabilizer had not been used for many years, and then had issues with batteries and hydraulics when Metrorail initially wanted to use it on short notice for track construction at the new Potomac Yard Station.

Other systems such as plows that may be attached to units similarly sit without maintenance or checks for extended periods, which allows for corrosion.

Metrorail stated that it would rely on its regular preventive maintenance of each vehicle, however this is designed around the use of the vehicles for specified hours or miles, not around vehicles that are not used and might risk corrosion, drying out of seals or other features, or other issues from an extended lack of use that could prevent the vehicles from being available if needed for maintenance or repair work.

◆ Recommended Corrective Action:

Metrorail may develop cold storage procedures and other processes to document its process to start and check equipment on a regular basis that is not being regularly used, including defining the minimum nature and frequency of such activities.

▶ 3. Metrorail is utilizing back-to-back gauges for RMM wheelsets that it has determined are insufficient to accurately make such a measurement on other rail vehicles.

Following the derailment of a 7000 Series railcar on the Blue Line in October 2021, and based on the subsequent investigation and Metrorail's development of a Return to Service Plan for each 7000 Series railcar as required by WMSC order, Metrorail determined that improvements were required to the measurement gauges used as part of its railcar preventive maintenance (periodic) inspections and associated processes.

As part of WMSC CAP oversight related to Class 1 (passenger) rail vehicles, Metrorail communicated to the WMSC on May 26, 2022 that all incremental back-to-back measurement gauges would be decommissioned upon the release of revised railcar PI procedures incorporating the new digital measurement gauges and other procedural improvements.

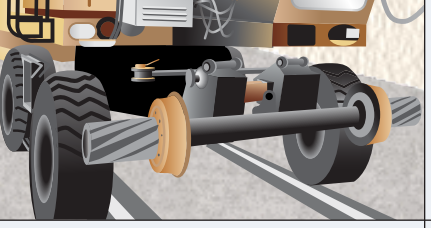
However, during this audit, Metrorail stated it was continuing to use incremental back-to-back measurement gauges for RMM measurements.

Metrorail had previously determined that these gauges were insufficient for its other vehicles, and determined that these gauges would be decommissioned. The continued presence of these incremental gauges introduces the opportunity for one to inadvertently be brought to and used in railcar maintenance processes. For example, at the Branch Avenue Rail Yard, Metrorail inspects and maintains RMM and Class 1 (passenger) rail vehicles in the same building.

In response to a draft of this report, Metrorail stated that it had intended its May 26, 2022 communication to the WMSC committing to decommissioning all incremental gauges to only apply to those incremental gauges used on Class 1 (passenger) rail vehicles.

◆ Recommended Corrective Action:

Metrorail may replace all back-to-back gauges with the current digital back-to-back measurement gauge and decommission and remove all other back-to-back gauges from Metrorail property.



Metrorail provided operational manuals and training that do not provide personnel with clear, consistently presented, understandable information.

▶ 4. Metrorail has not implemented a documented process for decommissioning RMMs, including a process to ensure that vehicles to be decommissioned are no longer needed to carry out work activities and that those vehicles are properly and safely disposed of.

Metrorail has a procedure for the consideration of decommissioning railcars (Class 1 vehicles) but does not utilize a documented process for the consideration of and actual decommissioning of RMMs (Class 2 vehicles).

SOP 301.10 Vehicle Retirement (Rev. 3, 10/21/20, past due for review) is designed around consideration for railcars and does not provide a workable process for RMMs. Personnel at multiple levels, including departmental leadership, acknowledged during this audit that a similar procedure for RMMs is needed to ensure that equipment is only decommissioned when it meets specific criteria. For railcars, Metrorail has considered areas such as age, obsolescence, usage of equipment, specific need for that equipment, remaining useful life, impact to operations, and replacement opportunity.

Just prior to this audit, Metrorail decommissioned its diesel locomotive. Following a WMATA Office of Inspector General investigation, Metrorail is also decommissioning a 35 Ton Rail-Bound Crane that did not perform as intended or meet contract specifications but that Metrorail accepted and has had on property for many years.

CTEM personnel expressed concern that some equipment that might be decommissioned if there were a procedure to do so and there were appropriate redundancies in place to conduct necessary work is taking up limited yard space needed to store and maintain other equipment that is used on a regular basis. They also expressed concern that some equipment that may be used infrequently may still be vital to system operations, and therefore suggested that decommissioning decisions needed to be very carefully considered and vetted.

◆ Recommended Corrective Action:

Metrorail may develop a documented process for decommissioning RMMs, including an interdepartmental process to ensure that vehicles to be decommissioned are no longer needed to carry out work activities and that those vehicles are properly and safely disposed of.

▶ 5. Metrorail can improve the effectiveness of training and available operational manuals by providing a consistent, complete format that documents operational restrictions and allows personnel to identify where to look for such information, and by incorporating these improvements into a recurring troubleshooting training.

Metrorail provided operational manuals and training that do not provide personnel with clear, consistently presented, understandable information when working on the wide range of RMMs in use at Metrorail.

For example, there is no consistent way for personnel to immediately identify key information such as dimensions (items such as size, any curve radius restrictions, the maximum grade for operations), operational restrictions, movement controls, job task operations, or operational troubleshooting basics. An accessible troubleshooting process allows for personnel to meaningfully communicate and address an issue.

Personnel interviewed for this audit stated that maintenance manuals for RMM are reviewed by engineers and adjusted as needed for Metrorail, but operational manuals or information and training manuals are not. The content of operational manuals at Metrorail is limited and does not include operational restrictions or processes specific to Metrorail.

Differences in training formats contribute to information missing from some classes, a lack of specifics on safe work locations, and a challenge for personnel to reference back to the training if needed. Some classes also indicate gauges, but do not provide the required readings on those gauges to operate safely.

Examples include the De-Icer/Flatcar training course and instructor guide (10/2022) and Pettibone/Speedswing Technical Skills & Maintenance Training (10/2022) that do not include values for pressures, voltages, temperature, or RPM that are acceptable during operations. Other documents, such as Operator Plasser PMC-50 Training (10/2022) have conflicting dates, also do not include values required, and have images of critical controls that do not clearly indicate the location, type, or purpose of each control.

Multiple people who provide and receive training expressed a need for more time physically on the vehicles in training and on-the-job training in addition to classroom time to provide or obtain the necessary understanding.

Complete and consistently formatted documentation would improve training and provide for more efficient response to safety and operational issues.

