



Washington Metropolitan Area Transit Authority
INTERNAL REVIEW 2017

Comprehensive Internal Review:
Metrorail Engineering and Maintenance

Metrorail Vertical Transportation: Escalator Maintenance and Inspections **(13)**

Metrorail Fire & Life Safety: Fire Suppression Inspection and Testing **(14)**

Parts and Materials Inventory Management **(15)**

Post-SafeTrack Assessment of Next-Level Maintenance Requirements **(16)**

November 17, 2017



Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"



QICO INTERNAL REVIEW

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COMPREHENSIVE INTERNAL REVIEW SUMMARY

What is QICO?

- It's an internal management function that reports to the General Manager (GM/CEO) that provides quality and compliance assessments to assure departments are fulfilling business objectives, addressing corrective actions, and complying with NTSB, FTA, TOC, MSC, and other agency requirements and recommendations, promoting transparency and accountability. Results of these reviews are presented to senior management to communicate what went well, and to promote the implementation of actions to address areas for improvement.

Purpose of this Review:

- The comprehensive nature of this internal review encompasses four distinct areas within Metrorail Engineering and Maintenance functions; Metrorail Vertical Transportation, Metrorail Fire & Life Safety Systems, Parts & Materials Inventory Management, and a Post-SafeTrack Assessment of Next-Level Maintenance Requirements; accounting for the 13th – 16th installments of QICO's 20-part CY2017 internal review. Each of these reviews was conducted in the third and fourth quarters (Q3 & Q4) of calendar year (CY) 2017, and are intended to collectively provide an overall assessment of observed activities to Metro's senior management to improve future capital program planning.

Methodology:

- QICO developed relevant review activities by assessing risks to integration management, scope management, time management, cost management, quality management, human resource management, communication management, risk management, procurement management, stakeholder management and records management.
- QICO reviewed each function's governing documentation and records, assessed their conformance to requirements, and interviewed key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale. Each is associated with either project-specific areas, or identified as a systemic issue across capital program management.

Note: An itemized Corrective Action Plan (CAP) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of CAP implementation go to:
<https://www.wmata.com/initiatives/transparency/upload/Overview-of-Internal-Compliance-Actions.pdf>

Metrorail Engineering & Maintenance



November 2017

13. Metrorail Vertical Transportation: Escalator Maintenance and Inspection

Key Takeaway: Implementation of a maintenance control program and improving data analysis activities will promote sustainable performance of Metro's escalator systems.

Wins:

- ✓ Escalator mechanics were well versed in system components.

Areas for Improvement:

- Effective maintenance planning and scheduling is required to maximize maintenance efforts.
- A formal maintenance control program is required to assure compliance with code requirements and effective application of maintenance practices.
- Consistent capture of maintenance data is required for future maintenance planning.

Required Actions:

- **QICO-MVT-17-01:** Conduct an analysis of the current practices used to gather and store vertical transportation information. Create or modify methods to enhance the value and reliability of data collected and stored.
- **QICO-MVT-17-02:** Establish methods for maintenance personnel to perform their work more properly, efficiently, and effectively.
- **QICO-MVT-17-03:** Establish a maintenance control program that follows ASME code A17.1 Section 8.6; including methods for capture and storage of relevant maintenance data.

15. Parts & Materials Inventory Management

Key Takeaway: The implementation of a Material Requirement Planning (MRP) process and the application of its fundamentals and principles will assure Metro has an effective and efficient supply chain.

Wins:

- ✓ Shipment analysis performed by Supply Chain Enterprise Services (SCES) promotes effective corrective measures.

Areas for Improvement:

- Effective management of supply chain systems is essential to the availability of parts/materials and reduce the number of stockouts.
- Clear definition of roles, responsibilities, and functions within MIPN is required to assure activities are carried out consistently and in coordination with other departments.

Required Actions:

- **QICO-PMIM-17-01:** Determine a method to implement a Material Requirement Planning (MRP) system while incorporating the fundamental industry standards which will enhance the efficiency and effectiveness of the supply chain process.
- **QICO-PMIM-17-02:** Evaluate current material receiving practices and develop methods to ensure items with shelf-life limitations are identified and tracked through the supply chain system. A shelf life policy needs to be developed to ensure incoming products have adequate shelf life prior to entering into stock across the authority.
- **QICO-PMIM-17-03:** Identify all parts and materials that require an incoming/receiving inspection for quality control purposes, define specific methods to verify key product characteristics of these items, and develop methods to ensure these items are inspected as required.
- **QICO-PMIM-17-04:** Establish governing documentation to define roles and responsibilities for the office of MIPN to ensure clear departmental duties across the supply chain.
- **QICO-PMIM-17-05:** Establish and clarify requirements vendors must follow to ensure WMATA has clear supplier promised date and ship date used to update WMATA's data enterprise services.
- **QICO-PMIM-17-06:** Procurement must identify and evaluate PR's that have been aging greater than 30 days in order to maximize efficiency and eliminate the continuing growth of the PR backlog.

14. Metrorail Fire & Life Safety: Fire Suppression Inspection and Testing

Key Takeaway: The Fire and Life Safety (FLS) equipment observed is in good condition and practices are in accordance with national standards; however, the oversight roles must be clearly defined.

Wins:

- ✓ Office of Plant Maintenance (PLNT) utilizes a FLS Work Order Escalation Process for resolving FLS issues.

Areas for Improvement:

- Clear definition of roles, responsibilities, and processes for the Fire Marshal's Office are required.
- Effective oversight of inspection, testing and maintenance programs for fire and life safety systems is required.
- Consistent application of maintenance practices is necessary.

Required Actions:

- **QICO-FLS-17-01:** Establish governing documentation to define the roles, responsibilities, and processes for the Fire Marshal's Office (FMO) to ensure clear departmental ownership and obligations across Fire and Life Safety (FLS) systems.
- **QICO-FLS-17-02:** Conduct an evaluation of current maintenance practices, including maintenance records and material storage, and establish methods to ensure requirements are clearly defined and adhered to.

16. Post-SafeTrack: Assessment of Next-Level Maintenance Requirements

Key Takeaway: Although the SafeTrack program significantly improved conditions within each surge area, improved scope definition, planning, and on-site inspection activities is needed to assure future routine maintenance and capital renewal work is completed effectively.

Wins:

- ✓ Management team introduced management tools to continually improve the planning and execution of Surges.
- ✓ Condition of track superstructure significantly improved in Surge areas.

Areas for Improvement:

- There was no specific requirement to develop a complete scope or plan prior to the launch of the emergency SafeTrack program
- Consistent practices for data capture are necessary to provide traceability of work completed during routine maintenance and capital renewal activities.
- Quality control measures are necessary to consistently identify and correct deficiencies during future routine maintenance and capital renewal.
- Additional maintenance is required for special trackwork not addressed during Surges.

Required Actions:

- **QICO-STP-17-01:** To promote the effective execution of future maintenance initiatives, establish or revise policy to indicate the minimum requirements for program documentation (plan, scope, schedule, etc.) and control mechanisms (change management), including development and approval timelines.
- **QICO-STP-17-02:** To improve the integrity of maintenance records, establish uniform requirements for the use of Maximo in the documentation of work activities, including applicable nomenclature and data fields for traceability.
- **QICO-STP-17-03:** To improve the quality and execution of future maintenance initiatives, establish formal quality control measures for use in corrective maintenance and rehabilitation activities that ensure identification and remediation of deficiencies prior to returning assets to passenger service.



Metrorail Engineering and Maintenance
Metrorail Vertical Transportation:
Escalator Maintenance and Inspections (13)



Quality Assurance, Internal Compliance & Oversight (QICO)
"Quality Trumps Quantity"



INTERNAL REVIEW SUMMARY

November 2017

13. Metrorail Vertical Transportation: Escalator Maintenance and Inspections

Key Takeaway: Implementation of a Maintenance Control Program and improving data analysis activities will promote sustainable performance of Metro's escalator systems.

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the state of the Office of Elevators & Escalators (ELES) and promote the actions needed to address any concerns.
- QICO is uninformed of the functions reviewed, and authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- Developed relevant review activities by identifying and assessing risks to quality of work, compliance with standards, records management, and safety.
- Reviewed maintenance documentation, observed maintenance and inspection work in-progress, and interviewed key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

Wins and Areas for Improvement:

- ✓ The use of escalator barricades to prevent unauthorized entrance into work areas was observed at visited sites.
- ✓ Escalator mechanics were well versed in system components.
- Maintaining the correct asset identification within station monitoring systems is essential to maintenance response and analysis.
- Effective maintenance planning and scheduling is required to maximize time available outside of passenger service hours.
- Analysis of work order data is necessary to determine accurate failure trends during peak passenger service periods and proactively manage maintenance activities.
- Effective inventory and control of calibrated equipment is required to assure items are scheduled and calibrated on-time.
- A formal maintenance control program is required to assure compliance with code requirements and effective application of maintenance practices.
- Accurate documentation of maintenance activities is essential to the availability of information for troubleshooting and that all equipment is within specified tolerances.
- Consistent capture of maintenance data is required for data integrity for future analysis and maintenance planning.

Required Actions:

- QICO-MVT-17-01: Conduct an analysis of the current practices used to gather and store vertical transportation information. Create or modify methods to enhance the value and reliability of data collected and stored. *(Risk Rating: High)*
- QICO-MVT-17-02: Establish methods for maintenance personnel to perform their work more properly, efficiently, and effectively. *(Risk Rating: High)*
- QICO-MVT-17-03: Establish a maintenance control program that follows ASME code A17.1 Section 8.6; including methods for capture and storage of relevant maintenance data. *(Risk Rating: High)*

Note: An itemized Corrective Action Plan (CAP) is developed for each required action to achieve effective and measurable resolution of identified concerns. To check the status of CAP implementation go to <https://www.wmata.com/initiatives/transparency/upload/Overview-of-Internal-Compliance-Actions.pdf>.

13.1. DEPARTMENT/FUNCTION OVERVIEW

Vertical Transportation: Elevators and Escalators

The Office of Elevators and Escalators (ELES) provides vertical transportation services, an important feature of the Metrorail system, to over 490,000 riders daily¹. The ELES department is responsible for maintenance and upkeep of the largest vertical transportation portfolio in transit across the United States with an inventory of 317 elevators and 618 escalators. The guiding principles of the ELES department are to:

- (1) Manage and maintain all vertical transportation equipment throughout the Metrorail system.
- (2) Provide the safest and most reliable quality service to their customers through the use of technology, training, and education.

There are three sections within the ELES department that work together to achieve these guiding principles: Capital Improvement Program, Maintenance, and Engineering.

The Capital Improvement Program section of ELES is responsible for facilitating the rehabilitation and replacement of elevator and escalator systems. The Maintenance section is responsible for maintaining and repairing all elevator and escalator assets throughout the Metrorail system. The Engineering section is responsible for the design, review, and approval of new construction submittals, supporting the procurement of parts and the Maintenance section on complex troubleshooting, and is responsible for the annual inspections of every vertical transportation asset to maintain jurisdictional compliance.

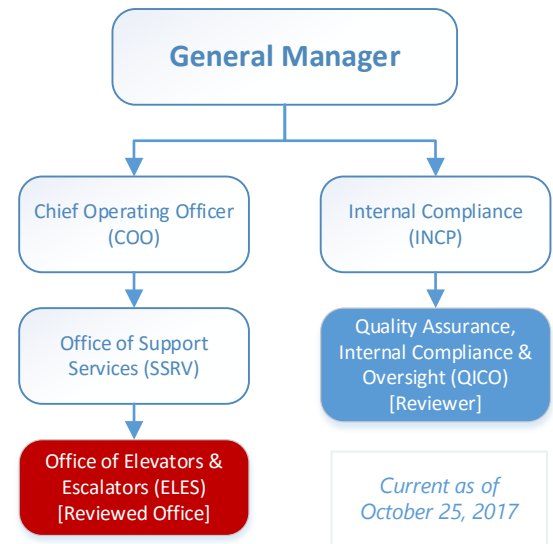
The intention of this internal review is to provide an objective review of ELES assets and operations, promote compliance with internal and external regulatory requirements, and drive quality improvement initiatives that safeguard the mission success of WMATA while enhancing customer experience. In this internal review areas of improvement are highlighted for corrective action to promote the guiding principles of the ELES department are met.

13.2. REVIEW METHODOLOGY

Internal Review Stakeholders

The Office of Quality, Internal Compliance and Oversight (QICO) conducted an internal review of the Office of Elevators and Escalators (ELES). The ELES department is responsible for providing the safe and reliable functionality of elevator and escalator systems. As shown in the organization chart (right), QICO is entirely separated from this department. QICO performed the internal review between May 2 and August 11, 2017.

QICO reviewed documentation, shadowed field visits, and interviewed personnel, noting both positive and negative findings. QICO's findings are categorized into four groups: **Quality of Work**, **Compliance with Standards**, **Records Management**, and **Safety**. For each finding there is an associated **Recommendation** (a suggestion for improving a process based upon QICO's review). Findings are combined into several **Required Actions**, which summarize the steps actions owners must take to address deficiencies.



REVIEW SCOPE

Category	Description
Internal Review Scope	ELES ORGANIZATIONAL CHART² <pre> graph TD A["ELES DEPARTMENT LEADER General Superintendent (Mitch Nici-Acting)"] B["CAPITAL IMPROVEMENT Project Manager, CIP [Redacted]"] C["MAINTENANCE Assistant General Superintendent [Redacted]"] D["ENGINEERING & INSPECTIONS Engineering Manager [Redacted]"] E["Assistant Project Manager, Construction Engineers, Construction Supervisors, Construction Aid (Approx. 15 Personnel)"] F["Superintendents, Supervisors, Remote Monitoring, Dispatchers, Clerk, Master Technicians, Journeymen, TSPs (Approx. 254 Personnel)"] G["Manager of Operations Contracts and Parts, Supervisory Engineer, Assistant Manager of Inspections, Coordinators, Engineers, Material Specialists, Clerk (Approx. 30 Personnel)"] A --- B A --- C A --- D B --- E C --- F D --- G </pre> Assistant Project Manager, Construction Engineers, Construction Supervisors, Construction Aid (Approx. 15 Personnel) Superintendents, Supervisors, Remote Monitoring, Dispatchers, Clerk, Master Technicians, Journeymen, TSPs (Approx. 254 Personnel) Manager of Operations Contracts and Parts, Supervisory Engineer, Assistant Manager of Inspections, Coordinators, Engineers, Material Specialists, Clerk (Approx. 30 Personnel) Indicates focus of internal review
Review of Existing Documentation	- Standard Operating Procedures (SOPs): 113-01, 212-SOP-02, 212-SOP-23, 212-SOP-25, 212-SOP-30, 212-SOP-35, 212-SOP-36, 212-SOP-37, 212-SOP-39, & 712-SOP-05. - Maximo data: escalator outages, downtime reports, work orders, & schedules. - Escalator preventative maintenance sheets of 20 escalator assets throughout the Metrorail system. - Operation and Maintenance (O&M) Manuals. - Escalator inspection reports.
Interviews of Key Personnel	- General Superintendent, [Redacted] - Capital Improvement Project Manager, [Redacted] - Assistant General Superintendent & Head of Maintenance, [Redacted] - Supervisory Engineer, [Redacted] - Assistant Manager of Inspection, [Redacted]
Field Assessments & Record Reviews	- Four different locations around the core of the Metrorail system were used to assess inspection, re-inspection, and preventative maintenance processes (below, left). - Preventative Maintenance (PM) records at 10 stations (Wheaton, Union Station, Gallery Place, Dupont Circle, Tenleytown, Clarendon, Foggy Bottom, Stadium Armory, Pentagon, and Naylor Road) were reviewed for completeness, consistency, accuracy, and validity. Stations were selected based on poorest performing assets and location within each of the five (5) ELES maintenance regions.

² Information gathered from ELES intranet page, updated as of March 2017.