Metrorail is beginning to address consistency of maintenance manuals under iCAPA CTEM-22-03 focused on implementing a comprehensive maintenance control plan and standardizing CTEM manuals for all equipment under Metrorail's Quality Management System. Metrorail would benefit from ensuring this consistency across maintenance manuals, operations manuals, and matching training. This would also provide Metrorail with the opportunity to ensure that all necessary information is available and provided.

Metrorail can similarly improve coordination among operational and maintenance departments and procurement personnel to ensure that minimum requirements for vendor training content (classroom, video examples, OJT) are adequate and are clearly specified with CTEM and operational training personnel provided a meaningful opportunity to review this training before it is accepted and for Metrorail training personnel to have the opportunity to be adequately trained themselves.

◆ Recommended Corrective Action:

Metrorail may develop and implement a consistent, complete format for training and manuals in alignment with its Quality Management System that documents operational restrictions and allows personnel to identify where to look for such information, and may incorporate these improvements into a recurring troubleshooting training (Note: Part of this corrective action may incorporate elements of iCAPA CTEM-22-03).

6. Metrorail has an opportunity to improve safety through effective interdepartmental coordination to fully utilize available safety data, technology, and contracts.

Metrorail has begun installation of a non-revenue vehicle monitoring system on rubber-tired vehicles, including hi-rail vehicles, that provides real-time safety tracking and information such as speed, tire pressure, video footage and other safety alerts. Personnel responsible for RMM operations and maintenance were not aware of this system that Service Vehicle Maintenance is installing across Metrorail's fleet of rubber-tired vehicles. Metrorail has an opportunity to utilize this information for RMM operations and hi-rail maintenance for shared benefit, including as personnel responsible for other RMM expressed desires during this audit to identify and implement similar systems that may provide improved data compared to current limited monitoring of rail-bound equipment.

The new system provides real-time alerts and clear camera images that could be useful to Metrorail's plans to provide improved safety data collection, data logging and video recording on RMMs.

However, those responsible for the system had not considered how the system would function or would need to function when the vehicle is operating on the rails.

Coordinating procurement information across departments would provide Metrorail with the opportunity to more fully take advantage of available safety data, technology, and contracts. Similar systems also provide the opportunity to track hours of service and pre-trip inspections and identify and deter potential fatigue or distraction and cell phone use.

◆ Recommended Corrective Action:

Departments such as CTEM, CENV, CMOR, TRST, and SAFE may establish a process to coordinate with SVMT (or successors) and Procurement on any current and future vehicle safety data and technology advancements and contracts under consideration and their potential application to RMM to ensure that Metrorail does not restrict safety improvements to one element of the organization.

Equipment Operators described to the WMSC regular radio dead spots in the rail system, including mainline and yards.

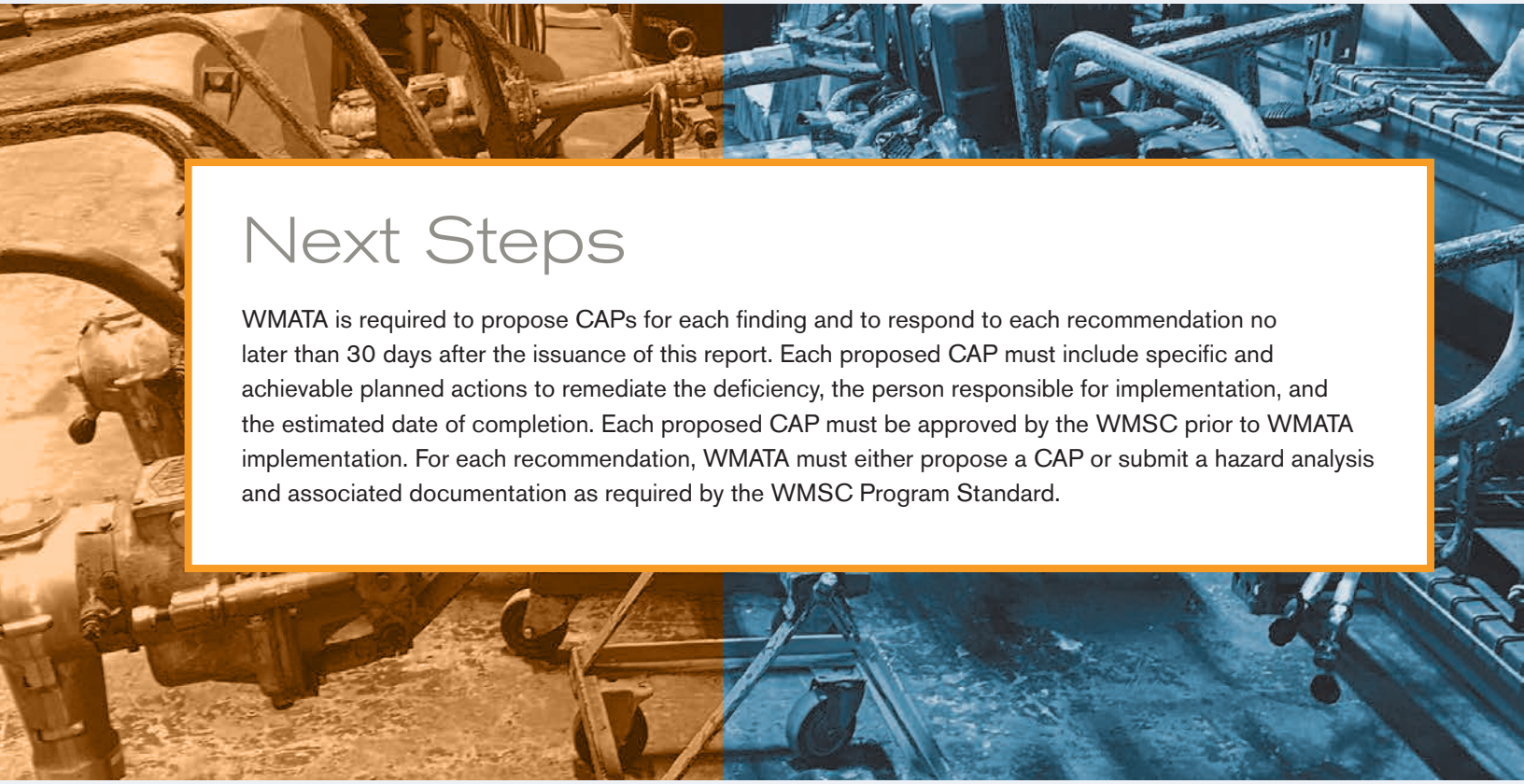
Other Observations

Equipment Operators described to the WMSC regular radio dead spots in the rail system, including mainline and yards. Metrorail is in the process of installing a new radio system and is addressing current deficiencies through open CAPs such as C-0100.