13.3. WHAT WORKED WELL

Measure	Finding	Description
Safety	The use of escalator barricades to prevent unauthorized entrance into work areas was observed at visited sites.	- QICO performed four field assessments, observing inspections, re-inspections, and preventative maintenance of ELES assets. During each field assessment QICO found that maintenance personnel had barricaded each asset, preventing unauthorized access into work areas.
Quality of Work	Escalator mechanics were well versed in escalator system components.	- ELES maintenance personnel showed in-depth knowledge of escalator systems when explaining maintenance processes during the four field assessments.

13.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Quality of Work	F-MVT-17-01: Maintaining the correct asset identification within station monitoring systems is essential to maintenance response and analysis. <u>Operational Risk</u> <u>Moderate (2,5)</u> 	- During one of the field assessments QICO observed maintenance personnel inputting data into a computer located in the station kiosk that showed two escalator assets mislabeled in the remote monitoring system. - QICO requested an explanation from ELES management. The response provided was that it is common practice for controller wires to be swapped during troubleshooting or verification of equipment thus leading to mislabeling of assets in the remote monitoring system. - Historical information stored in the remote monitoring system is unreliable as long as the practice of swapping asset identifying wires remains a common maintenance practice. Recommendation: Establish clear policies and procedures for verifying equipment that enhances the remote monitoring system and ensures historical data is reliable.

13.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Compliance with Standards	F-MVT-17-02: Use of approved communications devices is necessary to ensure reliable communication is available to support maintenance activities. <u>Operational Risk</u> <u>Elevated (4,4)</u> 	- During the field assessment at Dupont Circle maintenance personnel were observed using their personal cell phones in order to call each other. Communication through the use of personal devices was observed to be unreliable, causing delays. - The layout of longer escalators can require maintenance crews to split up in order to complete maintenance tasks or troubleshooting. In these instances, it is common for one crew member to be at the bottom of the escalator and another member to be underneath the asset near the top portion of the escalator making verbal communication challenging. - Additionally, safety concerns arise from this current practice. Maintenance personnel can be seriously injured due to miscommunication. Recommendation: Establish and provide a method for reliable communication between maintenance personnel during routine maintenance and troubleshooting activities.
Quality of Work	F-MVT-17-03: Effective maintenance planning and scheduling is required to maximize time available outside of passenger service hours. <u>Operational Risk</u> <u>High (5,4)</u> 	- There are three different shifts that maintenance personnel can work: morning, evening, and midnight shifts. Maintenance personnel working on the midnight shift find themselves tasked with completing the majority of escalator preventative maintenance tasks. - QICO observed that midnight shift crews had trouble completing all preventative maintenance tasks in a single shift. Observed factors affecting their ability to complete all required tasks included the following: - o Maintenance personnel wasted time retrieving forgotten tools and equipment from storage spaces and work vehicles. - o Maintenance personnel had to travel back and forth between station kiosk and escalator units in order to get unit information and input data. - o Unforeseen equipment issues during routine maintenance required major troubleshooting. Recommendation: Establish and implement achievable and clear expectations for the duration of preventative maintenance tasks, ensuring maintenance work does not overlap with revenue service.

13.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Quality of Work	F-MVT-17-04: Analysis of work order data is necessary to determine accurate failure trends during peak passenger service periods and proactively manage maintenance activities. <u>Operational Risk</u> <u>High (4.5)</u> 	- QICO analyzed over 2400 work orders from the month of March 2017. This analysis looked at active work orders during weekdays only and highlighted the work orders that fell into morning and afternoon rush hour periods (5:00am-9:30am & 3:00pm-7:00pm). These criteria were chosen because the highest volume of customers WMATA experiences is weekdays during peak fare times. - During this period, 65% of the work orders generated for elevators and escalators occurred during morning and afternoon rush hours. - Further investigation is required to determine the root cause(s) of the high volume of work orders during peak periods. Possible factors may include poor maintenance practices, ineffective design of units for peak loads, lack of engineering analysis being completed to spot these types of department-wide inefficiencies, and emergency shutdown activations. Recommendation: Establish procedures and policies to research and develop solutions addressing ineffectiveness of vertical transportation units during peak passenger periods.
	F-MVT-17-05: Effective inventory and control of calibrated equipment is required to ensure items are scheduled and calibrated on-time. <u>Governance Risk</u> <u>Elevated (4.4)</u> 	- An ELES standard operating procedure (SOP), 212-SOP-02, mandates the maintenance and calibration of tools and test equipment. However, there were several instances during QICO field assessments where tools and test equipment were out of calibration. - Currently there is no consistent method used for documenting and performing the calibration of tools and test equipment. Recommendation: Revise and enforce a consistent method for calibrating tools and test equipment that will facilitate the upkeep and maintenance of all ELES tools and test equipment.
Compliance with Standards	F-MVT-17-06: A formal maintenance control program is required to ensure compliance with code requirements and effective application of maintenance practices. <u>External Risk</u> <u>High (4.5)</u> 	- Governing elevator and escalator standard ASME A17.1 section 8.6.1.2 states, "A Maintenance Control Program (MCP) shall be in place to maintain the equipment in compliance with the requirements of Section 8.6." - After an interview with the head of ELES engineering, QICO was made aware that there is no MCP currently developed. Code requires that there be a written MCP in place. Recommendation: Establish and implement a maintenance control program that meets code requirements stated in ASME A17.1 Section 8.6.

13.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Records Management	F-MVT-17-07: Accurate documentation of maintenance activities is essential to ensure information is available for troubleshooting and that all equipment is within specified tolerances. <u>Governance Risk</u> <u>Elevated (3,5)</u> 	- QICO found only 32 of the 120 (27%) preventative maintenance sheets contained all markings and numerical readings required for completing monthly or annual preventative maintenance documentation. - Example of preventative maintenance sheet missing markings and numerical readings. - QICO found 88 of the 120 (73%) preventative maintenance sheets contained comb impact readings (escalator component) that were out of the allowable tolerance yet were marked acceptable by maintenance personnel. All but one of the readings were below the acceptable value range. Having lower comb impact settings than the tolerance allows will cause escalators to go out of service more often, which will contribute to higher outages during peak rush periods. Recommendation: Establish and distribute a policy requiring preventative maintenance sheets to have all required readings recorded and that ensures maintenance personnel properly indicate and repair out-of-tolerance issues. The policy should require supervisory spot checks to ensure proper maintenance record keeping.
Compliance with Standards	F-MVT-17-08: Clear requirements for fire extinguisher placement and inspection are required to ensure appropriate safety equipment is available where necessary. <u>Governance Risk</u> <u>Moderate (3,3)</u> 	- After notifying a fire protection engineer in ENGA, QICO learned that there is no code requiring that fire extinguishers be located in escalator control cabinets. - QICO performed a field assessment at Gallery Place Station and found that an escalator control cabinet did not contain a fire extinguisher. Task 21 of the <i>Escalator PM Check Sheet</i> requires a check of the fire extinguisher. However, during a document review of these preventative maintenance sheets it was found that 44 of the 120 (37%) sheets were missing checks or marked not applicable for task 21. Recommendation: Specify the location of fire extinguishers that are expected to be checked according to preventative maintenance tasks and implement a process that ensures all maintenance tasks are completed.

13.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Records Management	F-MVT-17-09: Consistent capture of maintenance data is required to ensure data integrity for future analysis and maintenance planning. <u>Governance Risk</u> <u>Elevated (4,4)</u> 	- While reviewing ELES Work Orders in the asset management database (Maximo) the following issues were observed: (1) Actual Start dates/times were found to be exactly the same as the Actual Finish date/time. This represents a zero minute difference between the time the asset was down (Out of Service) and the time it was back up and running (In Service). (2) Actual Start date/times were after the Actual Finish date/time. This represents a negative time difference between the time the asset was down (Out of Service) and the time it was back up and running (In Service). (3) Work order descriptions are vague. For example, a common description of "will not start" may have a range of downtime values between 0 minutes and 11+ hours. - Currently the only way to report that an ELES asset is out of service is if a station manager calls in a service request. ELES remote monitoring does not allow for work order tickets to be opened remotely. This means that an asset could potentially be out of service for an indeterminate amount of time without being reported which would further skew data found in Maximo. Recommendation: Establish and implement clear practices and procedures that ensure elevator and escalator out-of-service data is usable and reliable for engineering and maintenance analysis.

13.5. SUMMARY OF REQUIRED ACTIONS

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Required Action	Finding	Owner
QICO-MVT-17-01: Conduct an analysis of the current practices used to gather and store vertical transportation information. Create or modify methods to enhance the value and reliability of data collected and stored. High	F-MVT-17-01 	Maintaining the correct asset identification within station monitoring systems is essential to maintenance response and analysis. ELES
	F-MVT-17-04 	Analysis of work order data is necessary to determine accurate failure trends during peak passenger service periods and proactively manage maintenance activities. ELES
	F-MVT-17-09 	Consistent capture of maintenance data is required to ensure data integrity for future analysis and maintenance planning. ELES
QICO-MVT-17-02: Establish methods for maintenance personnel to perform their work more properly, efficiently, and effectively. High	F-MVT-17-02 	Use of approved communications devices is necessary to ensure reliable communication is available to support maintenance activities. ELES
	F-MVT-17-03 	Effective maintenance planning and scheduling is required to maximize time available outside of passenger service hours. ELES
	F-MVT-17-05 	Effective inventory and control of calibrated equipment is required to ensure items are scheduled and calibrated on-time. ELES
QICO-MVT-17-03: Establish a maintenance control program that follows ASME code A17.1 Section 8.6; including methods to capture and store relevant maintenance data. High	F-MVT-17-06 	A formal maintenance control program is required to ensure compliance with code requirements and effective application of maintenance practices. ELES
	F-MVT-17-07 	Accurate documentation of maintenance activities is essential to ensure information is available for troubleshooting and that all equipment is within specified tolerances. ELES
	F-MVT-17-08 	Clear requirements for fire extinguisher placement and inspection are required to ensure appropriate safety equipment is available where necessary ELES

Approved [Corrective Action Plans \(CAPs\)](#) are provided following the Internal Review reports, with each developed to address the findings and required actions listed above.



Metrorail Engineering and Maintenance
Metrorail Fire & Life Safety:
Fire Suppression Inspection and Testing (14)



Quality Assurance, Internal Compliance & Oversight (QICO)
"Quality Trumps Quantity"



INTERNAL REVIEW SUMMARY

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the current Fire and Life Safety (FLS) system conditions. This includes effectiveness of the programs used for inspection, testing, and maintenance as well as the organizational layering and responsibilities of groups involved.
- QICO is uninvolved the functions reviewed, and authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- This QICO review focused on the fire suppression function of the FLS systems, with future reviews to expand the scope to other FLS systems functions, including Emergency Trip Stations (ETS).
- QICO observed personnel performing FLS inspections, testing, and maintenance, to assess their conformance to requirements, reviewed records and documents, interviewed key personnel and conducted objective field inspections.
- Review findings and required actions are rated based upon severity of risk, which ranges on a scale from 'Insignificant' to 'High'.

November 2017

14. Metrorail Fire & Life Safety: Fire Suppression Inspection and Testing

Key Takeaway: The Fire and Life Safety equipment observed is in good condition and practices are in accordance with national standards; however, the oversight roles must be clearly defined.

Wins and Areas for Improvement:

- ✓ The Office of Plant Maintenance (PLNT) utilizes a FLS Work Order Escalation Process for resolving FLS issues.
- ✓ The Office of Plant Maintenance (PLNT) continuously improves its processes to provide proper direction on FLS inspection and maintenance policies.
- ✓ The Office of Emergency Management (OEM) provides training to emergency responders throughout the tristate area.
- Clear definition of roles, responsibilities, and processes for the Field Marshal's Office (FMO) are required to establish ownership of FLS systems across the organization.
- Effective oversight of inspection, testing and maintenance programs for FLS systems is required to assure maintenance functions are carried out consistently and documented appropriately.
- Consistent documentation of maintenance records is essential to the accurate accounting of asset status.
- Consistent application of maintenance practices is essential to the availability of FLS equipment.

Project-Specific Required Actions:

- QICO-FLS-17-01: Establish governing documentation to define the roles, responsibilities, and processes for the Fire Marshal's Office (FMO) to ensure clear departmental ownership and obligations across fire and life safety (FLS) systems. *(Risk Rating: High)*
- QICO-FLS-17-02: Conduct an evaluation of current maintenance practices, including maintenance records and material storage, and establish methods to ensure requirements are clearly defined and adhered to. *(Risk Rating: Elevated)*

Note: An itemized Corrective Action Plan (CAP) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of CAP implementation go to <https://www.wmata.com/initiatives/transparency/upload/Overview-of-Internal-Compliance-Actions.pdf>.

14.1. DEPARTMENT/FUNCTION OVERVIEW

Introduction

Fire and Life Safety (FLS) systems provide the critical function of detecting and suppressing fire events within the Metrorail system. The Metrorail system spans the jurisdictions of the District of Columbia, Maryland counties of Montgomery and Prince George's, Northern Virginia counties of Arlington, Fairfax and Loudon, as well as the cities of Alexandria, Fairfax, and Falls Church. WMATA must observe local jurisdiction codes as well as national fire codes. The functions and responsibilities of inspecting, testing and repairing the numerous subsystems that comprise the FLS system are decentralized among a number of departments within WMATA. The Office of Plant Maintenance (PLNT) handles the bulk of the maintenance work and thus plays a central role, with other departments handling other support functions.

In order to understand the current condition and practices throughout the system, 20 individual field assessments were conducted and 8 test activities (performed by PLNT personnel) were observed. The locations were selected according to their risk exposure in the event of a fire or smoke emergency, considering daily ridership numbers, ridership spikes, transfer stations, and transportation hubs. Underground stations were given priority due to the heightened sensitivity to any fire and smoke events at those locations.

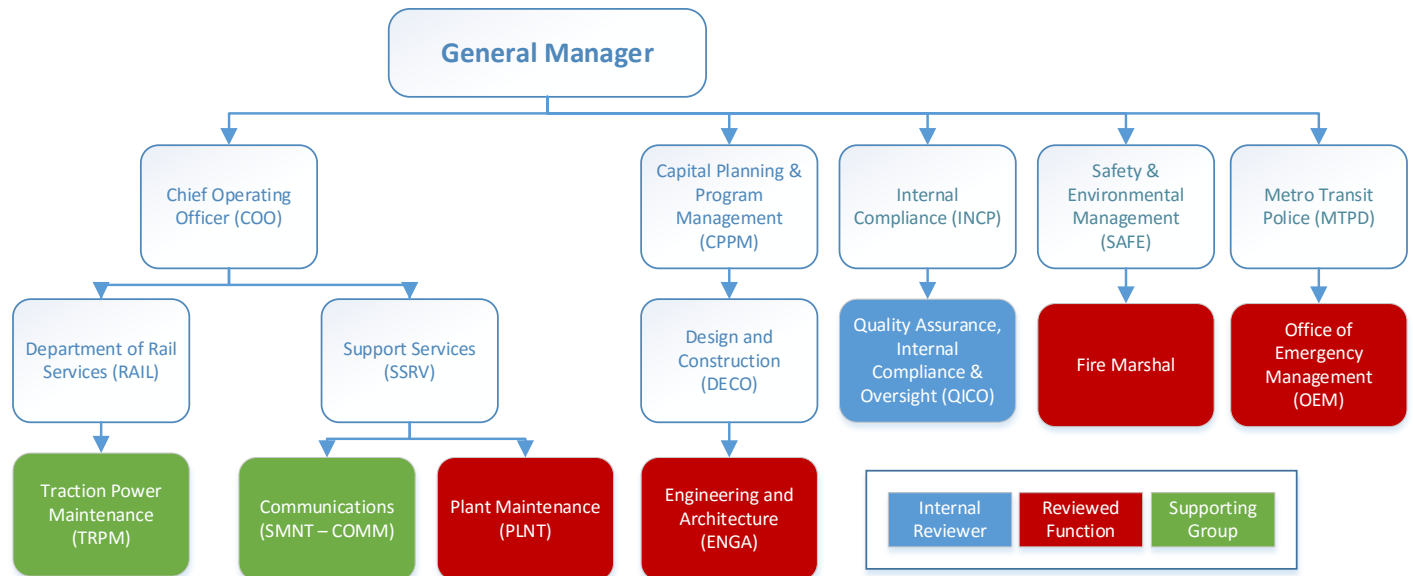
14.2. REVIEW METHODOLOGY

Objectives

This internal review of FLS focused primarily on the fire suppression function of the FLS system, concentrating on standpipes (wet and dry), sprinklers, fire pumps, and fire extinguishers. Future internal reviews will expand the scope to other aspects of the FLS system, including fire and smoke detection functions. The main goals for the internal review were as follows:

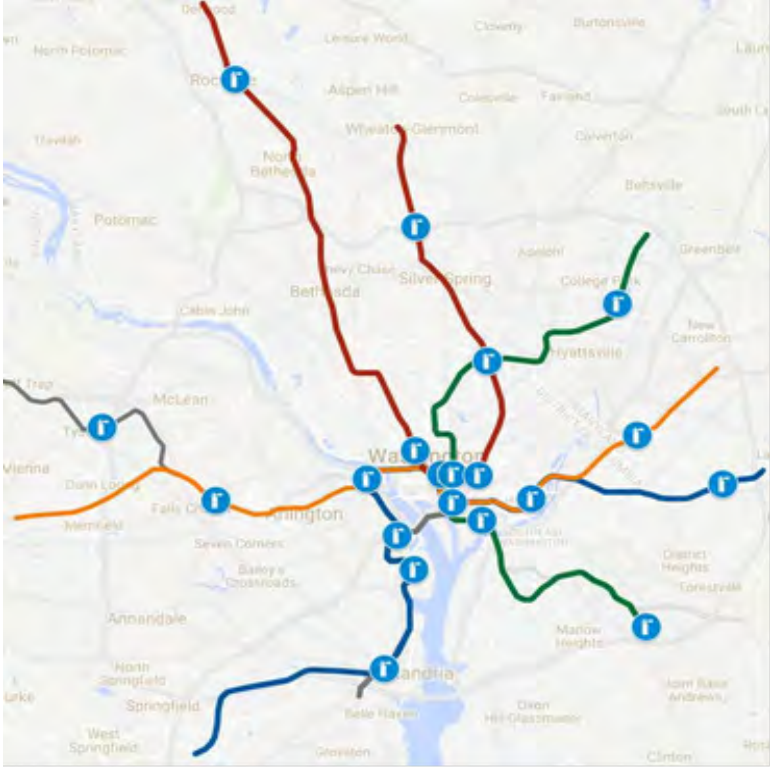
1. Review the effectiveness of procedures and practices used to perform inspection, testing and maintenance through document review, interviews, and field assessments.
2. Evaluate the readiness of fire suppression assets such as sprinklers, standpipes, fire pumps, etc. through field assessments at strategically identified facilities and metro stations.
3. Determine organizational compliance to established national and federal codes, engineering specifications, Standard Operation Procedures (SOPs), work instructions, checklists, permanent orders, the Metrorail Safety Rules and Procedures Handbook (MSRPH), and Roadway Worker Protection (RWP) requirements.
4. Assess organizational layering and responsibilities of groups tasked with maintaining, inspecting and testing FLS systems as well as those groups tasked with safety, oversight, and compliance.

The Office of Quality, Internal Compliance and Oversight (QICO) conducted the review from July 13 to October 13 2017. As shown in the organizational chart, QICO is separate from the groups reviewed.



The organizational chart above depicts the departments directly involved with FLS systems. Engineering and Architecture (ENGA) provides engineering support to Plant Maintenance (PLNT). The Fire Marshal's Office (FMO) currently provides yearly inspections and alerts Maintenance Operations Center (MOC) of FLS issues it identifies. The Office of Emergency Management (OEM) plays the role of liaison to external agencies, communicating any conditions that could affect how emergency responders respond to an emergency at WMATA facilities and stations. OEM additionally provides training to emergency responders and WMATA employees and conducts full-scale emergency exercises. PLNT conducts the bulk of inspection, testing, and maintenance of FLS systems. The Communications section of Systems Maintenance (under Support Services SSRV) provides inspections, testing, and maintenance to the fire alarm signal devices, and Traction Power Maintenance (TRPM) maintains emergency trip buttons inside Emergency Trip Station (ETS) boxes. The functions of the last two offices mentioned (COMM, TRPM) are not within the scope of this review but will be included in future QICO FLS reviews.

REVIEW SCOPE

Category	Description
Review of Existing Documentation	PM records for the past two years for the following FLS items: - Wet standpipe system inspection and testing - Dry standpipe system inspection and testing - Dry sprinkler riser inspection and testing - Pre-action sprinkler riser inspection and testing - Wet sprinkler riser inspection and testing - Deluge sprinkler riser inspection and testing - Fire pump inspection and churn test - Fire extinguisher inspections
Interviews of Key Personnel	- [REDACTED] (Office of Engineering and Architecture) - [REDACTED] Fire Marshal) - [REDACTED] (Director of Office of Emergency Management) - [REDACTED] (Plant Maintenance) - [REDACTED] (Plant Maintenance)
Field Observations	Two types of field assessments were performed: individual QICO field inspections and shadowing of PLNT activities. The following locations were visited: - Dupont Circle - Rockville - Forrest Glen - Gallery Pl. – Chinatown - L'Enfant Plaza - Metro Center - Navy Yard – Ballpark - Pentagon - National Airport - Stadium Armory - Tysons Corner - East Falls Church - Rosslyn - Fort Totten - Branch Avenue - Morgan Boulevard - Cheverly - King Street - Union Station - College Park 

14.3. WHAT WORKED WELL

Measure	Finding	Description
Work Order Management	The Office of Plant Maintenance (PLNT) utilizes a FLS Work Order Escalation Process for resolving FLS issues.	- PLNT has a process for managing open FLS work orders. Weekly email reports notify the Fire Marshal's Office (FMO), OEM, and group supervisors. Work orders open for 30 or more days are highlighted red. Monthly escalation reports are generated and distributed to FMO, OEM, PLNT, SMNT, ATCM, and TRPM management.
Business Practices	The Office of Plant Maintenance (PLNT) continuously improves its processes to provide proper direction on FLS inspection and maintenance policies.	- SOP #209-07 (Prioritizing and Documenting Maintenance Work) clearly defines FLS items, prohibits the rescheduling of preventive maintenance for these, outlines the standards for the inspection and maintenance of fire protection/fire suppression systems in accordance with appropriate national fire protection codes, and directs PLNT personnel to inspect any FLS asset 72 hours after use.
	The Office of Emergency Management (OEM) provides training to emergency responders throughout the tristate area.	- OEM has reportedly trained over 4000 emergency responders in 2017 on WMATA fire and life safety equipment locations and emergency event measures.

14.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Business Practices	F-FLS-17-01: Clear definition of roles, responsibilities, and processes for the FMO are required to ensure FLS systems have defined ownership across the organization. Strategic Risk Elevated (5,5) 	- The current manpower (8 staff) of the Fire Marshal's Office (FMO) has been in place for less than a year. Before that, the entire FMO was a single employee. - Some functions currently listed in the fire marshal job description and those that are typically under that office have been carried out by other departments. Examples include: - o Communication with emergency responders (currently performed by OEM) - o Training of internal/external personnel on FLS topics (currently performed by OEM) - o Review of construction plans for compliance with fire and safety codes (currently performed by ENGA) - o Development and maintenance of procedures for regular testing of all smoke detection devices (currently performed by PLNT and ENGA) - The Fire Marshal's Office does not have procedural documents. - Due to the lack of procedural documentation it is difficult to determine if the department is performing in accordance to any set of requirements. - The only document available to review the performance of the FMO is the Fire Marshal's job description. Based on the job description, the FMO does not perform all of the responsibilities assigned to it. Furthermore, it does not perform some of its functions to the level stipulated by that same job description. - The FMO, mission statement, goals, responsibilities, procedures, schedules, standards of inspection, etc. have not yet been developed and there is no time table to develop them. Recommendation: Establish and implement department internal control documents (i.e. role, mission statement, goals, responsibilities, procedures, schedules, standards of inspection, etc.) to ensure consistent and reliable department performance.

14.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Quality Control Measures	F-FLS-17-02: Effective oversight of inspection, testing and maintenance programs for fire and life safety systems is required to ensure maintenance functions are carried out consistently and documented appropriately. Legal & Compliance Elevated (4,4) 	- Of the four reports shared with QICO by the Fire Marshal's Office, none mention any specific internal or external code violations. - The reports contained minor housekeeping observations but did not make mention of key FLS elements such as stand pipes, sprinklers, or communication systems. There is no evidence (photo or written) that these elements were inspected. - Fire and Life Safety Inspection Reports do not adequately capture the overall readiness to detect, communicate, and suppress, smoke and fire events of the FLS systems. Additionally, current FLS reporting from the FMO fails to capture the effectiveness of the inspection, testing, and maintenance programs that support them. Recommendation: Establish inspection and reporting standards to ensure that reporting consistently provides a detailed condition assessment of FLS systems, exploring the evaluation of additional FLS assets.
Work Order Management	F-FLS-17-03: Consistent documentation of maintenance records is essential to ensure accurate accounting of asset status. Safety Moderate (5,4) 	- PLNT SOP #209-07 Section 6.2.3 directs supervisors to review maintenance documentation submitted by mechanics (e.g. preventative maintenance (PM) checklists), but during document review it was found that PM checklists were missing data and indication markings. Location, equipment operational checks, and dates were missing from multiple reports that were signed off by supervisors. - Reports ask for "Area Protected," but were often populated with ambiguous wording; "same" or "same as above." Area Protected is meant to indicate what areas are protected with fire suppression and therefore should be written out explicitly. - There were many different form versions of the form titled "<i>Sprinkler/Standpipe System Test Report</i>"; to avoid confusion, document control (indicating form number and issue date) should be implemented. If there is a need for distinct forms varying by location perhaps a different form should be created for each type of system or location. Creating system specific forms would remove any confusion. Recommendation: Evaluate FLS maintenance records against SOP 209-07 sections 6.2.3 and 6.3.2 to ensure records consistently capture data.

14.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Procedural Requirements	F-FLS-17-04: Consistent application of maintenance practices is necessary to ensure FLS equipment is readily available. Service Delivery Moderate (3,3) 	- QICO performed 20 field assessments of Metrorail station cleaning rooms, water service rooms, fire cabinets, and end-of-platform fire equipment cabinets. QICO frequently found non-FLS items found inside fire equipment cabinets; these cabinets are not meant to be used for storage purposes. Recommendation: Evaluate fire equipment cabinet maintenance procedures to ensure unauthorized equipment or debris is not stored in fire equipment cabinets.

14.5. SUMMARY OF REQUIRED ACTIONS

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Required Action	Finding	Owner
QICO-FLS-17-01: Establish governing documentation to define the roles, responsibilities, and processes for the Fire Marshal's Office (FMO) to ensure clear departmental ownership and obligations across fire and life safety (FLS) systems. High ■	F-FLS-17-01 ■	Clear definition of roles, responsibilities, and processes for the FMO are required to ensure FLS systems have defined ownership across the organization. FMO
	F-FLS-17-02 ■	Effective oversight of inspection, testing and maintenance programs for fire and life safety systems is required to ensure maintenance functions are carried out consistently and documented appropriately. FMO
QICO-FLS-17-02: Conduct an evaluation of current maintenance practices, including maintenance records and material storage, and establish methods to ensure requirements are clearly defined and adhered to. Elevated ■	F-FLS-17-03 ■	Consistent documentation of maintenance records is essential to ensure accurate accounting of asset status. PLNT
	F-FLS-17-04 ■	Consistent application of maintenance practices is necessary to ensure FLS equipment is readily available. PLNT
Approved Corrective Action Plans (CAPs) are provided following the Internal Review reports, with each developed to address the findings and required actions listed above.		



Metrorail Engineering and Maintenance Parts & Materials Inventory Management (15)



Quality Assurance, Internal Compliance & Oversight (QICO)
"Quality Trumps Quantity"



INTERNAL REVIEW SUMMARY

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of Metro's parts and materials inventory, and assure those items are being managed efficiently and effectively. The departments reviewed during this assessment included the Procurement & Materials (PRMT), Supply Chain Enterprise Services (SCES), and Material & Inventory Planning (MIPN) offices with cooperation from various engineering and supporting departments. This assessment is intended to provide an overall review of each of the department's performance of assigned duties, and to promote the actions needed to address areas of concern.
- QICO is uninformed the functions reviewed, and authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- QICO developed relevant review activities based on the Procurement & Materials (PRMT), and Supply Chain Enterprise Services (SCES) office rules, and Procedures Manuals. In addition, QICO identified and assessed risks to the quality of work, compliance with internal and industry standards, records management, and safety.

November 2017

19. WMATA Parts & Materials Inventory Management

Key Takeaway: *The implementation of a Material Requirement Planning (MRP) process and the application of its fundamentals and principles will assure Metro has an effective and efficient supply chain.*

Wins and Areas for Improvement:

- Shipment analysis performed by SCES promotes effective corrective measures from identified discrepancies.
- Effective management of supply chain systems is essential to the availability of parts/materials and reduce the number of stockouts.
- Accounting for shelf-life limitations of parts and materials is necessary to assure availability for use.
- Clearly-defined key product characteristics/specifications are required for the accurate procurement of parts/materials while enhancing the quality control inspection process.
- Clear definition of roles, responsibilities, and functions within MIPN is required for activities to be carried out consistently.
- Communication of expected delivery dates from suppliers is necessary to improve inventory planning for scheduled maintenance activities.
- Identifying the reason Purchase Requisitions are aging beyond 30-days is required to maximize efforts to diminish the Procurement PR backlog.

Required Actions:

- QICO-PMIM-17-01: Determine a method to implement a Material Requirement Planning (MRP) system while incorporating the fundamental industry standards which will enhance the efficiency and effectiveness of the supply chain process. [\(Risk Rating: Elevated\)](#)
- QICO-PMIM-17-02: Evaluate current material receiving practices and develop methods to ensure items with shelf-life limitations are identified and tracked through the supply chain system. A shelf life policy needs to be developed to ensure incoming products have adequate shelf life prior to entering into stock across the authority. [\(Risk Rating: Moderate\)](#)
- QICO-PMIM-17-03: Identify all parts and materials that require an incoming/receiving inspection for quality control purposes, define specific methods to verify key product characteristics of these items, and develop methods to ensure these items are inspected as required. [\(Risk Rating: Elevated\)](#)
- QICO-PMIM-17-04: Establish governing documentation to define roles and responsibilities for the office of MIPN to ensure clear departmental duties across the supply chain. [\(Risk Rating: High\)](#)
- QICO-PMIM-17-05: Establish and clarify requirements vendors must follow to ensure WMATA has clear supplier promised date and ship date used to update WMATA's data enterprise services. [\(Risk Rating: Moderate\)](#)
- QICO-PMIM-17-06: Procurement must identify and evaluate PR's that have been aging greater than 30 days in order to maximize efficiency and eliminate the continuing growth of the PR backlog. [\(Risk Rating: High\)](#)

Note: An itemized Corrective Action Plan (CAP) is developed for each required action to achieve effective and measurable resolution of identified concerns. To check the status of CAP implementation go to

<https://www.wmata.com/initiatives/transparency/upload/Overview-of-Internal-Compliance-Actions.pdf>.

15.1. DEPARTMENT/FUNCTION OVERVIEW

Procurement & Materials (PRMT)

The Office of Procurement & Materials (PRMT) purpose is to provide expert, professional acquisition services in support of the transportation service needs of customers across the jurisdictions serviced by the Washington Metropolitan Transit Authority (WMATA), while maintaining compliance with local and federal agency procurement laws and regulations.