Metrorail personnel interviewed for this audit expressed an opportunity for improvement to the advanced planning and specifications of RMMs. They stated that Metrorail should conduct more pre-planning design phase work for RMMs. Metrorail does conduct this work for railcars (Class 1 vehicles). This could provide opportunities to reduce the risk of occurrences such as the brake beam failures noted above and to mitigate or eliminate other operational or mechanical hazards through improved design, including by developing and holding to design specifications.

At the time of this audit, Metrorail was still determining whether any additional RMMs would be required to maintain Silver Line Phase 2, which had opened to riders a few months prior to the on-site portion of this audit. The Dulles Rail Yard CTEM shop was also still getting parts and tools, but this had not impacted work as personnel were regularly being assigned to other shops as needed.

Metrorail CTEM personnel suggested additional specific tools could make them more productive, such as additional jump starter packs that would increase the opportunity to get equipment running in time for track maintenance personnel to conduct their work on the intended shift.



Next Steps

WMATA is required to propose CAPs for each finding and to respond to each recommendation no later than 30 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. For each recommendation, WMATA must either propose a CAP or submit a hazard analysis and associated documentation as required by the WMSC Program Standard.

Appendices

Appendices **A, B, C** and **D**

Appendix A: Personnel Interviewed

- **Chief Mechanical Officer, Rail (CMOR)**
  - Vice President & Chief Mechanical Officer
    - Vehicle Engineering (CENV)
      - Deputy Chief Vehicle Engineer
      - Sr. Vehicle Engineer
    - Car Maintenance (CMNT)
      - Assistant General Superintendent
      - Engineering, Assistant Manager
    - Car Track Equipment Maintenance (CTEM)
      - Mechanic (3)
      - Project Coordinator Special Projects
      - Regional Shop Supervisor (3)
- **Technical Skills and Maintenance Training**
  - Training Instructor (2)
- **Track and Structures**
  - Manager TGV Operations
  - Equipment Operator (2)
- **Service Vehicle Maintenance (SVMT)**
  - Heavy Truck Equipment Mechanic
  - Superintendent Service Vehicle Shops
  - Supervisor

Appendix B: Site Visits

Conducted in February 2023

- **New Carrollton CTEM Shop**
- **Greenbelt CTEM Shop**
- **Alexandria CTEM Shop**
- **Dulles CTEM Shop**

Appendix C: Documents Reviewed

DEPARTMENT INFORMATION

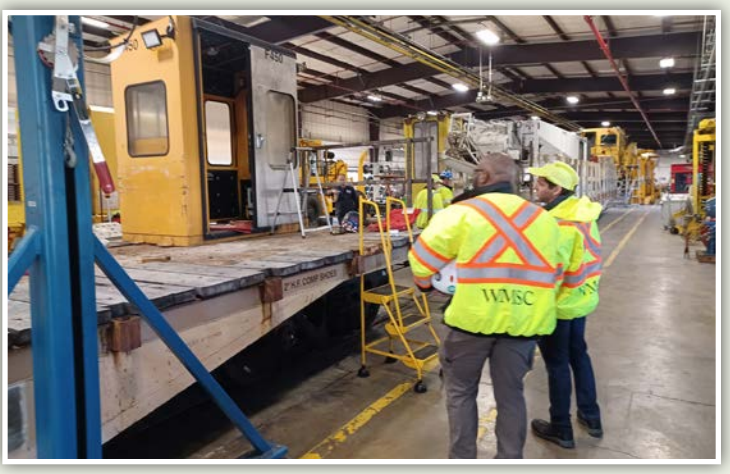
- BMNT Organizational Chart (11/2022)
- BMNT Organizational Roles and Responsibilities (no date)
- CMOR/CENV Organizational Roles and Responsibilities (no date)
- CTEM department overview (no date)
- CTEM Organizational Structure (no date)
- CTEM Personnel List (no date)
- List of departments responsible for RMM, CENV, CTEM, SVMT, MOWE, and TSMT Operations (no date)
- RMM Budgeted Positions, spreadsheet (no date)

TRAINING

- 5-Ton Swingloader Operator Training, slides (10/2022)
- Basic Training for Flagperson, Student Guide (1/2022)
- Basic Training for Vehicle Flagperson, Instructor Guide (1/2022)
- CENV MOWE CTEM PLNT Training Transcripts, spreadsheet (no date)
- CTEM Equipment and Information Update (no date)
- CTEM Heavy Equipment Photos and Identification (9/2022)
- CTEM Yard Moves Certification Lesson Plans (5/2022)
- CTEM Yard Moves Class Course Syllabus (1/2022)
- CTEM Yard Moves Course (Rev. 2) (2/2022)
- CTEM Yard Moves Course (Rev. 3) (5/2022)
- De-Icer/Flat Car DI, 40 (10/2022)
- De-Icer/Flat Car DI, 40 Instructor Guide (10/2022)
- De-Icer/Flat Car RCC Instructor Guide (10/2022)
- De-Icer/Flat Car RCC Student Guide (10/2022)
- Equipment Inspection Procedures and Brake Tests (no date)
- Equipment Operator Basic Training, slides (10/2022)
- Fall Protection Advanced Training, Course Syllabus (Rev. 01/2023)

- Fall Protection Advanced Training, slides (Rev. 01/2023)
- Fall Protection Initial Training, slides (Rev. 01/2023)
- Flagman's Booth Training (11/20/2019)
- Flat car Flagman's Booth Training Information, slides (no date)
- Initial Equipment Operator Training (10/2022)
- Initial Equipment Operator Training materials
- Initial Equipment Operator Training with Presenter Notes (10/2022)
- Initial Fall Protection, Course Syllabus (Rev. 01/2023)
- K-Line MP4 Video (17:24 minutes)
- OPRTAQUET, Aspen Aerials Course Syllabus (1/2021)
- OPRTAQUET-20210428ILT, Aspen Aerial SVMT Heavy Truck Mechanic Training Log (4/28/2021)
- OPRTIEOT, Initial Equipment Operator Training Course Syllabus (10/2022)
- OPRTPLASSERPM, Plasser PMC-50 Course Syllabus (10/2022)
- OPRTSM181VEN, Swing Master 181-Vendor Course Syllabus (10/2022)
- OPRTUCPBONE, Hi-Rail Utility Crane Pettibone PB11-PB16 Course Syllabus (10/2022)
- Pettibone/Speed Swing Training, slides (10/2022)
- Piloting Procedures/Expectations
- Plasser DI-40 De-Icer Exam (10/2022)