PRMT is primarily responsible for the following:

- Efficiently and effectively managing the acquisition of supplies, materials, and services in support of WMATA.
- Issues invitations to bid on contracts, submits requests for information (RFI) and/or requests for proposal (RFP), and issues/awards contracts.
- Issues purchase orders (PO's), developing contract terms; and ensuring supplies, materials, and/or services are acquired that meet the Clients fit, form and function, and at the best price.

According to Operations Open Purchase Requisitions Data, at the time of this internal review WMATA had 2394 total open purchase requisitions (PR's) with an average number of days being open of 75-days. Of these 2394 open PR's, WMATA has 1504 purchase requisitions which have aged beyond 30-days with the average number of days open being 113-days. At the current placement rate goal of 700 PO's a month according to PRMT Buyer Productivity Report, to clear the backlog it would take over 3-months to complete. This would not account for any new PR generation.

Supply Chain Enterprise Services (SCES)

The Office of Supply Chain Enterprise Services (SCES) purpose, according to its procedure's manual, is to maintain an inventory of supplies and materials to support the normal functions of administrative and maintenance personnel. Included in such inventory are, materials for special projects, campaigns and programs necessary for the effective, long-term operation of the Metro public transportation system.

SCES is primarily responsible for the following:

- The receiving, quality inspection, receipting, stocking or storing, and issuing of materials required by the Client to complete necessary, builds, rebuilds, repairs and/or maintenance.
- Completing cycle counts, and making the necessary adjustments in the system to validate the inventory counts are accurate, which aid in the prevention of stock outs, and reordering material that is already on-hand.
- Once WMATA determines there is no need for a material, the Investment Recoveries team takes over disposition of the material.

According to SCES Weekly Storeroom Report provided by SCES, storeroom inventory has a value of 124 million dollars of which 33 million dollars (27%) has no demand within the past two years.

Materials & Inventory Planning (MIPN)

The Office of Materials and Inventory Planning (MIPN) was established on May 26, 2016. According to the Rail Services (RAIL) Reorganization staff notice, the purpose of MIPN is to unite all procurement and material logistics activities that are currently being performed by individuals groups under one office. MIPN's intent is to serve the offices of the Chief Mechanical Officer (CMOR), Traction Power Maintenance (TRPM), Track and Structures (TRST), ATC Maintenance (ATCM), Rail Transportation (RTRA), Operations Management Services (OPMS), and Reliability Centered Maintenance Planning (RCMP) by collaborating with the offices of Procurement & Materials (PRMT), General Council (COUN), Information Technology (IT), Accounting (ACCT), Supply Chain Enterprise Services (SCES), and Human Resources (HR).

According to the Rail Services (RAIL) Reorganization staff notice, MIPN will be primarily responsible for the following:

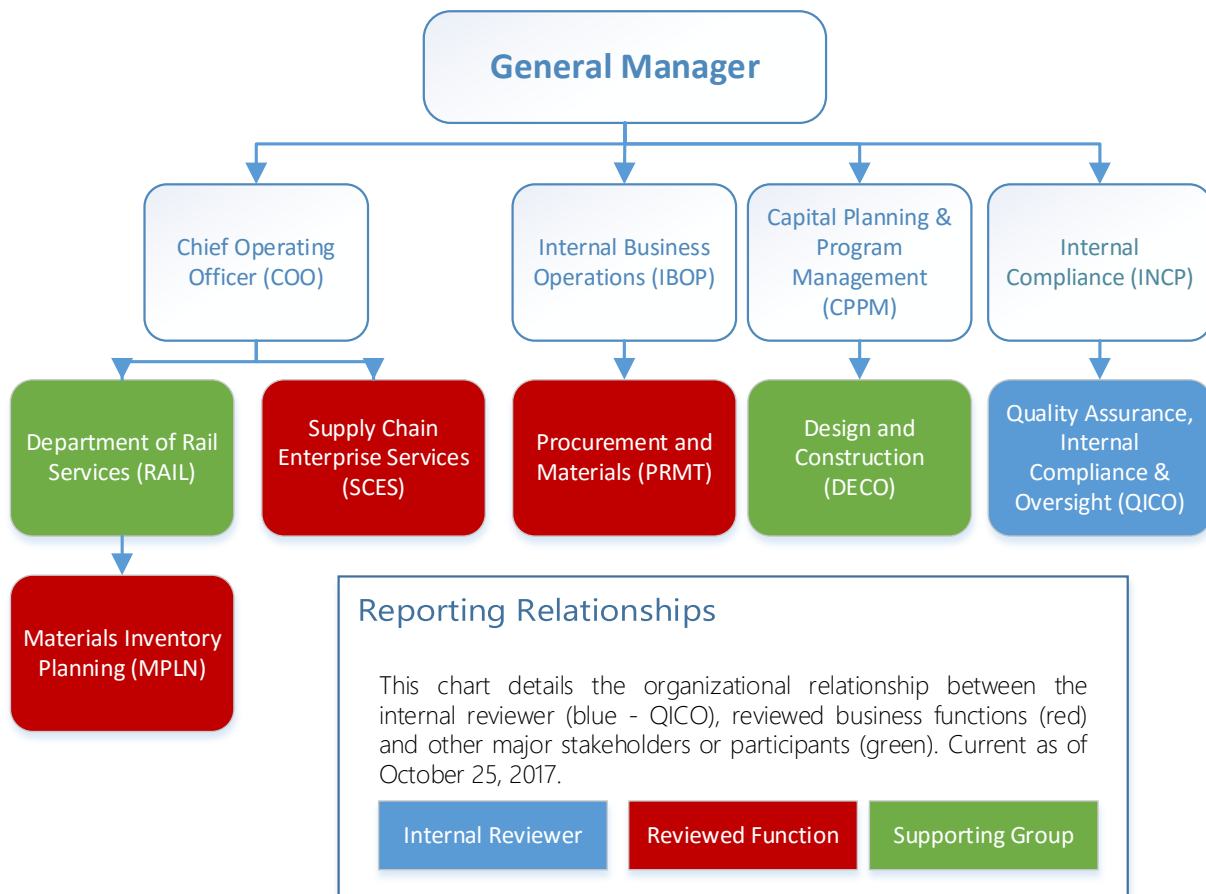
- Centralization of all RAIL's procurement, material logistics, material planning, compliance, and inspection.

At the time of this review, there was a generic business plan in addition to the initial staff notice providing preliminary information for the office of MIPN, and how it would operate. There has been zero progress since that time in the development of Standard Operating Procedures (SOP's), policies, or governing documentation to outline, highlight and/or define MIPN's role.

15.2. REVIEW METHODOLOGY

Internal Review Stakeholders

The **Office of Quality Assurance, Internal Compliance and Oversight (QICO)** conducted an internal review of the parts and material inventory management, which includes the Office of Procurement & Material (PRMT), the Office of Supply Chain Enterprises (SECS), and the Office of Material & Inventory Planning (MIPN). These groups are responsible for the acquisition, planning, forecasting, managing, shipping, receiving, and storage/warehousing of parts and material. Design Engineering & Construction (DECO) and Chief Operating Officer (COO) are supporting offices during this internal review as the supporting engineering departments are not isolated to a particular office or department (herein will refer to as Engineering to include all parties). As shown below, QICO is separate from the function under review, reporting to the General Manager through Internal Compliance (INCP). QICO provides objective quality assurance and compliance services in order to improve the quality of Metrorail operations, processes, and compliance to regulatory requirements).



QICO interviewed key personnel from each office, reviewed supporting documentation from both the PRMT and SCES offices, and followed six inventory items from generation to issuance using Windchill, Maximo, and inventory counts.

QICO's findings are categorized into four groups: **Quality of Work**, **Compliance with Standards**, **Records Management** and **Safety**. This internal review notes both positive findings ([What Worked Well](#)) and negative findings ([Areas for Improvement](#)). The findings are rated based on severity of risk, which ranges from 'Insignificant' to 'High.' For each finding, there is an associated recommendation (a suggestion for improving a process based upon QICO's systematic review). The recommendations are combined into several [Required Actions](#), which summarize the steps/actions owners must take to address deficiencies.

15.2. REVIEW METHODOLOGY

Internal Review Stakeholders

QICO's Approach

During the assessment, QICO took a snapshot of current procurement and supply chain methods and practices for deficiencies that threaten to derail WMATA's safety, service reliability, and fiscal responsibilities. This snapshot focused on a Windchill, Maximo, and inventory count review of six inventory items that were monitored throughout the procurement process from beginning to end. Each item was tracked as it moved through the various stages of the supply chain process to identify areas which will require further review due to the scale of the supply chain process. QICO chose the following six parts as the focus of this internal review due to their unique characteristics and covering a range of operational systems.

Part Selection Criteria	Timber Ties 8'6"	KONE Escalator Step	EucoSpeed Grout	Fresh Air Filter	Disc Brake Assembly	Vertical Bushing
Infrastructure	✓	✓	✓			
Rolling Stock				✓	✓	✓
Safety					✓	✓
Long Lead Time					✓	
Shelf life			✓			
Structural			✓			
High Usage	✓			✓		
Use Until Depletion		✓				
Critical to Operations	✓	✓	✓	✓	✓	✓

Below is a process flow diagram illustrating each stage that was reviewed by QICO:



Windchill (Engineering module for parts, specifications, and drawings)

The first stage in QICO's verification process was to review Windchill to determine if any engineering and/or manufacturing documents (drawings, specifications, and/or other technical documents) were available. These documents serve as a reference to Procurement when trying to verify requirements prior to placing orders, and when receiving parts/material.

Maximo (The enterprise database software used for maintenance planning and supply chain management)

Secondly, the Item Master and Inventory Records stages during which the items properties and salient characteristics are identified. During these two stages, Item Master tab give relative information on each particular item such as current vendor information, the various storerooms inventory is currently held at, product specification details, and opportunity to link any files such as; standards, specifications, checklists or drawings pertinent to the item. The Inventory page contains information including the current value of inventory, current and past demand, and reordering details such as; reorder point, lead time (days), safety stock, and economic order quantity can be found.

15.2. REVIEW METHODOLOGY

Internal Review Stakeholders

Next, purchase requisitions are typically automatically generated when an inventory items reorder point has met its threshold. The automatically generated purchase requisition will have all the necessary information (established on the materials inventory page and item master) ready for a Supply Chain Analyst to either approve, deny or modify. Ideally the requisitions should be ready for approval upon generation based on the correct reorder point, lead time, safety stock, and economic order value. QICO looked at requisition generation dates and required date in reference to lead time. Once a purchase requisition has been approved the information now is relayed to procurement to submit the item out for a purchase order.

Finally, purchase orders were analyzed for the entered date, required date, and vendor date. This information can give an understanding of the time difference between requisition generation, purchase order date, and a vendor acknowledgement date.

Following the placement of a purchase order, items will arrive at WMATA and be receipted for in Peoplesoft and a receiving output will be loaded into Maximo. On the receiving information within Maximo, QICO took note to look for actual date of receiving, quantity of shipment, were any expiration/shelf life data field identified, and associated packing slip. By this point QICO can analyze the process the time from purchase requisition, purchase order and ultimately the time it took to receive the item.

PeopleSoft (Financial Enterprise Database)

QICO looked in PeopleSoft to cross-reference supplier original promised date and ship date versus the vendor date observed in Maximo for each of the purchase orders reviewed. Having this information readily available for the client to view can assure planned maintenance activities can occur by having the correct parts necessary at the correct time without delay.

Inventory Count (process of validating physical inventory count against the Maximo system count)

QICO performed inventory counts on each of the six parts. The parts respective warehouse facility and inventory bin was retrieved using Maximo to dispatch the team to the locations in order to get a blind inventory count. This information was given to a third party to verify the current inventory count displayed in Maximo on the same day.

REVIEW SCOPE

Category	Description
Interviews of Key Personnel	- Commodity Manager, [REDACTED] (Office of Procurement) - Purchasing Agent, [REDACTED] (Office of Procurement) - Purchasing Agent, [REDACTED] (Office of Procurement) - Manager Warehouse and Distribution, [REDACTED] (Supply Chain Enterprise Services) - Storeroom & Material Logistics Coordinator, [REDACTED] (Supply Chain Enterprise Services) - Manager Inventory Planning, [REDACTED] (Supply Chain Enterprise Services) - Manager Inventory Planning, [REDACTED] (Supply Chain Enterprise Services) - Project Coordinator, [REDACTED] (Car Maintenance) - Project Coordinator, [REDACTED] (Material and Inventory Planning) - Supporting Rail Personnel, [REDACTED] (Track and Structures) - Engineering Manager, [REDACTED] (Elevator and Escalators) - Deputy Chief Engineer, [REDACTED], (Vehicle Program Services) - Chief Engineer, [REDACTED], (Maintenance of Way Engineering)
Field Observations	- Inventory Counts - Storage Conditions - Expired Material verification
Review of Existing Documentation	SCES: - Supply Chain Enterprise Services Manual - Enterprise database records (Maximo, Windchill, etc.) - Standard Operating Procedures (SOP) PRMT: - Procurement Procedure Manual - Enterprise database records (Maximo) - Standard Operating Procedures (SOP) MIPN: - 2017-2019 MIPN Business Plan - "Rail Services (RAIL) Reorganization" staff notice

15.3. WHAT WORKED WELL

Measure	Finding	Description
Performance of Work	Shipment analysis performed by SCES promotes effective corrective measures from identified discrepancies.	SCES is documenting shipment discrepancies between the MSF and satellite storerooms. MSF Transfer Discrepancies form provides a discrepancy, related stock and transfer number, and relative comments from both storerooms.

15.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Business Practices	F-PMIM-17-01: Effective management of supply chain systems is essential to ensure availability of parts/materials and reduce the number of stockouts. <u>Strategic Risk</u> <u>Elevated (4.4)</u> 	2 of the 6 parts reviewed the supplier delivered earlier than the Maximo defined lead time. This translates into suppliers delivered 4 of the 6 parts beyond the Maximo defined lead time. 1 of the 6 parts reviewed had the requisition generation date and the required date equal to lead time. Purchase requisitions for parts that do not have lead times entered have identical generation and request dates, which does not reflect the accurate WMATA need date. Due to purchasing not having proper need date information, PO's are routinely sent to supplier's using the supplier's standard lead time, without consideration for WMATA's need date. - Vendor acknowledgement date was observed only on 1 of the 6 parts reviewed. The lack of expected delivery date information impacts planned maintenance activities. - At the time of this review, one part (Disc Brake Assembly Fleet 5K & 6K) was stocked out. Safety stock was not utilized on any of the 6 parts reviewed. Industry standard formula established by the American Production Inventory Control Society (APICS) calls for safety stock to be part of the calculation for ROP. 1 of the 6 items (infrastructure) was not being documented in the same manner as the other reviewed items in Maximo including; no EOQ, ROP, vendor information, PR's, PO's and receipts. - During inventory count activities, QICO observed 2 of the 6 parts/materials did not match their Maximo inventory count. Recommendation: Determine a method to implement a Material Requirement Planning (MRP) system while incorporating the fundamental industry standards which will enhance the efficiency and effectiveness of the supply chain process.

15.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Materials and Tooling	F-PMIM-17-02: Accounting for shelf-life limitations of parts and materials is necessary to ensure availability for use. Service Delivery Risk Moderate (3,3) 	- During Inventory Count for the six parts identified in this internal review, EucoSpeed grout was found to have 23 bags of material expired October 2016 placed adjacently to new material without any identification of do not use in Storeroom 300. - During QICO's Structural Inspection Internal Review (SIM) in June 2017, corrective action plan QICO-SIM-17-01 a deliverable was derived from finding expired EucoSpeed material with expiration date of October 2016. - During QICO's Car Track Equipment Maintenance Internal Review (CTEM) in August 2017, a corrective action plan QICO-CTE-17-04 was derived from finding expired adhesives and lubricants stored within a fire resistance cabinet. - Expiration date and shelf life continue to be an ongoing and increased concern as not being limited to one department, but across the authority. - Due to the lack of a procedure, the expiration date and shelf life fields were not being utilized in Maximo. Recommendation: Evaluate current material receiving practices and develop methods to ensure items with shelf-life limitations are identified and tracked through the supply chain system. A shelf life policy needs to be developed to ensure incoming products have adequate shelf life prior to entering into stock across the authority.
Quality Control Measures	F-PMIM-17-03: Clearly-defined key product characteristics/specifications are required to ensure accurate procurement of parts/materials while enhancing the quality control inspection process. Service Delivery Risk Moderate (3,4) 	- Of the 4 items reviewed subject to quality control inspection (other than identification, damage and quantity), none have identified key product characteristics (KPC's) to allow for quality control inspection. - There is no designation of parts in Maximo to indicate which parts require quality inspection. Recommendation: Identify all parts and materials that require an incoming/receiving inspection for quality control purposes (according to specification and contract requirements), define specific methods to verify key characteristics of these items, and develop methods to ensure these items are inspected as required.
Business Practices	F-PMIM-17-04: Clear definition of roles, responsibilities, and functions within MIPN is required to ensure activities are carried out consistently and in coordination with other departments. Service Delivery Risk High (5,5) 	- The office of Material Planning and Inventory Management (MIPN) has no governing documentation, standard operating procedures, organizational approved procedure or established responsibilities. Recommendation: Establish governing documentation to define roles and responsibilities for the office of MIPN to ensure clear departmental duties across the supply chain.

15.4. AREAS FOR IMPROVEMENT

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Measure	Finding	Description
Business Practices	F-PMIM-17-05 Requiring the communication of expected delivery dates from suppliers is necessary to improve inventory planning for scheduled maintenance activities. Service Delivery Risk Moderate (3,3) 	- 100% of the purchase orders observed for the five parts in PeopleSoft contained vendor original promised date, however, this information is not being observed in Maximo consistently. 0% of vendor ship dates are being captured in PeopleSoft on the same purchase orders. - The lack of expected delivery date information in Maximo impacts planned maintenance activities as it unsure if/when parts and materials needed for scheduled work will arrive on time. - According to PRMT personnel only some suppliers acknowledge receipt of PO, but do not provide WMATA with the expected delivery date, there currently is no formal process to address this issue. - Observed on the WMATA webpage (wmata.com), a WMATA Supplier Portal through CLM software. There are currently no requirements for vendors to use this service. Recommendation: Establish and clarify requirements vendors must follow to ensure WMATA has clear supplier promised date and ship date used to update WMATA's data enterprise services.
Business Practices	F-PMIM-17-06 Identifying the reason Purchase Requisitions are aging beyond 30-days is required to maximize efforts to diminish the Procurement PR backlog. Service Delivery Risk High (5,5) 	- WMATA has 1504 purchase requisitions which have aged beyond 30-days with the average number of days open being 113-days. - When requested for review, there is currently no tracking measures to why purchase requisitions are open and aging. It is unknown to how many purchase requisitions are not purchase order ready for any number of reasons and a supplemental metric to identify large causes of concern. Recommendation: Procurement must identify and evaluate PR's that have been aging greater than 30 days in order to maximize efficiency and eliminate the continuing growth of the PR backlog.

15.5. SUMMARY OF REQUIRED ACTIONS

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Required Action	Finding	Owner
QICO-PMIM-17-01 Determine a method to implement a Material Requirement Planning (MRP) system while incorporating the fundamental industry standards which will enhance the efficiency and effectiveness of the supply chain process. Elevated 	F-PMIM-17-01  Effective management of supply chain systems is essential to ensure availability of parts/materials and reduce the number of stockouts.	SCES
QICO-PMIM-17-02 Evaluate current material receiving practices and develop methods to ensure items with shelf-life limitations are identified and tracked through the supply chain system. A shelf life policy needs to be developed to ensure incoming products have adequate shelf life prior to entering into stock across the authority Moderate 	F-PMIM-17-02  Accounting for shelf-life limitations of parts and materials is necessary to ensure availability for use.	SCES
QICO-PMIM-17-03: Identify all parts and materials that require an incoming/receiving inspection for quality control purposes, define specific methods to verify key product characteristics of these items, and develop methods to ensure these items are inspected as required. Elevated 	F-PMIM-17-03  Clearly-defined key product characteristics/specifications are required to ensure accurate procurement of parts/materials while enhancing the quality control inspection process.	SCES
QICO-PMIM-17-04 Establish governing documentation to define roles and responsibilities for the office of MIPN to ensure clear departmental duties across the supply chain. High 	F-PMIM-17-04  Clear definition of roles, responsibilities, and functions within MIPN is required to ensure activities are carried out consistently and in coordination with other departments.	MIPN
QICO-PMIM-17-05 Establish and clarify requirements vendors must follow to ensure WMATA has clear supplier promised date and ship date used to update WMATA's data enterprise services. Moderate 	F-PMIM-17-05  Requiring the communication of expected delivery dates from suppliers is necessary to improve inventory planning for scheduled maintenance activities.	PRMT

15.5. SUMMARY OF REQUIRED ACTIONS

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Required Action	Finding	Owner
QICO-PMIM-17-06 Procurement must identify and evaluate PR's that have been aging greater than 30 days in order to maximize efficiency and eliminate the continuing growth of the PR backlog. High 	F-PMIM-17-06  Identifying the reasons Purchase Requisitions are aging beyond 30-days is required to maximize efforts to diminish the Procurement PR backlog.	PRMT
Approved Corrective Action Plans (CAPs) are provided following the Internal Review reports, with each developed to address the findings and required actions listed above.		



Metrorail Engineering and Maintenance
Post-SafeTrack: Assessment of
Next-Level Maintenance Requirements (16)



Quality Assurance, Internal Compliance & Oversight (QICO)
"Quality Trumps Quantity"



INTERNAL REVIEW SUMMARY

November 2017

20. Post-SafeTrack: Assessment of Next-Level Maintenance Requirements

Key Takeaway: Although the SafeTrack program significantly improved conditions within each surge area, improved scope definition, planning, and on-site inspection activities is needed to assure future routine maintenance and capital renewal work is completed effectively.

SafeTrack Program Goals:

- WMATA launched the emergency SafeTrack Program to address the most urgent safety-related track conditions in high priority areas identified by WMATA and Federal Transit Administration (FTA) inspections.
- The strategy involved 16 "safety Surges," or shutdowns of portions of the rail system, between June 2016 and June 2017, allowing crews to perform three years' worth of preventive and corrective maintenance in 12 months.

Why QICO Performed This Review:

- QICO conducted this internal review to provide Metro senior management with assessment of key strengths, areas for improvement, and next-level maintenance requirements subsequent to the emergency SafeTrack Program. Recommended actions will maximize the value of future routine maintenance and capital renewal initiatives, including Metro's first-of-its-kind preventive maintenance program.

QICO's Methodology:

- QICO's review activities spanned the three major lifecycle phases of the program: **Planning**, **Execution**, and **Outcome**.
- QICO reviewed program management methodologies and conducted assessments of all 16 Surge areas to assess the next-level maintenance requirements.

Wins and Areas for Improvement:

Planning:

- ✓ Continuous improvement is evident in reviewing Surge areas.
- There was no specific requirement to develop a complete scope or plan prior to the launch of the emergency SafeTrack program.
- Identification and classification of program risks (i.e. program delays, material deficiencies, weather, etc.) is essential to effective management and execution of future capital renewal activities.

Execution:

- ✓ The overall injury rate experienced under the program was lower than other WMATA operations during the same period.
- ✓ Management team introduced management tools to continually improve the planning and execution of Surges.
- Consistent practices for data capture are necessary to provide traceability of work completed during routine maintenance and capital renewal activities.
- Formal processes are required to govern changes in scope and schedule for future capital renewal activities.
- Quality control measures are necessary to consistently identify and correct deficiencies during future routine maintenance and capital renewal.

Outcome (Next-Level Maintenance Requirements):

- ✓ Condition of track superstructure significantly improved in Surge areas.
- ✓ Met stated goals for crosstie replacement.
- While remediation addressed immediate safety concerns, more work is required to achieve a system-wide state of good repair.
- Additional maintenance is required for special trackwork not addressed during Surges.

Required Actions:

- QICO-STP-17-01: To promote the effective execution of future maintenance initiatives, establish or revise policy to indicate the minimum requirements for program documentation (plan, scope, schedule, etc.) and control mechanisms (change management), including development and approval timelines.
(Risk Rating: High)
- QICO-STP-17-02: To improve the integrity of maintenance records, establish uniform requirements for the use of Maximo in the documentation of work activities, including applicable nomenclature and data fields for traceability.
(Risk Rating: Low)
- QICO-STP-17-03: To improve the quality and execution of future maintenance initiatives, establish formal quality control measures for use in corrective maintenance and rehabilitation activities that ensure identification and remediation of deficiencies prior to returning assets to passenger service.
(Risk Rating: Moderate)

Note: An itemized Corrective Action Plan (CAP) is developed for each required action to achieve effective and measurable resolution of identified concerns. To check the status of CAP implementation go to <https://www.wmata.com/initiatives/transparency/upload/Overview-of-Internal-Compliance-Actions.pdf>.

16.1. PROJECT OVERVIEW

Maintenance of Way

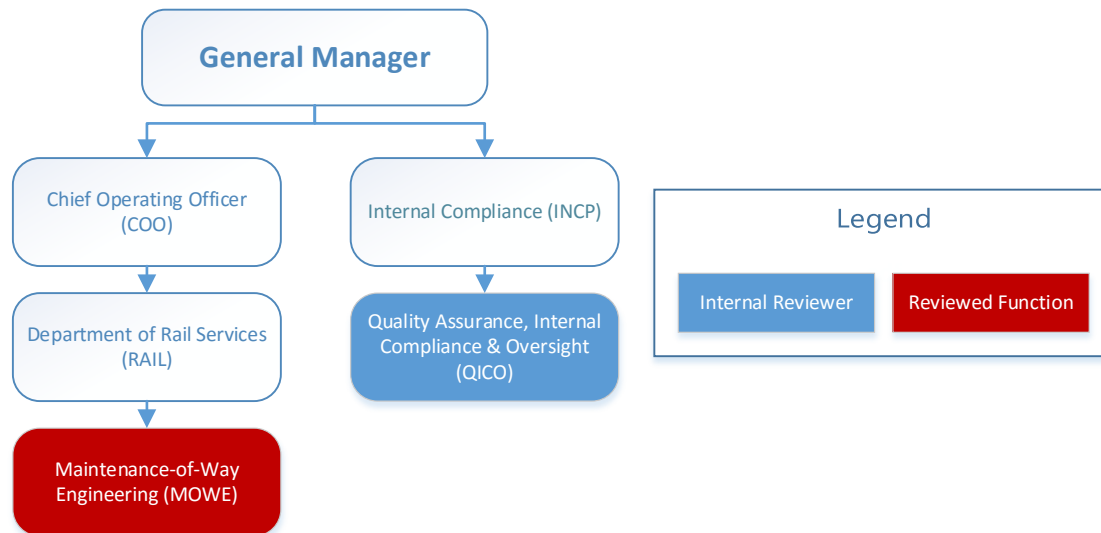
WMATA launched the emergency SafeTrack Program to address the most urgent safety-related track conditions in high priority areas identified by WMATA and FTA inspections. The strategy involved 16 "safety Surges," or shutdowns of portions of the rail system, between June 2016 and June 2017.

SafeTrack was an accelerated track work plan to address safety recommendations and rehabilitate the Metrorail system to improve safety and reliability, in order to complete approximately three years' worth of work in approximately one year and mitigate long-term disruption to customers.

This report provides a post-SafeTrack review of certain track and roadway conditions that remain to be addressed through future routine maintenance and capital renewal initiatives, including Metro's first-of-its-kind preventive maintenance program.

16.2. REVIEW METHODOLOGY

Initially, the SafeTrack team had primary responsibility for planning and coordination of the SafeTrack program, reporting to the Department of Rail Services (RAIL) under the Chief Operating Officer (COO). As the program transitioned towards closeout, the responsibility for the development of Metro's first-of-its-kind preventive maintenance program for track was established under Maintenance-of-Way Engineering (MOWE). This new function resides under RAIL and the COO, managing the implementation of this preventive maintenance program and future maintenance initiatives.



For its review of program management practices, QICO reviewed documentation, interviewed management personnel and other stakeholders. The report notes [What Worked Well](#), [Next-Level Maintenance Requirements](#), and [Areas for Improvement](#). Findings are categorized in consideration of the Project Management Institute (PMI) Knowledge areas and the Federal Transit Administration (FTA) quality elements identified in the [FTA Quality Management System Guidelines \(FTA-PA-27-5194-12.1\)](#).

16.3. PROGRAM MANAGEMENT REVIEW CRITERIA

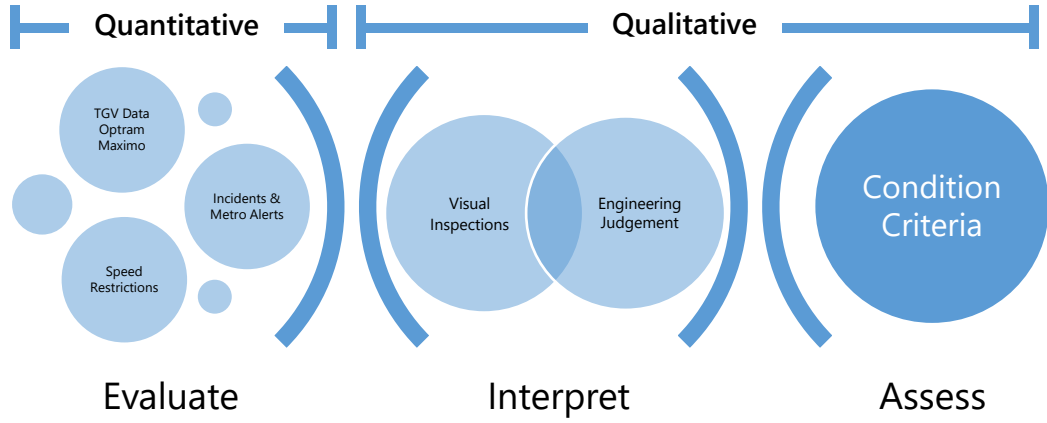
Measures	Definition
Integration Management	Processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities within the project management process groups.
Scope Management	Processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully.
Time Management	Processes required to manage the timely completion of the project.
Cost Management	Processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.
Quality Management	Processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. In particular it involves implementation of the 15 Federal Transit Authority (FTA) Quality Management Elements .
Human Resource Management	Processes that organize, manage, and lead the project team.
Communication Management	Processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information.
Risk Management	Processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project.
Procurement Management	Processes necessary to purchase or acquire products, services, or results needed from outside the project team. Processes in this area include Procurement Planning, Solicitation Planning, Solicitation, Source Selection, Contract Administration, and Contract Closeout.
Stakeholder Management	Processes required to identify all people or organizations impacted by the project, analyzing stakeholder expectations and impact on the project, and developing appropriate management strategies for effectively engaging stakeholders in project decisions and execution.
Records Management	Processes established to control scheduling, documentation and tracking of work accomplished. Documented requirements for project tasks, documentation, and maintenance of records.
<i>The review criteria align with Project Management Institute (PMI) instituted Knowledge Areas. For more details, refer to Project Management Body of Knowledge (PMBOK).</i>	

REVIEW SCOPE

Category	Description
Review of Documentation	- SafeTrack Project Management Plan - Surge Documentation located on the SafeTrack Network Drive - Government Accountability Office (GAO) Audit Report "Improved Planning of Future Rehabilitation Projects Could Prevent Limitations Identified with SafeTrack" March 14, 2017 - SafeTrack Project Management Oversight Contractor (PMOC) reports (FTA)
Interviews of Key Personnel and Stakeholder Departments	- Director, Chief of Maintenance-of-Way Engineering - Business Analyst - Schedulers - Stakeholder Department Representatives
Post-Surge Assessments of Next-Level Maintenance Requirements	- Visual inspections of track: QICO's quality assurance officers visually inspected SafeTrack Surge areas during passenger service hours (10 am – 2 pm). The inspections were conducted six months after the close of each Surge. - Track geometry data: QICO reviewed pre- and post-SafeTrack Track Geometry Vehicle (TGV) data, as well as other data aggregated in the Authority's linear asset management viewer (Qptram). - Condition rating: QICO developed a track asset condition rating system based on the Federal Transit Administration (FTA)'s asset management guidance and used the above inputs to develop condition ratings for each section of track¹ to assess next-level maintenance requirements.