TRAINING (CONTINUED)



- Plasser PMC – 50 Basic Operating Instructions
- Plasser PMC 50 Operator's Quiz (10/2022)
- Plasser PMC 50 Operator Training, slides (10/20222)
- Post Incident/Accident Procedures
- Racine E Clipper Operator Training Attendance Sheet (8/25/2021)
- Rail Infrastructure Maintenance and Engineering (RIME) Safety Stand Down (4/2020)
- RCC De-Icer Flat Car Training, slides (10/2022)
- RCC De-Icer Operator Exam (10/2022)
- RMM Training Matrix, spreadsheet (12/8/2022)
- Roadway Maintenance Machine Prior To Use Inspection Template (5/8/2017)
- Swingloader Operator's Test (10/2022)
- Swingmaster Operator Training and Certification Guide (10/2022)
- Track and Wayside Equipment Descriptions and Definitions (PowerPoint Slides) (3/27/2020)
- Track Equipment Operator OJT Performance Checklists (various dates)
- Track Equipment Operator On-the Job Tracking Performance Checklist Book (Guidelines) (no date)
- Training Materials on SV Line Familiarization for Equipment Operators and Other CTEM Personnel (various dates)
- TRST Equipment Operator Information Session (4/30/2019, 5/1/2019)
- TRST Training Calendar, 1/2023 through 4/2023 (Ver. 12.0)
- TSMT Swingmaster 181 + 1 Vendor Training Course Attendance Sheet (4/11/2022, 4/13/2022, 2/20/2023, 2/22/2023)
- TSMT Training Course Syllabus (Rev. 1/2022)
- TSSM Operator Plasser PMC-50 Student Manual (10/2022)
- Updated VFP Operator Training materials (various dates)
- Vehicle Flag Person Exam Answer Key (1/2020)
- Vehicle Flag Person Practical Evaluation Sheet
- Vehicle Flag Person Training, slides (1/2022)
- Vehicle Flag Person Lesson Plan (no date)
- WMATA Class 2 Rail Vehicle Prior To Use Inspection checklists (2/7/2023, 2/8/2023)
- WMATA Equipment Operator Final Practical Exam (no date)
- Yard Moves MSRPH Rules Sections
- Yard Moves Class 3-1 materials (various dates)

SOP, OAP, POLICIES, BULLETINS, ORDERS, AND OTHER PROCEDURES

- List of Policies/SOP Governing RMM, spreadsheet (no date)
- Metrorail Safety Rules and Procedures Handbook Operating Procedures (effective 1/1/2023)
- MSI 110000, Core Drilling Flatcar Winterization (Rev. 0, 3/5/2020)
- OAP 101.01, Inspection of Contractor Rail Vehicle for Roadway Usage (Rev. 2.0, 8/27/2021)
- OAP 102.01, Management of Organizational Administrative Policies Standard Operating Procedures and Work Instructions (Rev. 1.0, 5/26/2022)
- OAP 102.02, Qualification of Suppliers and Parts (Rev. 0, 8/27/2021)
- OAP 102.03, Management of the CMOR Warranty Program (Rev. 0, 7/12/2021)
- OAP 102.06, Rail Vehicle Event Investigation Policy (Rev. 0, 10/15/2021)

SOP, OAP, POLICIES, BULLETINS, ORDERS, AND OTHER PROCEDURES (CONTINUED)

- OAP 102.07, Targeted Opportunities for Parts and Suppliers (Rev. 0, 1/27/2022)
- P/I 10.4/1 Incident and Accident Investigation (5/14/2018)
- P/I 10.5/2 Safety Belt Usage (5/24/2019)
- Permanent Order No. T-20-09, SOP # 29 Blue Flag Protection Changes to RPM Operation (effective 4/3/2020)
- Permanent Order No. T-20-11, Implementation of SOP # 17 Movement of Class 2 Rail Vehicles Into, With-in, and Out of a Maintenance Facility (effective 4/3/2020)
- Permanent Order T-17-12, Modifies SOP 29 Blue Flag Protection Storage Tracks, Shop, Shop Leads and Yards (11/9/2017)
- RAIL-OAP-100-21-01, Rail Incident Management (3/27/2020)
- RCMP-RPA-P08-00 (10/21/2021)
- RQM.001, WMATA Contractor Class 2 Rail Vehicle Requirements (Rev. 1.0, 10/27/2021)
- SB X-015, Plasser Brake Beam Weld Failure (Rev. 1, 3/15/2022)
- SB X-016, BV01 Brake Beam Inspection (Rev. 0, 3/15/2022)
- SOP 1.02, Management of Torque Indicating Devices, (Rev. 4, 1/5/2015)
- SOP 101.01, Procedures for Inspection of Contractor Class 2 Rail Vehicles for Roadway Usage (Rev. 0, 9/28/2021)
- SOP 2.05, Life Cycle Planning and Execution for Class 1 and 2 Rail Vehicle Assets (Rev. 2.3, 6/24/2019)
- SOP 202.04, Preparing, Processing and Approvals of Maintenance Service Instructions (Rev. 9.0, 6/23/2022)
- SOP 202.05, Preparing, Processing, and Approvals of Engineering Service Bulletins (SB) (Rev. 7.0, 5/25/2022)
- SOP 202.08, Preparing, Processing and Approvals of Engineering Change Notice (Rev. 6.0, 9/28/2022)
- SOP 202.14, Maintaining, Revising and Updating Periodic Inspection Procedures for Class 1 Rail Vehicles & Preventive Maintenance for Class 2 Rail Vehicles (Rev. 0, 12/9/2020)
- SOP 202.16, Preparing, Processing and Approvals of Equipment Configuration Change (Rev. 3.0, 11/4/2022)
- SOP 202.19, Preparing, Processing, and Approvals of Data Collection, Measurements and Validation (DCMV) (Rev. 3.0, 2/28/2022)
- SOP 27, Configuration Management (Rev. 0, 3/11/2019)
- SOP 3.07, Lockout/Tagout Procedures (Rev. 4, 6/3/2019)
- SOP 301.10, Rail Vehicle Retirement and Disposition Procedures (Rev. 3, 10/21/2020)
- SOP 401.01, Quality Control Program for Class 2 Rail Vehicle(s) and Small Equipment(s) (Rev. 2.0, 11/20/2020)
- SOP 401.2, Procedures for Recording Work Order(s) for Class 2 Rail Vehicle(s) and Small Equipment(s) (Rev. 3, 11/20/2020)
- SOP 401.03, Reporting Class 2 Rail Vehicle and Small Equipment Deficiencies (Rev. 1.1, 1/8/2020)
- SOP 403.01, Procedures for Controlling Shop Tools and Mandatory Personnel Tools (Rev. 1.0, 1/26/2022)
- SOP 6.01, Procedures for Controlling Shop Tools and Mandatory Personnel Tools (Rev. 1, 1/16/2019)

MANUALS, WORK INSTRUCTIONS

- CTEM WI 11PM01, PM Manual, Nordco Quad Drill (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM02, PM Manual, Nordco Spike Driver (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM03, PM Manual, Badger Rail Cart RC80 40T (Ver. 0.1, 6/25/2021)
- CTEM WI 11PM03, PM Manual, Nordco Spike Puller (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM03, PM Manual, Sperling Tie Cart (Ver. 0.1, 6/25/2021)
- CTEM WI 11PM03, PM Manual, Teleweld Rail Heater (Ver. 1.0, 6/2/2021)
- CTEM WI 11PM04, PM Manual, Nordco TRIPP Machine (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM05, PM Manual, Nordco Tie Shear (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM06, PM Manual, Jackson Spot Tamping Machine (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM07, PM Manual, Kershaw Rotary Scarifier (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM08, PM Manual, Core Drilling Equipment Flatcar (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM09, PM Manual, Geismar 360 (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM10, PM Manual, RCC Deicer (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM11, PM Manual, Knox Kershaw Tie Crane (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM12, PM Manual, Plasser Deicer (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM13, PM Manual, Slab Lift Unit (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM14, PM Manual, Pettibone Speedswing (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM16, PM Manual, Case Backhoe (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM17, PM Manual, Hyundai Excavator (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM18, PM Manual, Holland CWR Rail Train (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM20, PM Manual, Mobile Maintenance Unit (Ver. 2.0, 3/16/2021)
- CTEM WI 11PM24, PM Manual, Plasser Prime Mover PMC-50 (Ver. 3.0, 3/18/2021)
- CTEM WI 11PM25, PM Manual, Metro 4X4 Tamping Machine (Plasser 4X4) (Ver. 2.0, 3/19/2021)
- CTEM WI 11PM26, PM Manual, Harsco Switch Tamping Machine (Ver. 2.0, 3/22/2021)
- CTEM WI 11PM27, PM Manual, Concrete Batch Plant (Ver. 2.0, 3/22/2021)
- CTEM WI 11PM28, PM Manual, Kershaw Ballast Regulator (Ver. 2.0, 3/22/2021)
- CTEM WI 11PM29, PM Manual, Swingmaster 5 Ton (Ver. 2.0, 3/22/2021)
- CTEM WI 11PM30, PM Manual, Plasser PMC-50 Welder (Ver. 2.0, 3/22/2021)
- CTEM WI 11PM31, PM Manual, Plasser TGV (Ver. 2.0, 3/23/2021)
- CTEM WI 11PM32, PM Manual, Harsco UTV-354C (Ver. 2.0, 3/23/2021)
- CTEM WI 11PM33, PM Manual- Harsco UTV-ALV (Ver. 2.0, 3/23/2021)
- CTEM WI 11PM34, PM Manual, Bobcat Skid Steer (Ver. 2.0, 3/23/2021)

MANUALS, WORK INSTRUCTIONS (CONTINUED)

- CTEM WI 11PM35, PM Manual, Harsco Jet Rodder (Ver. 2.0, 3/24/2021)
- CTEM WI 11PM36, PM Manual, Swingmaster 10 Ton (Ver. 2.0, 3/26/2021)
- CTEM WI 11PM37, PM Manual, CAT 302.5C Mini Excavator (Ver. 2.0, 3/24/2021)
- CTEM WI 11PM38, PM Manual, Doosan Loader (Ver. 2.0, 3/25/2021)
- CTEM WI 11PM39, PM Manual, Plasser Jet Rodder (Ver. 2.0, 3/25/2021)
- CTEM WI 11PM40, PM Manual, Kubota SVL75 Skid Steer (Ver. 2.0, 3/29/2021)
- CTEM WI 11PM42, PM Manual, Flat Car (Ver. 2.0, 3/30/2021)
- CTEM WI 11PM46, PM Manual, Case TV380 CTL (Ver. 0.1, 7/9/2021)
- CTEM WI 11PM49, PM Manual, Racine Dual Clip Applicator (Ver. 0.1, 4/4/2022)
- CTEM WI 11PM50, PM Manual, Ballast Regulator BR-01 (Ver. 0.1, 3/3/2022)
- CTEM WI11PM19, PM Manual, Plasser Vacavator (Ver. 2.0, 3/16/2021)
- CTEM WI11PM21, PM Manual, John Deere Mini Excavator (Ver. 2.0, 3/16/2021)
- Harsco Utility Track Vehicle, UTV354C, Operation and Maintenance Manual (Rev. 3/2011)
- Jackson 2400 Hydraulic Tamper Operator's Manual (Issue 1, Rev. 7/2006)
- Nordco Tripp Model "D" Operation and Maintenance Manual (Rev. 9/2011)
- Plasser American Operation Manual for VM170 Vacuum Car, VM170 Power Car, MFS-15, MDH (no date)
- Plasser American PMC-50 Operation Manual (no date)
- PM Manual, 44 Ton Locomotive (Ver. 0, 5/23/2016)
- PM Manual, Boom Attachments (Ver. 0.1, 6/29/2020)
- PM Manual, JLG Telehandler (Ver. 0.1, 5/27/2020)
- PM Manual, John Deere Wheel Loader (Ver. 0.1, 6/23/2020)
- PM Manual, Nordco Rail Lifter (Ver. 1.0, 6/30/2018)
- Swingmaster Model 181+1 Swingloader Operation Manual (Rev. 9/22/2021)