¹ Evaluation of auxiliary work elements (e.g. Intrusion Detection Warning Box, Emergency Trip Stations) are not included in this review/rating, being secondary in importance to the proper functioning of the railroad.

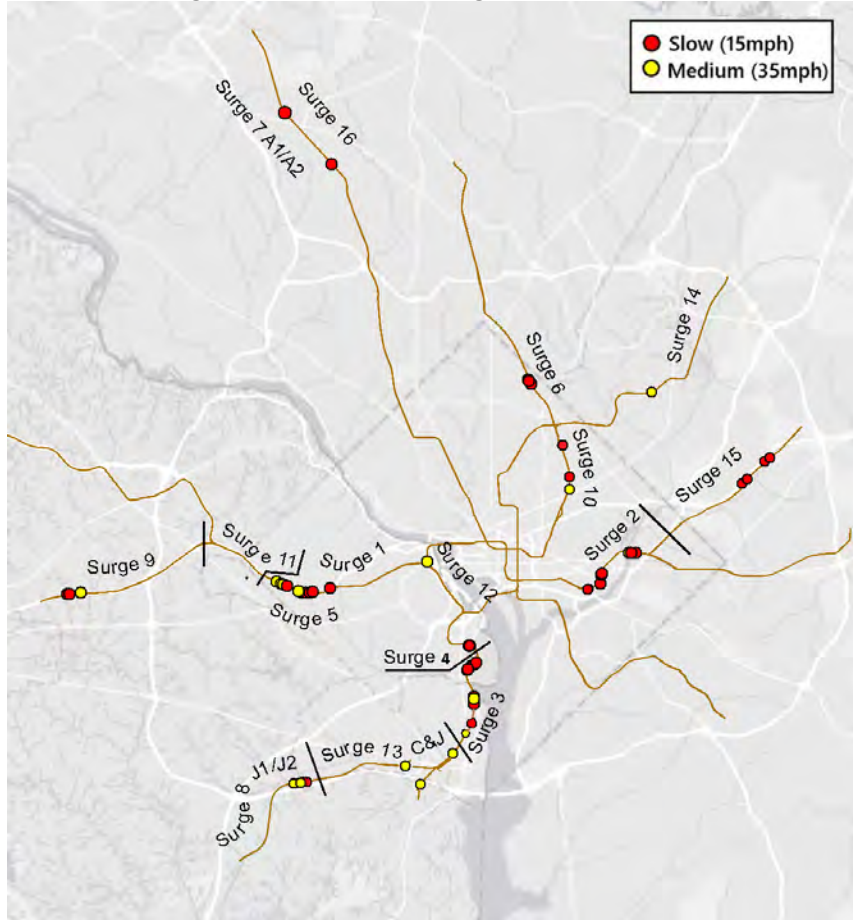
16.4. QICO CONDITION RATING APPROACH

Element	Detail
Considerations	- The condition rating is developed as a qualitative engineering assessment of objective data (TGV measurements, Optram/Maximo defects), objective track-walking inspections, and review of Track Inspection reports. - Condition ratings were developed to a level of precision (i.e. fractions) only to the extent that QICO engineers are confident in drawing a distinction. - The 1-5 condition ratings applied to each SafeTrack Surge area reflect engineering assessments of the overall condition of track system in the SafeTrack work limits, inclusive of both replaced and pre-existing track components. - The 1-5 condition rating does not represent a judgment on the efficiency of maintenance work performed during SafeTrack; it reflects only an evaluation of the outcome, not a judgement on whether alternative approaches to the work might have resulted in a higher post-SafeTrack condition.
Condition Rating Methodology	 The diagram illustrates the QICO Condition Rating Methodology, which is divided into two main sections: Quantitative and Qualitative. The process follows three steps: Evaluate, Interpret, and Assess. Evaluate (Quantitative): This step involves gathering objective data, including TGV Data, Optram, Maximo, Incidents & Metro Alerts, and Speed Restrictions. Interpret (Qualitative): This step involves analyzing the data through Visual Inspections and Engineering Judgement. Assess (Qualitative): This final step involves determining the Condition Criteria. For the purposes of this assessment and because of data integrity issues, QICO decided upon a “deduction” system (i.e. school test) over a system of weighted averages to derive a composite condition score. From visual inspections, a base impression or average “age” of the track was estimated and aligned with the scoring rubric provided by the FTA (e.g. 3.0 as threshold for “state of good repair”). Then deductions were assessed for issues involving track geometry, performance restrictions, and systematic quality observations. See Track Condition Rating Scale for additional details regarding the application of this methodology for this review.

16.4. QICO CONDITION RATING APPROACH

Element	Detail
Data Sources	QICO used several sources of data in its qualitative condition assessment. No single indicator is sufficient to describe State-of-Good Repair (SGR) for a large section of track. - <i>Speed restriction data</i>: minimizing speed restrictions is a key outcome of maintaining a state-of-good repair (SGR). Speed restriction data is sensitive to the quality of the track inspection force assigned to the associated area and how rigidly rules set forth in the WMATA-1000 are adhered to, and must be used cautiously when evaluating state-of-good repair for a large area. Speed restriction data in this report was validated in coordination with the Office of Performance. - <i>Track Geometry Vehicle (TGV) data</i>: TGV data is a precise tool for detecting deviations from required track geometry tolerances in the WMATA-1000. In this regard, it is superior to what can usually be expected from track inspection with regards to track geometry; in addition, comparing TGV runs pre- and post- Surge provides insights into the quality of work completed. - <i>Defects</i>: QICO noted and evaluated the potential significant of defect clustering in TRST inspection reports. Applying a crude metric such as “defects/mile” provides little value, as the net effect of defects on track performance is too dependent on other variables. - <i>Visual inspections</i>: inspecting on foot provides insight into the condition of assets and are effective at formulating general impressions on asset lifecycle; it is ill-suited to comprehensively assessing track geometry. Visual inspections can also provide insight on how the track is reacting to loading by the rolling-stock and seeing different phenomenon transpire. - <i>Age of components</i>: accounting for the age of components, based on manufacture and installation dates, is component in the measurement of asset lifecycle. Different direct fixation fasteners were used for the various trackwork contracts, and thus age can often be roughly inferred. The significance of component age (both in years and in tonnage) is strongly dependent on track curvature, and is applicable in only the broadest sense to describing track condition. - <i>TrackIT (used sparingly)</i>: WMATA’s TrackIT system collects data from accelerometers integrated into passenger service vehicles to detect abnormalities in ride-quality and categorize them according to severity. Other than abnormalities labeled “urgent,” this system was used sparingly in analysis. QICO will continue to explore ways to use TrackIT data to make observations with regards to state-of-good repair. - <i>Tie-score data (not available post-Surge)</i>: automated tie scoring (pre-Surge provided by GREX) is a precise method for identifying defective timber ties. Tie-scoring does not provide data on the other elements of the track superstructure (e.g. rail head defects), and does not assess condition on direct fixation.
Examples and Detail	The following pages provide visual examples of the scoring system using actual WMATA track assets for reference, as well detailed descriptions of the parameters by which condition scoring was assigned to decimal level.

16.5. POST-SAFETRACK ASSESSMENT OF NEXT-LEVEL MAINTENANCE REQUIREMENTS

Surge Information		Condition Rating Before ²	Accomplishments <i>Notable Improvements Post-Surge</i>	Condition Rating After	# Speed Restrict After ³	Post-SafeTrack <i>Next-Level Maintenance Requirements</i>	Other Information																				
1	 Ballston to East Falls Church, Track 1 (13 days)	<2.5	+ Direct fix-ballast transitions improved	3.3	7	— Direct fixation track near Ballston Portal Post-Surge tamping incomplete Broken rail (1/7/2017)	<table><tr><th colspan="5">CONDITION RATING LEVELS</th></tr><tr><th>EXCELLENT 4.7-5.0</th><th>GOOD 4.0-4.6</th><th>ADEQUATE 3.0-3.9</th><th>MARGINAL 2.0-2.9</th><th>WORN 1.0-1.9</th></tr><tr><td>New asset.</td><td>Asset showing minimal signs of wear.</td><td>Asset has reached its mid-life condition (3.5)</td><td>Asset near end of useful life. Below SGR.</td><td>Asset is past its useful life.</td></tr><tr><td colspan="3">State of good repair. Preventative maintenance can outpace degradation of components.</td><td colspan="2">Below state of good repair. Requires continued corrective maintenance.</td></tr></table> SafeTrack Surge Area and Post-Surge Speed Restrictions 	CONDITION RATING LEVELS					EXCELLENT 4.7-5.0	GOOD 4.0-4.6	ADEQUATE 3.0-3.9	MARGINAL 2.0-2.9	WORN 1.0-1.9	New asset.	Asset showing minimal signs of wear.	Asset has reached its mid-life condition (3.5)	Asset near end of useful life. Below SGR.	Asset is past its useful life.	State of good repair. Preventative maintenance can outpace degradation of components.			Below state of good repair. Requires continued corrective maintenance.	
CONDITION RATING LEVELS																											
EXCELLENT 4.7-5.0	GOOD 4.0-4.6	ADEQUATE 3.0-3.9	MARGINAL 2.0-2.9	WORN 1.0-1.9																							
New asset.	Asset showing minimal signs of wear.	Asset has reached its mid-life condition (3.5)	Asset near end of useful life. Below SGR.	Asset is past its useful life.																							
State of good repair. Preventative maintenance can outpace degradation of components.			Below state of good repair. Requires continued corrective maintenance.																								
2	 Eastern Market to Minnesota Ave  Tracks 1 & 2 (16 days)	<2.5	+ D&G pocket track partial upgrade G1 & G2 ballasted section improved Wide gauge eliminated	2.8*	13	— Fasteners on curve 322 (Potomac) D&G speed restrictions from grout/fasteners Untorqued fasteners																					
3	 National Airport to Braddock Road  Tracks 1 & 2 (7 days)	<2.5	+ Wide gauge eliminated in curves Direct fix-ballast transitions improved	3.0	9	— Grout pads, curve 5 (855-ft curve) Inadequate timber tie replacement Two broken rails (Winter 2017)																					
4	 Pentagon City to National Airport  Tracks 1 & 2 (7 days)	<2.5	+ Rail replaced in tight radius curves	3.6	1	— Grout pads in tight radius curves (27-30) 1500 feet of rail will need replacement soon																					
5	 Ballston to East Falls Church, Track 2 (12 days)	<2.5	+ Ballasted track remediated Direct fix-ballast transitions improved	3.7	2	— EFC double crossover not addressed Post-Surge tamping incomplete																					
6	 Silver Spring to Takoma, Track 1 (7 days)	<2.5	+ No instances of wide gauge on either track	3.7	2	— Pumping at Silver Spring crossovers Incomplete ballast consolidation																					
7	 Shady Grove to Twinbrook, Track 1 (13 days)	<2.5	+ No instances of wide gauge (Track 1)	3.6	1	— Track 1 needs ballast management																					
8	 Franconia-Springfield to Van Dorn Tracks 1 & 2 (16 days)	<2.5	+ High levels of timber tie replacement Track re-gauged closer to standard	4.0	3	— Low ballast throughout Sections of track are still narrow gauge																					
9	 West Falls Church to Vienna Tracks 1 & 2 (42 days)	<2.5	+ Ballasted track upgraded Vienna tail tracks upgraded	4.1	2	— Minor rail defects remain Surge area																					
10	 NOMA to Fort Totten Tracks 1 & 2 (25 days)	<2.5	+ New double crossover at Rhode Island Structural repairs, Rhode Island aerial (B1)	3.7	3	— Grout pads require additional work Further structural repairs required (B2)																					
11	 East Falls Church to West Falls Church Tracks 1 & 2 (23 days)	<2.5	+ Large amounts of running rail replaced	3.8	0	— Curve 10 superelevation issue (TGV) 2000-ft of adjacent track not addressed in SafeTrack (WFC to K98 Junction)																					
12	 Rosslyn to Pentagon, Tracks 1 & 2 (18 days)	<2.5	+ Arlington Cemetery double crossover now in adequate condition	4.1	1	— New grout pads have uneven surfaces within Surge limits																					
13	 Braddock Road to Huntington/Van Dorn,  Tracks 1 & 2 (40 days)	<2.5	+ New C98 Alex Yard double crossover	3.7	3 ⁵	— C15 Huntington double crossover Track to Alexandria Yard (non-mainline)																					
14	 Prince George's Plaza to Greenbelt Tracks 1 & 2 (30 days)	<2.5	+ Large scale joint elimination Running rail replacement	4.1	1 ⁵	— Fasteners outbound of PG Plaza																					
15	 Minnesota Ave to New Carrollton Tracks 1 & 2 (31 days)	<2.5	+ Improved gauge (TRST amber measurements)	3.6	4 ⁵	— Minnesota Ave. aerial grout work Defects on aerial structures appearing																					
16	 Shady Grove to Twinbrook, Tracks 1 & 2 (9 days)	<2.5	+ Twinbrook to Rockville largely free of defects (per track database post-6/25)	3.7	1 ⁴	— Twinbrook double crossover needs work Inadequate ballast distribution Rail break shortly after Surge (7/10/2017)																					

* Challenging conditions in the track sections of the Surge 2 area have resulted in a high rate of post-SafeTrack defects and service impacts. WMATA has prioritized this area for further remediation, work is planned to begin during FY2018, to continue in FY2019 and beyond.

² A baseline of <2.5 condition was assumed for each Surge area prior to work, based on age degraded condition, resulting in regular passenger service disruptions beyond regular off-peak (late night/weekend) maintenance windows.

³ Speed restrictions implemented for track-related hazards. Internal re-training (9/16 onwards) likely led to improved identification and increased reporting of speed restriction conditions.

⁴ These surges concluded less than 6 months prior to the assembly of this report. The speed restrictions shown are since the surge has ended (as of 8/1/2017).

16.6. WHAT WORKED WELL - ACCOMPLISHMENTS

Measure	Finding	Description
Planning & Execution		
Stakeholder Management	Management team successfully engaged and collaborated with internal stakeholders to continually improve the execution of each subsequent Surge.	- In recognition of SafeTrack's emergency priority to the organization, WMATA designated a management position to lead the engagement of stakeholders to improve execution. - Through inter-functional collaboration, WMATA departments were able to develop operational alternatives to minimize rail service disruptions and mitigate service delivery concerns, documenting the finalized service alternatives for implementation.
Safety	The overall injury rate experienced under the emergency program was lower than other WMATA operations during the same period.	- The overall injury rate experienced under the program, as reported by the SafeTrack team, was lower than other WMATA operations during the same period. - This success was achieved as a result of early and continual focus on the compliance with existing WMATA rules for roadway worker protection and personal protective equipment, while focusing on means and methods to continuously improve safety throughout the program.
Quality Management	Management team introduced management tools to continually improve the planning and execution of Surges and documentation of work completed.	- Management team implemented several execution tools to manage the delivery of scope of work. Specifically, the team implemented tools such as daily coordination calls during Surge events, time-distance diagrams (March Chart), and lessons learned during coordination meetings. - The time-distance diagram improved through the execution of each subsequent Surge, with revision control being implemented to reflect changes in plans.
Outcomes		
Scope Management	WMATA accomplished three years of track maintenance in one year.	- The Agency reduced the backlog of infrastructure maintenance needs through an accelerated renewal schedule, maximizing the use of available manpower and resources to restore immediate reliability issues prior to initiation of a new preventive maintenance program.
	Condition of track superstructure significantly improved in Surge areas.	- The oldest at-grade and aerial track in the Metrorail system (now 30-40 years old) has been remediated, with every Surge area demonstrating notable major improvements post-SafeTrack.
	Met stated goals for crosstie replacement.	- The stated goal of mitigating 95% of defective ties system-wide and achieving 75% or better acceptable cross ties in any stretch of track has been achieved.