MEETING MINUTES

- Alexandria Local Safety Committee Action Items (1/18/2022, 2/15/2022, 3/15/2022, 4/26/2022, 5/17/2022, 6/21/2022, 7/19/2022, 8/16/2022, 9/20/2022, 10/18/2022, 12/20/2022)
- CTEM Monthly Staff Meeting Minutes (9/28/2022, 10/24/2022, 11/30/2022, 12/21/2022, 1/25/2023)
- Local Safety Committee Meeting Minutes Branch Ave Rail Yard (2/15/2022, 3/8/2022, 4/12/2022, 5/17/2022, 6/14/2022, 7/12/2022, 8/9/2022, 9/13/2022, 10/11/2022)
- Local Safety Committee Meeting Minutes Greenbelt Yard (2/24/2022, 3/24/2022, 4/28/2022, 5/26/2022, 6/23/2022, 7/28/2022, 8/25/2022, 10/27/2022)
- Local Safety Committee Meeting Minutes New Carrollton Rail Yard (12/22/2021, 1/26/2022, 2/16/2022, 3/16/2022, 4/20/2022, 6/29/2022, 7/20/2022, 8/17/2022, 9/21/2022, 10/19/2022)

OTHER

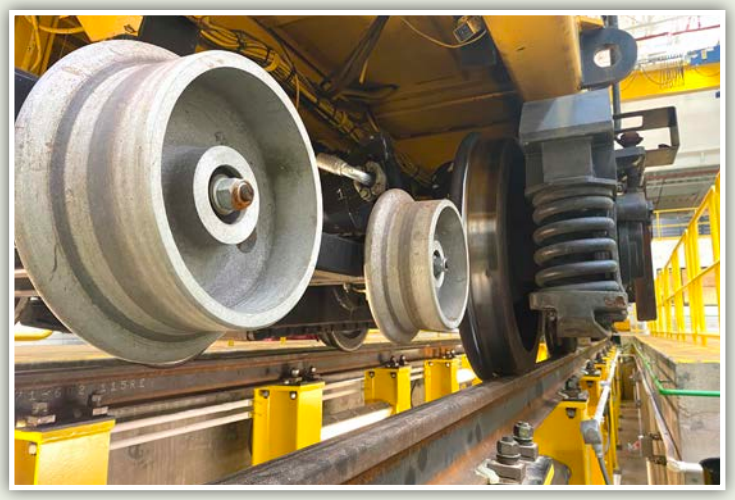
- Approved ECC List from 11/1/2020 through 11/1/2022
- Car Track Equipment Maintenance Status Reports (CTEM)
- CENV Equipment Configuration Change #2110042, Trip Machine Camera System Upgrade (Rev. 0, 5/17/2022)

OTHER (CONTINUED)

- CENV Equipment Configuration Change #2112054, Tie Exchange Detection (Rev. 0, 5/2/2022)
- CENV Equipment Configuration Change #2203012, 700MHZ Radio Upgrade (Rev. 0, 6/3/2022)
- CENV Equipment Configuration Change #2205023, Brake Fulcrum Installation (Rev. 0, 1/31/2023)
- CMNT Shop Safety and Health Inspection Checklist, Alexandria (9/2/2021)
- CMNT Shop Safety and Health Inspection Checklist, Alexandria (10/1/2021)
- CMNT Shop Safety and Health Inspection Checklist, Branch Ave CTEM (9/1/2021)
- CMNT Shop Safety and Health Inspection Checklist, Branch Ave CTEM (10/4/2021)
- CMNT Shop Safety and Health Inspection Checklist, Greenbelt Building C (8/30/2021)
- CMNT Shop Safety and Health Inspection Checklist, Greenbelt Building C (9/30/2021)
- CMNT Shop Safety and Health Inspection Checklist, New Carrollton CTEM Building B (9/3/2021)
- CMNT Shop Safety and Health Inspection Checklist, New Carrollton CTEM Building B (10/1/2021)
- Contractor Rail Vehicle Consist Movement Plan (11/8/2022)
- Contractor Rail Vehicle Consist Movement Plan (8/12/2022) Contractor Rail Vehicle Consist Movement Plan (9/9/2022)
- Contractor's Rail Vehicle Inspection Checklist (10/13/2022)
- Contractor's Rail Vehicle Inspection Checklist (11/9/2021)
- Contractor's Rail Vehicle Inspection Checklist (4/14/2022)
- Contractor's Rail Vehicle Inspection Checklist (4/22/2014)
- Contractor's Rail Vehicle Inspection Checklist (4/27/2022)
- Contractor's Rail Vehicle Inspection Checklist (8/9/2022)
- Contractor's Rail Vehicle Inspection Checklist (9/22/2022)
- Contractor's Rail Vehicle Inspection Checklist (9/7/2022)
- Contractor's Rail Vehicle Inspection Checklist (9/8/2022)
- CTEM Corrective Maintenance Work Orders opened in 2021 and those opened before 2021 that remain open, spreadsheet (as of 11/1/2022)
- CTEM Heavy Repair PMI Schedule (February 2023)
- CTEM Mechanics Tools Checklist (12/23/2022)
- CTEM Post-Derailment & Accident Damage Inspection Form (2/1/2018)
- CTEM Status Reports (10/24/2022-10/31/2022)
- CTEM Status Reports (3/7/2022-3/11/2022)
- CTEM Status Reports (5/16/2022-5/23/2022)
- CTEM Supervisory Quality Control Inspection Checklist, Cylinders (1/18/2023)
- CTEM Supervisory Quality Control Inspection Checklist, D31 (11/4/2022)
- CTEM Supervisory Quality Control Inspection Checklist, D34 (1/5/2023)
- CTEM Supervisory Quality Control Inspection Checklist, D57 (11/2/2023)
- CTEM Supervisory Quality Control Inspection Checklist, DI481 (11/9/2022)
- CTEM Supervisory Quality Control Inspection Checklist, EC02 (1/11/2023)
- CTEM Supervisory Quality Control Inspection Checklist, F606 (11/25/2022)
- CTEM Supervisory Quality Control Inspection Checklist, Gas Trimmer (11/14/2022)

OTHER (CONTINUED)

- CTEM Supervisory Quality Control Inspection Checklist, HGRS45 (12/16/2022)
- CTEM Supervisory Quality Control Inspection Checklist, Hydraulic Fittings and Hoses (12/20/2022)
- CTEM Supervisory Quality Control Inspection Checklist, LPM53 (1/27/2023)
- CTEM Supervisory Quality Control Inspection Checklist, ME01 (11/14/2022)
- CTEM Supervisory Quality Control Inspection Checklist, n/a (11/18/2022)
- CTEM Supervisory Quality Control Inspection Checklist, NSP02 (12/23/2023)
- CTEM Supervisory Quality Control Inspection Checklist, PB11 (1/23/2023)
- CTEM Supervisory Quality Control Inspection Checklist, PB13 (1/25/2023)
- CTEM Supervisory Quality Control Inspection Checklist, PM35 (1/3/2023)
- CTEM Supervisory Quality Control Inspection Checklist, PM37 (11/19/2022)
- CTEM Supervisory Quality Control Inspection Checklist, PM39 (1/17/2023)
- CTEM Supervisory Quality Control Inspection Checklist, PM39 (12/21/2022)
- CTEM Supervisory Quality Control Inspection Checklist, PM44 (11/21/2022)
- CTEM Supervisory Quality Control Inspection Checklist, PM49 (12/25/2022)
- CTEM Supervisory Quality Control Inspection Checklist, PM58 (12/12/2022)
- CTEM Supervisory Quality Control Inspection Checklist, PM61 (12/15/2022)
- CTEM Supervisory Quality Control Inspection Checklist, Ross Rubin Spill Pallets (11/14/2022)
- CTEM Supervisory Quality Control Inspection Checklist, Ross Rubin Label Station (11/14/2022)
- CTEM Supervisory Quality Control Inspection Checklist, RS02 (11/23/2022)
- CTEM Supervisory Quality Control Inspection Checklist, Rubin Tool Box (12/27/2022)
- CTEM Supervisory Quality Control Inspection Checklist, SS02 (1/26/2023)
- CTEM Supervisory Quality Control Inspection Checklist, T005 (1/23/2023)
- CTEM Supervisory Quality Control Inspection Checklist, T006 (1/7/2023)
- CTEM Supervisory Quality Control Inspection Checklist, TB02 (11/4/2022)
- CTEM Supervisory Quality Control Inspection Checklist, TC04 (12/8/2022)
- CTEM Supervisory Quality Control Inspection Checklist, TGV01 (12/9/2023)
- CTEM Supervisory Quality Control Inspection Checklist, TR06 (12/16/2022)
- EC01 Certification Package
- EC02 Certification Package
- EC03 Certification Package
- EC04 Certification Package
- Equipment Inventory Coding System list (no date)
- Internal Safety Review CTEM iCAPA Status Report (11/4/2022)
- Kershaw Ballast Regulator, Mechanic's Checklist (1/18/2022)
- List of contractor hi-rails with expiration dates (no date)



OTHER (CONTINUED)

- List of engineering requests from 11/1/2020 through 11/1/2022
- List of RMM Modifications from 11/1/2020 through 11/1/2022
- Memorandum, CTEM Procedures for Testing Out of Service RMM (2/16/2023)
- Memorandum, Re: CTEM Hazard Log not maintained for RMM Equipment (11/15/2022)
- Memorandum, Waiver to Allow Transport of Non-compliant G.W. Peoples Tamper and Ballast Regulator to and from the Potomac Yard AC (9/14/2022)
- Memorandum, Waiver to Use GW Peoples Track Tamper and Ballast Regulator with Known Deficiency within the Potomac Yard ACS (9/14/2022)
- Memorandum, WMSC RMM Audit Cycle 2 Follow-up Questions regarding RMM Decommissioning or Purchase (2/2/2023)
- Nordco Tie Shear, Mechanic's Checklist (3/29/2022)
- Pettibone Speedswing, Mechanic's Checklist (6/17/2021)
- Plasser Prime Mover PMC-50, Mechanic's Checklist (12/07/2021)
- PM56, CTEM Branch Supervisory Quality Control Inspection Checklist (12/11/2020)
- Preventive Maintenance Maximo Work Orders Opened in 2021, spreadsheet (as of 11/1/2022)
- REAM Class 2 Rail Vehicle Performance (10/2022)
- REAM Class 2 Rail Vehicle Performance (3/2022)
- REAM Class 2 Rail Vehicle Performance (4/2022)
- REAM Class 2 Rail Vehicle Performance (5/2022)
- REAM Class 2 Rail Vehicle Performance (6/2022)
- REAM Class 2 Rail Vehicle Performance (7/2022)
- REAM Class 2 Rail Vehicle Performance (8/2022)
- REAM Class 2 Rail Vehicle Performance (9/2022)
- Reported Failures Under RCMP-RPA-P08-00 Section 3.24 (9/27/2022 through 10/31/2022)
- RMM Preventive Maintenance required frequency, spreadsheet (no date)
- SM07 Certification Package
- SM08 Certification Package
- SM09 Certificate Package
- Swingmaster 10 Ton, Mechanic's Checklist (11/23/2022)
- TGV Pre-Trip Inspection (10/11/2022)
- TGV Pre-Trip Inspection (10/12/2022)
- TGV Pre-Trip Inspection (10/28/2022)
- TGV Pre-Trip Inspection (10/4/2022)
- TGV Pre-Trip Inspection (10/5/2022)
- TGV Pre-Trip Inspection (10/6/2022)
- TGV Pre-Trip Inspection (9/12/2022)
- TGV Pre-Trip Inspection (9/13/2022)
- TGV Pre-Trip Inspection (9/14/2022)
- TGV Pre-Trip Inspection (9/15/2022)
- TGV Pre-Trip Inspection (9/19/2022)
- TGV Pre-Trip Inspection (9/20/2022)
- TGV Pre-Trip Inspection (9/21/2022)
- TGV Pre-Trip Inspection (9/22/2022)
- TGV Pre-Trip Inspection (9/26/2022)
- TGV Pre-Trip Inspection (9/8/2022)
- TMDE/Shop Equipment/Special Tool Inventory Report (as of 2/15/2023)
- Toolbox Shift Forms (Car Track Equipment Maintenance) (4/7/2022 through 4/13/2022, 5/16/2022 through 5/23/2022, 10/24/2022 through 10/31/2022)

OTHER (CONTINUED)