16.7. NEXT-LEVEL MAINTENANCE REQUIREMENTS

Item	Observation	Description
Outcomes		
1	While remediation addressed immediate safety concerns, more work is required to achieve a system-wide state of good repair.	Several Surge areas will require further mitigation to address new or remaining defects and mitigate the development of speed-restrictable conditions. For additional detail, see the Condition Assessment Table and the Condition Rating Approach .
2	Track at the D&G Junction, while improved, remains at the threshold of falling below a State of Good Repair.	Following Surge #2, this section has experienced clustering of defects, particularly with respect to grout pads and fasteners. Additional grout and fastener replacement will be required. WMATA has prioritized this area for further remediation, work is planned to begin during FY2018, to continue in FY2019 and beyond.
3	Additional maintenance is required for special trackwork and adjacent track that could not be addressed during SafeTrack, future routine maintenance and capital renewal initiatives, including Metro's first-of-its-kind preventive maintenance program.	SafeTrack utilized extended shutdown time to completely replace and/or conduct mid-life maintenance on special trackwork (e.g. Rhode Island Avenue and Greenbelt double crossovers, respectively). However, in some Surge areas, it was not feasible to upgrade special trackwork due to the necessity to turn passenger trains to the nearest station.
Next-Steps		
Improved planning for future routine maintenance and capital renewal initiatives, including Metro's first-of-its-kind preventive maintenance program, will improve the outcomes of these efforts.		

16.8. AREAS FOR IMPROVEMENT: PLANNING & EXECUTION

Measure	Finding	Description
Scope Management	F-STP-17-01: There was no specific requirement to develop a comprehensive maintenance scope prior to the launch of the emergency SafeTrack program. Strategic Risk Elevated (3, 4) 	- A formal project management plan was not developed prior to the execution of SafeTrack program. However, the definition of "Surge" was established and the locations of the Surges defined. It is recognized that the emergency nature of the required track remediation restricted the time available to develop a comprehensive project management plan prior to program launch. - Initial development of maintenance plans did not include input from engineering functions until after the preliminary schedule had been established. - Progressively through the execution of Surges, management identified additional requirements and made revisions to strategies that improved execution: - o Timelines for transition nights, returning track[s] back to service, were developed. - o A service delivery document was developed to detail the steps needed to execute passenger service around Surge areas. Recommendation: To improve the planning and execution of future maintenance initiatives, establish policy requiring the development of comprehensive maintenance scope prior to execution of work. This policy should establish the minimum required elements for maintenance program plans to ensure consistency in implementation.
Records Management	F-STP-17-02: Consistent practices for data capture are necessary to ensure traceability of work completed during future routine maintenance and capital renewal activities. Strategic Risk Low (2, 4) 	- The track maintenance department was unable to efficiently and accurately develop the scope of work from the track defect data stored in enterprise maintenance management database (Maximo) due to "insufficient or out of date information." - While SafeTrack's PMP identifies that all stakeholders are required to follow existing policies and procedures, each maintenance department has its own methods for using Maximo to plan and record maintenance activities. - While there was improvement in generation and identification of Maximo work orders specific to SafeTrack Surges, there was inconsistent execution of the Work Order process. Recommendation: To improve the integrity of maintenance records, establish uniform requirements for the use of Maximo in the documentation of work activities, including applicable nomenclature and data fields for traceability.

16.8. AREAS FOR IMPROVEMENT: PLANNING & EXECUTION

Measure	Finding	Description
Scope Management	F-STP-17-03: Formal processes are required to govern changes in scope and schedule for Metro's future capital renewal activities. <u>Strategic Risk</u> <u>Elevated (4, 5)</u> 	- Since public notification of the SafeTrack program, several significant changes to the overall schedule of Surges were made, utilizing different practices for each change. - Surge 14 was shifted from a single tracking event (from College Park to Greenbelt stations) to a shutdown event (from Prince George's Plaza to Greenbelt Yard) three weeks prior to the start of the Surge. - The following actions had to be taken by WMATA as a result of executing Surge 14 as a shutdown: - o Bus shuttles were established for the closed stations. - o Railcars available for passenger service were relocated to other yards to meet the available car service requirement. Railcars not available for passenger service needed to be consolidated at Greenbelt Yard. - Surge 15 and Surge 16, added in January 2017, were changed from scheduled single-tracking events to shutdown events. - Although controls exist for capital projects, no such requirements exist for work self-performed by operational teams. Recommendation: To improve control of changes in scope, schedule and implementation of future maintenance initiatives, define clear requirements for change management processes that ensure all impacts to critical areas are reviewed, approved and shared with key project stakeholders.
Quality Management	F-STP-17-04: Quality control measures are necessary to consistently identify and correct material deficiencies future routine maintenance and capital renewal activities. <u>Service Delivery Risk</u> <u>Moderate (3, 4)</u> 	- RAIL Operations Administrative Policy (OAP) 100-20 "Supervisory Inspections of Work Performed in the Rail System" was established as a result of FTA R-4-32-a, directing each maintenance group to develop and publish roles and responsibilities including the frequency of inspection, method of inspection, and items to be reviewed during inspection in policies and procedures specific to the group. - o Although current maintenance control policies include requirements for quality control of preventative maintenance activities, there is little guidance for corrective maintenance or large-scale rehabilitation activities. Recommendation: To improve the quality and execution of future maintenance initiatives, establish formal quality control measures for use in corrective maintenance and rehabilitation activities that ensure identification and remediation of deficiencies prior to returning assets to passenger service.

16.8. AREAS FOR IMPROVEMENT: PLANNING & EXECUTION

Measure	Finding	Description
Risk Management	F-STP-17-05: Identification and classification of program risks (i.e. program delays, material deficiencies, weather, etc.) is essential to effective management and execution of future capital renewal activities. <u>Strategic Risk</u> <u>Elevated (4, 3)</u> 	- Due to a delay in creation, the risk register developed for the SafeTrack program was used to capture a series of issues (realized situations), as well as potential future risks (unrealized situations). This management tool should be used to capture potential risks to a program prior to initiation and updated periodically through execution, including potential delays, material deficiencies, inclement weather, production capacities, etc., while also noting potential opportunities. - By May of 2017, 35 program risks were identified in the register: - o 28 risks had been realized - o No opportunities were identified - The risk register is missing important components such as the identification of action owners and due dates for the implementation/resolution on the action plans and due dates for when the risk is planned to be mitigated. The register also does not prioritize/rank risks in terms of severity, probability and/or impact. Recommendation: To reduce the impact of future program risks, establish a risk management structure to ensure risks and opportunities are identified and analyzed, resulting in response development and continuous monitoring.

16.9. SUMMARY OF REQUIRED ACTIONS

Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.

Refer to [Appendix A: Risk Assessment](#) for further details

Required Action	Finding	Owner
QICO-STP-17-01: To promote the effective execution of future maintenance initiatives, establish or revise policy to indicate the minimum requirements for program documentation (plan, scope, schedule, etc.) and control mechanisms (change management), including development and approval timelines. Elevated 	F-STP-17-01  There was no specific requirement to develop a comprehensive maintenance scope prior to the launch of the emergency SafeTrack program.	RAIL
	F-STP-17-03  Formal processes are required to govern changes in scope and schedule for Metro's future capital renewal activities.	RAIL
	F-STP-17-05  Identification and classification of program risks (i.e. program delays, material deficiencies, weather, etc.) is essential to effective management and execution of future capital renewal activities.	RAIL
QICO-STP-17-02: To improve the integrity of maintenance records, establish uniform requirements for the use of Maximo in the documentation of work activities, including applicable nomenclature and data fields for traceability. Low 	F-STP-17-02  Consistent practices for data capture are necessary to ensure traceability of work completed during future routine maintenance and capital renewal activities.	RAIL
QICO-STP-17-03: To improve the quality and execution of future maintenance initiatives, establish formal quality control measures for use in corrective maintenance and rehabilitation activities that ensure identification and remediation of deficiencies prior to returning assets to passenger service. Moderate 	F-STP-17-04  Quality control measures are necessary to consistently identify and correct material deficiencies future routine maintenance and capital renewal activities.	RAIL
Approved Corrective Action Plans (CAPs) are provided following the Internal Review reports, with each developed to address the findings and required actions listed above.		

CORRECTIVE ACTION PLANS (CAPs)

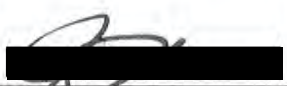
INTERNAL REVIEW

Capital Program Management and Execution

In response to the internal review of Metrorail Engineering and Maintenance, including review of Metrorail vertical Transportation: Escalator Maintenance and Inspections, Metrorail Fire & Life Safety: Fire Suppression Inspection and Testing, Parts and Materials Inventory Management, and Post-SafeTrack Assessment of Next-Level Maintenance Requirements, the office of Quality Assurance, Internal Compliance & Oversight (QICO) has coordinated the development of fourteen (14) CAPs. Each CAP outlines the findings, recommendations and requirements to be addressed, and a detailed action plan outlining responsible parties and specific actionable items.

EXECUTIVE LEADERSHIP OF RESPONSIBLE PARTIES

Corrective Action Plan Commitment


Joseph Leader
Chief Operating Officer (COO)

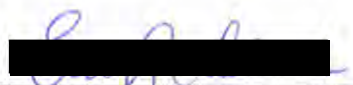
11/17/17
Date

WMATA INTERNAL OVERSIGHT

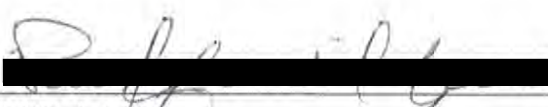
Corrective Action Plan Acknowledgement


Angel Peña
Managing Director, Quality Assurance, Internal Compliance & Oversight (QICO)

11/15/17
Date


Eric Christensen
Chief, Internal Compliance (INCP)

11/15/17
Date


Paul J. Wiedefeld
General Manager & Chief Executive Officer (GM/CEO)

11/15
Date

METRORAIL VERTICAL TRANSPORTATION: ESCALATOR MAINTENANCE AND INSPECTIONS CAPS

[\(Summary of Required Actions\)](#)

CORRECTIVE ACTION PLAN

Purpose and Scope

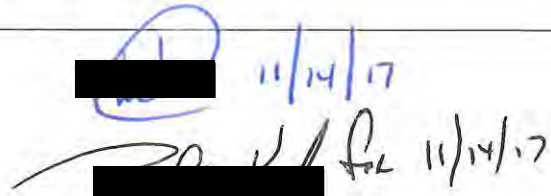
On September 8, 2017 QICO issued a comprehensive Report from an internal review into the assessment of the Metrorail Vertical Transportation Review: Escalator Maintenance and Inspections. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-MVT-17-01.

QICO Finding	QICO Recommendation
F-MVT-17-01: Maintaining the correct asset identification within station monitoring systems is essential to maintenance response and analysis.	- Establish clear policies and procedures for verifying equipment that enhances the remote monitoring system and ensures historical data is reliable.
F-MVT-17-04: Analysis of work order data is necessary to determine accurate failure trends during peak passenger service periods and proactively manage maintenance activities.	- Establish procedures and policies to research and develop solutions addressing reliability trends of vertical transportation units during peak passenger periods.
F-MVT-17-09: Consistent capture of maintenance data is required to ensure data integrity for future analysis and maintenance planning.	- Establish and implement clear practices and procedures that ensure elevator and escalator out-of-service data is usable and reliable for engineering and maintenance analysis.

Required Action

QICO-MVT-17-01: Conduct an analysis of the current practices used to gather and store vertical transportation information. Create or modify methods to enhance the value and reliability of data collected and stored.

(Risk Rating: High) ■





ACTION PLAN

Description

Until ELES can acquire additional resources we will create and analyze weekly high failure reports of escalators and elevators to optimize reliability.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) ELES Operations Analysis	Evaluate the current workload and responsibilities of ELES Engineering and Maintenance teams to assess current capabilities and project future needs.	Mitchell Nici (ELES)	01/01/18	02/28/18
2) ELES Data Analysis Process	Develop a process to perform analysis of maintenance and service data for vertical transportation. This process will guide designated team members in the performance of analysis and reporting activities.	Mitchell Nici (ELES)	01/01/18	02/28/18
3) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	02/28/18	03/28/18

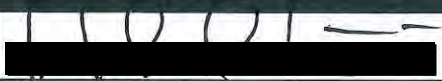
*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.

COMPLETION DOCUMENTATION

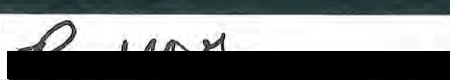
Performance Measures

- 90 days sample of data analysis produced in accordance with process developed under actionable item #2.

RESPONSIBLE PARTIES

ELES	Mitchell Nici		11/08/17
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SECOND LEVEL RESPONSIBILITY

Managing Director, SSRV	Randall Grooman		11/8/17
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CORRECTIVE ACTION PLAN

Purpose and Scope

On September 8, 2017 QICO issued a comprehensive Report from an internal review into the assessment of the Metrorail Vertical Transportation Review: Escalator Maintenance and Inspections. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-MVT-17-02.

QICO Finding	QICO Recommendation
F-MVT-17-02: Use of approved communications devices is necessary to ensure reliable communication is available to support maintenance activities.	- Establish and provide a method for reliable communication between maintenance personnel during routine maintenance and troubleshooting activities.
F-MVT-17-03: Effective maintenance planning and scheduling is required to maximize time available outside of passenger service hours.	- Establish and implement achievable and clear expectations for the duration of preventative maintenance tasks, ensuring maintenance work does not overlap with revenue service.
F-MVT-17-05: Effective inventory and control of calibrated equipment is required to ensure items are scheduled and calibrated on-time.	- Revise and enforce a consistent method for calibrating tools and test equipment that will facilitate the upkeep and maintenance of all ELES tools and test equipment.

Required Action

QICO-MVT-17-02: Establish methods for maintenance personnel to perform their work more properly, efficiently, and effectively.
(Risk Rating: High) ■

ACTION PLAN

Description

ELES will coordinate with the Communications department to facilitate two-way communication for mechanics that is in compliance and in accordance with WMATA standards. ELES will develop Internal Maintenance Bulletin outlining maintenance expectations with regards to durations and impact to the public. Reinforce the policy requiring the calibration of equipment.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) ELES Communications Solution	Collaborate with Communications (COMM) to determine the most appropriate methods of communication based on operational needs.	Mitchell Nici (ELES)	12/01/17	05/30/18
2) ELES Preventative Maintenance Standards	Enforce current Preventative Maintenance and develop new performance standards to determine appropriate manpower, time requirements, and appropriate periodicity for each item to improve work planning and execution- Internal Maintenance Bulletin.	Mitchell Nici (ELES)	11/01/17	07/05/18
3) Acknowledgement of New Standards	Present and discuss with ELES personnel new expectations described in #2, including employee signature acknowledgement of new standards in the meeting roster.	Daniel White (ELES)	07/05/18	08/06/18
4) ELES Equipment Calibration Process	ELES will enforce existing written instructions for ELES Supervision to periodically inventory and inspect calibrated equipment, in accordance with existing calibration policies. ELES will add checklist to ensure return of tools.	Madhavan Kozhipurath (ELES)	11/01/17	07/05/18
5) Acknowledgement of Calibration Process/Checklist	Present and discuss with ELES personnel new Calibration Process/Checklist, including employee signature acknowledgement of new SOP in the meeting roster.	Madhavan Kozhipurath (ELES)	07/05/18	08/06/18
6) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	08/06/18	09/05/18

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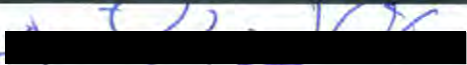
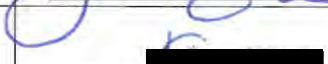


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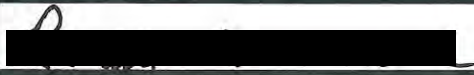
Performance Measures

- 80% of active ELES personnel responsible for preventative maintenance activities provide signature acknowledgement of updated standards.
- 80% of active ELES supervisors responsible for calibrated equipment provide signature acknowledgement of calibration process and updated checklist.