- Track and Structures/MOWE Maintenance Bulletin, Stretch Test for Flat Car Coupling (4/13/2021)
- TRST daily locator (1/9/2023)
- WMATA Hot Work Program Manual (4/30/2021)
- WMATA Response, re WMSC Roadway Maintenance Machine Audit Site Inspection hot work procedures, fall protection, hazardous materials storage, and NFPA signage (2/8/2023)
- WMATA response, WMSC Roadway Maintenance Machine Audit Site Inspection Re hot work procedures, fall protection, hazardous materials storage, and NFPA signage (2/28/2023)
- WMATA Responses to Additional RMM Questions (3/3/2023)
- WMATA Roadway Job Safety Briefing Form (10/11/2022)
- WMATA Roadway Job Safety Briefing Form (10/11/2022)
- WMATA Roadway Job Safety Briefing Form (10/12/2022)
- WMATA Roadway Job Safety Briefing Form (10/13/2022)
- WMATA Roadway Job Safety Briefing Form (10/28/2022)
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- WMATA Roadway Job Safety Briefing Form (10/5/2022)
- WMATA Roadway Job Safety Briefing Form (10/6/2022)
- WMATA Roadway Job Safety Briefing Form (11/1/2022)
- WMATA Roadway Job Safety Briefing Form (9/12/2022)
- WMATA Roadway Job Safety Briefing Form (9/13/2022)
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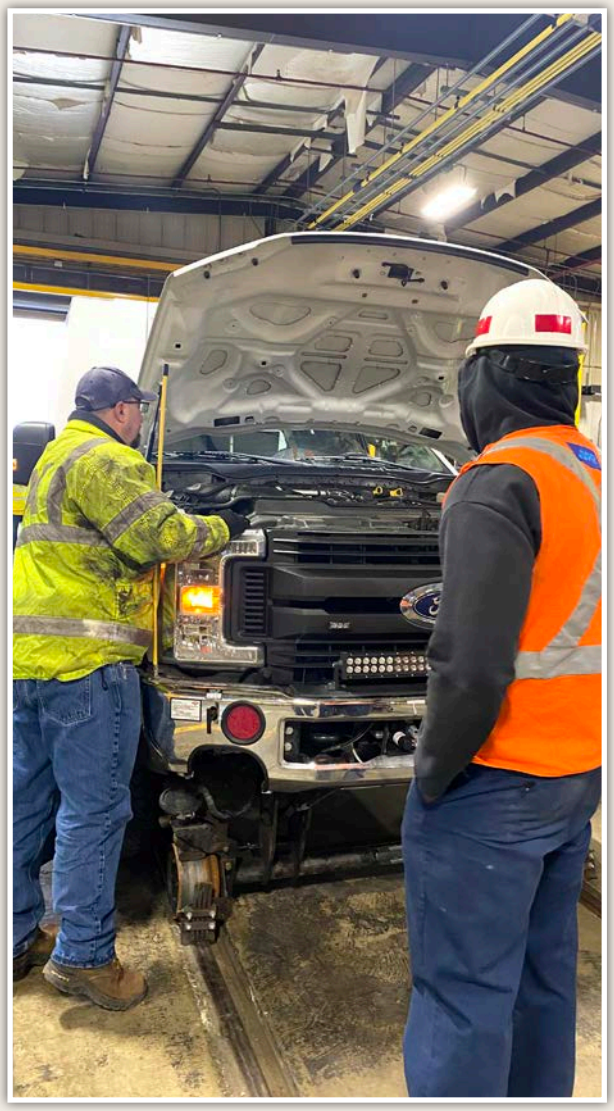
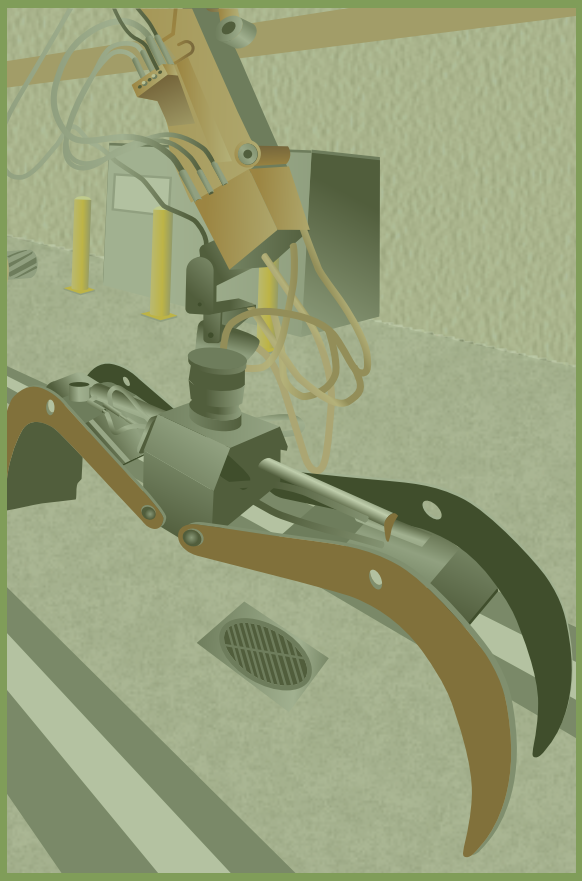
- WMATA Roadway Job Safety Briefing Form (9/28/2022)
- WMATA Roadway Job Safety Briefing Form (9/8/2022)
- WMATA Roadway Job Safety Briefing Form (9/8/2023)
- WO #14798387 hi-rail information
- WO #14818810 hi-rail information
- WO #14818821 hi-rail information
- WO #14818827 hi-rail information
- WO #14818833 hi-rail information
- WO #14818837 hi-rail information
- WO #14818841 hi-rail information
- WO #14818855 hi-rail information
- WO #14818856 hi-rail information
- WO #14818867 hi-rail information
- WO #14818873 hi-rail information
- WO #15585269 hi-rail information
- WO #16194236 details, Pettibone speed swing (closed as of 7/14/2021)
- WO #16597614 details, ballast regulator (closed as of 1/31/2022)
- WO #16605578 details, PM56 prime mover (closed as of 1/7/2022)
- WO #16678159 details, swingmaster swing loader (closed, as of 12/14/2022)
- WO #16754648 details, tripp machine (closed as of 4/1/2022)

Appendix D: Public Transportation Agency Safety Plan (PTASP) Elements Reviewed

1. **Safety Management Policy**
   a. Safety performance targets
   c. Organizational SMS Accountabilities and Responsibilities
   d. SMS documentation
2. **Safety Risk Management**
   a. Safety Risk Management (SRM) process
   b. Risk Assessment Process
   c. Risk assessment methodology
   d. Hazard identification
   e. Hazard investigation
   f. Hazard analysis and evaluation of safety risk
   g. Hazard resolution (mitigation, elimination)
   h. Hazard tracking
3. **Safety Assurance**
   a. Systematic, integrated data monitoring and recording of safety performance
   b. Real-time assessment with timely information
   d. Departmental controls
   e. Compliance and sufficiency monitoring (i.e., quality management system plan (QMSP))
   f. Document assurance activities
   g. Preventive, Predictive, and Corrective Maintenance
   h. Event reporting/investigations
   i. Change management
   j. Safety and Security Certification
   k. Corrective action plans
4. **Safety Promotion**
   a. Training
   b. Contractor Safety
   c. Safety Communications
   d. Hazard and safety risk information
   e. Safety committees
   f. Hazardous materials and environmental management





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