RESPONSIBLE PARTIES

ELES	Daniel White		11/8/2017
ELES	Madhavan Kozhipurath		11/8/2017
ELES	Gedion Gebremariam		11/8/2017
ELES	Mitchell Nici		11/8/2017

SECOND LEVEL RESPONSIBILITY

Managing Director, SSRV	Randall Grooman		11/8/17
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CORRECTIVE ACTION PLAN

Purpose and Scope

On September 8, 2017 QICO issued a comprehensive Report from an internal review into the assessment of the Metrorail Vertical Transportation Review: Escalator Maintenance and Inspections. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-MVT-17-03.

QICO Finding	QICO Recommendation
F-MVT-17-06: A formal maintenance control program is required to ensure compliance with code requirements and effective application of maintenance practices.	- Establish and implement a maintenance control program that meets code requirements stated in ASME A17.1 Section 8.6.
F-MVT-17-07: Accurate documentation of maintenance activities is essential to ensure information is available for troubleshooting and that all equipment is within specified tolerances.	- Establish and distribute a policy requiring preventative maintenance sheets to have all required readings recorded and that ensures maintenance personnel properly indicate and repair out-of-tolerance issues. The policy should require supervisory spot checks to ensure proper maintenance record keeping.
F-MVT-17-08: An escalator control cabinet was missing a fire extinguisher.	- Specify the location of fire extinguishers that are expected to be checked according to preventative maintenance tasks and implement a process that ensures all maintenance tasks are completed.

Required Action

QICO-MVT-17-03: Establish a maintenance control program that follows ASME code A17.1 Section 8.6; including methods for capture and storage of relevant maintenance data.

(Risk Rating: High) ■

ACTION PLAN

Description

Currently, Maintenance Control Policies (MCPs) for Traction and Hydraulic Elevators are in place. An MCP for Escalators is in the developmental stage with the help of a contractor. Once completed it must be vetted through engineering, maintenance, and training for execution. ELES will develop an SOP for maintenance records: completion, review, and filing of form. ELES will develop a comprehensive list of ELES related spaces/areas equipped with a fire extinguishers.

Business Impact – Budget/Cost Estimate

Process Execution – A current process/procedure exists that meets the QICO Required Action, but needs to be executed. This type of initiative does not need additional resources.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Escalator Maintenance Control Plan- Draft	Coordinate with ELES Engineering and Maintenance to develop a draft comprehensive Maintenance Control Policy (MCP), establishing consistent methods for maintenance planning, execution, documentation and data capture activities.	Daniel White Madhavan Kozhipurath (ELES)	09/25/17	03/29/18
2) Escalator Maintenance Control Plan- Pilot Program	Pilot Program of Maintenance Control Plan	Daniel White (ELES)	07/02/18	10/01/18
3) Escalator Maintenance Control Plan- Final	Final Maintenance Control Policy (MCP), establishing consistent methods for maintenance planning, execution, documentation and data capture activities.	Daniel White (ELES)	03/29/18	12/31/18
4) ELES Maintenance Records Management	Develop a written process for the completion, review, data entry, and filing of ELES maintenance documentation to ensure clear and consistent capture of maintenance activities.	Daniel White (ELES)	11/01/17	03/29/18
5) ELES Fire Extinguisher Inventory	Identify all ELES locations requiring fire extinguisher placement, ensure all locations identified possess the required equipment, and develop methods to ensure all extinguishers are periodically inspected.	Madhavan Kozhipurath (ELES)	10/03/17	01/31/18
6) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	12/13/18	01/31/19

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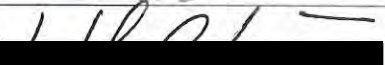


COMPLETION DOCUMENTATION

Performance Measures

- Evidence of Maintenance Control Plan implementation, including signature acknowledgement of updated requirements by 80% of active ELES personnel.
- 90-day sample of work order data demonstrating compliance with records management practices developed under actionable item #4.
- Evidence of fire extinguisher placement at 100% of locations identified under actionable item #5.

RESPONSIBLE PARTIES

ELES	Daniel White		11/8/2017
ELES	Madhavan Kozhipurath		11/8/2017
ELES	Mitchell Nici		11/08/2017

SECOND LEVEL RESPONSIBILITY

Managing Director, SSRV	Randall Grooman		11/8/17
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METRORAIL FIRE & LIFE SAFETY: FIRE SUPPRESSION INSPECTION AND TESTING CAPS

[\(Summary of Required Actions\)](#)



CORRECTIVE ACTION PLAN

Purpose and Scope

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report on Fire and Life Safety: Fire Suppression System Inspection, Testing and Maintenance. This CAP has been developed to address the findings and required actions per QICO-FLS-17-01.

QICO Finding	QICO Recommendation
F-FLS-17-01: Clear definition of roles, responsibilities, and processes are required to ensure all fire protection systems (FPS's) have defined ownership across the organization.	- Establish and implement department internal control documents (i.e. role, mission statement, goals, responsibilities, procedures, schedules, standards of inspection, etc.) to ensure consistent and reliable department performance.
F-FLS-17-02: Effective oversight of inspection, testing, and maintenance (ITM) programs for FPS's is required to ensure ITM functions are carried out consistently and documented appropriately.	- Establish ITM and recordkeeping standards to ensure that reporting consistently provides a detailed condition assessment of FPS's, and evaluation of additional FPS assets.

Required Action

QICO-FLS-17-01:

Establish governing documentation to define the roles, responsibilities, and processes to ensure clear departmental ownership and obligations for ITM of all WMATA FPS's.

(Risk Rating: High) 

**ACTION PLAN****Description**

The WMATA Fire Marshal's Office (FMO) is currently developing a comprehensive organization-wide program for fire protection system (FPS) inspection, testing, and maintenance (ITM) that will outline the roles and responsibilities of all departments involved in the process. This program is expected to be completed in ten (10) months. Additionally, the FMO will establish a communication plan that informs WMATA staff, stakeholders, and end users.

Business Impact – Budget/Cost Estimate

Process Improvement – The current processes/procedures need to be optimized to address the Quality Assurance, Internal Compliance & Oversight (QICO) Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the processes.

PLAN STRUCTURE

Actionable items		Description	Responsible Party	Estimated Start	Estimated Completion
1)	Inspection, Testing, & Maintenance Program	Development of a comprehensive, organization-wide FPS ITM program that ensures compliance with regulatory requirements.	SAFE	11/20/17	09/20/18
2)	Establish an organizational communication plan to announce newly established policy and inform WMATA staff, stakeholders, and end users.	The communication plan will ensure effective information sharing of newly established organizational policies to include outreach to necessary maintenance, inspection, and testing personnel in adoption of new policy. The plan will also include methods, upon adoption, to communicate and inform the wider WMATA community and end users.	SAFE	12/20/17	10/22/18
3)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and required actions have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	11/21/19	12/20/19

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.



COMPLETION DOCUMENTATION

Performance Measures

- Signature acknowledging receipt and understanding from department heads of the Inspection, Testing, and Maintenance Program under action item 1.

RESPONSIBLE PARTIES

SAFE

Vincent Caponi



11/7/17

SECOND LEVEL RESPONSIBILITY

Fire Marshal

Richard Arvin



11/7/17

**CORRECTIVE ACTION PLAN****Purpose and Scope**

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report on Fire and Life Safety: Fire Suppression Inspection and Testing. This Corrective Action Plan (CAP) has been developed to address the findings and required action per QICO-FLS-17-02.

QICO Finding	QICO Recommendation
F-FLS-17-03: Consistent documentation of maintenance records is essential to ensure accurate accounting of asset status.	- Evaluate FLS maintenance records against SOP 209-07 sections 6.2.3 and 6.3.2 to ensure records consistently capture data.
F-FLS-17-04: Consistent application of maintenance practices is necessary to ensure FLS equipment is readily available.	- Evaluate fire equipment cabinet maintenance procedures to ensure unauthorized equipment or debris is not stored in fire equipment cabinets.

Required Action**QICO-FLS-17-02:**

Conduct an evaluation of current maintenance practices, including maintenance records and material storage, and establish methods to ensure requirements are clearly defined and adhered to.

(Risk Rating: Elevated) 



ACTION PLAN

Description

PLNT will update existing checklists to ensure fire suppression systems and fire equipment cabinets are tested, inspected, and maintained appropriately. Additionally, PLNT will create system specific checklists that will ensure all FLS system assets are properly tested, inspected, and maintained in accordance with fire suppression codes and standards.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Updated Work Instruction	PLNT will modify the existing fire extinguisher checklist to require inspection of the fire cabinet to ensure proper housekeeping.	PLNT	11/01/17	11/30/17
2) System Specific Checklists	PLNT will revise existing multi-system checklists and create system specific checklists based on the appropriate codes and standards.	PLNT	01/01/18	03/30/18
3) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	04/30/18	06/04/18

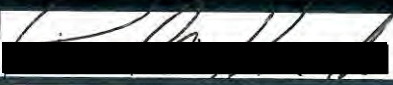
*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.

COMPLETION DOCUMENTATION

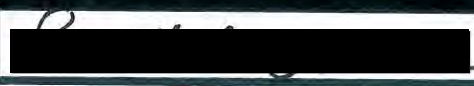
Performance Measures

- 95% signed acknowledgement of new checklists and work instructions of maintenance personnel performing tasks.

RESPONSIBLE PARTIES

PLNT	Paul Kram	 11/6/17
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SECOND LEVEL RESPONSIBILITY

Managing Director	Randall Grooman	 11/6/17
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PARTS AND MATERIALS INVENTORY MANAGEMENT CAPS

[\(Summary of Required Actions\)](#)

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PMIM-17-01.

QICO Finding	QICO Recommendation
F-PMIM-17-01: Effective management of supply chain systems is essential to ensure availability of parts/materials and reduce the number of stockouts.	- Determine a method to implement a Material Requirement Planning (MRP) system while incorporating the fundamental industry standards which will enhance the efficiency and effectiveness of the supply chain process.
Required Action	
QICO-PMIM-17-01: Determine a method to implement a Material Requirement Planning (MRP) system while incorporating the fundamental industry standards which will enhance the efficiency and effectiveness of the supply chain process. (Risk Rating: Elevated) 	

ACTION PLAN

Description

Establish the Governance necessary to implement an ERP system.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Supply Chain Analysis	Conduct an end-to-end analysis of supply chain activities in accordance with industry standards. Identify gaps and areas for an improvement plan.	SCES	11/27/17	5/26/18
2) Centralized Supply Chain	Develop a framework of policies and controls that ensure consistent application of supply chain and storeroom practices throughout WMATA's Operations Department.	SCES	12/1/17	11/30/18
3) Standardize Supply Chain	Develop and implement standard requirements for supply chain activities, to include order processing, receiving, inventory management, reverse logistics, and distribution throughout WMATA's Operations Department	SCES	5/27/17	11/30/18
4) Maintenance Requirements Planning Process	Establish baseline methods for resource planning, including requirements for data entry, forecasting, and ordering processes, clearly-defining the roles and responsibilities of stakeholder departments.	SCES	12/17/17	12/1/18
5) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	09/30/18	11/07/18

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.

COMPLETION DOCUMENTATION

Performance Measures

- 90% of active SCES employee acknowledgement of new standard requirements for supply chain activities in actionable item #3.



RESPONSIBLE PARTIES

SCES

Rodolfo Bitar

SECOND LEVEL RESPONSIBILITY

Managing Director, SSRV

Randall Grooman

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PMIM-17-02.

QICO Finding	QICO Recommendation
F-PMIM-17-02: Accounting for shelf-life limitations of parts and materials is necessary to ensure availability for use.	- Evaluate current material receiving practices and develop methods to ensure items with shelf-life limitations are identified and tracked through the supply chain system. A shelf life policy needs to be developed to ensure incoming products have adequate shelf life prior to entering into stock across the authority.

Required Action

QICO-PMIM-17-02: Evaluate current material receiving practices and develop methods to ensure items with shelf-life limitations are identified and tracked through the supply chain system. A shelf life policy needs to be developed to ensure incoming products have adequate shelf life prior to entering into stock across the authority.

(Risk Rating: Moderate)

ACTION PLAN

Description

Perform an overview of processes related to shelf life/expiration date to assess needs to develop and implement a method to track shelf life/expired items. Identify parts and materials which have shelf life and expiration dates. Develop a method of tracking shelf life/expired material to ensure expired items do not remain in WMATA's inventory and a proper quarantine area is established for these items. Receive acknowledgement from stakeholders receiving parts/materials ensuring WMATA will track shelf life/expired material across the organization. Implement the developed tracking of shelf life/expired material measures.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items		Description	Responsible Party	Estimated Start	Estimated Completion
1)	Evaluation of current shelf life/expiration processes	Perform an overview of processes related to shelf life/expiration date to assess needs to develop and implement a method to track shelf life/expired items. Identify parts and materials which have shelf life and expiration dates.	SCES	10/16/17	12/08/17
2)	Develop tracking measures for shelf life/expired material	Develop a method of tracking shelf life/expired material to ensure expired items do not remain in WMATA's inventory and a proper quarantine area is established for these items.	SCES	11/01/17	02/16/18
3)	Acknowledgement from stakeholders	Receive acknowledgement from stakeholders receiving parts/materials ensuring WMATA will track shelf life/expired material across the organization.	SCES	11/17/17	03/16/18
4)	Implement the tracking of shelf life/expired material	Implement the developed tracking of shelf life/expired material measures.	SCES	03/26/18	07/01/18
5)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	07/01/18	08/29/18

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.



COMPLETION DOCUMENTATION

Performance Measures

- Signature acknowledgements provided by all required stakeholders, as identified under actionable item #3.
- Evidence of material tracking in accordance with requirements established under actionable item #4.

RESPONSIBLE PARTIES

SCES

Rodolfo Bitar

SECOND LEVEL RESPONSIBILITY

Managing Director, SSRV

Randall Grooman

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PMIM-17-03.

QICO Finding	QICO Recommendation
F-PMIM-17-03: Clearly-defined key product characteristics/specifications are required to ensure accurate procurement of parts/materials while enhancing the quality control inspection process.	- Identify parts and materials that require an incoming/receiving inspection for quality control purposes (according to specification and contract requirements) and define specific methods to verify key characteristics of these items.

Required Action

QICO-PMIM-17-03: Identify parts and materials that require an incoming/receiving inspection for quality control purposes and define specific methods to verify key product characteristics of these items.

(Risk Rating: Elevated)

ACTION PLAN

Description

Engineering (herein referred to as the Offices of Engineering and Architecture (ENGA) and Chief Mechanical Officer (CMO)) will identify critical parts/materials which require quality control inspection and the associated key product characteristics (salient) which will be measured for acceptance or rejection upon delivery.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Identify Items Requiring QC Inspection	Engineering departments will identify critical components which require QC inspection upon delivery to the Authority.	ENGA CMO	01/1/2018	8/1/2018
2) Identify Key Product Characteristics	Engineering departments will identify the key product characteristics (salient) associated with critical components which must be measured for acceptance into the Authority upon delivery.	ENGA CMO	03/1/2018	12/15/2018
3) Collaboration of Engineering and MIPN	Engineering will collaborate with the Office of Materials and Inventory Planning (MIPN) to ensure the information of the parts/materials identified and their respective key product characteristics (salient) will be quality control inspected accordingly.	ENGA CMO	5/1/2018	12/15/2018
4) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	1/01/2019	02/28/2019

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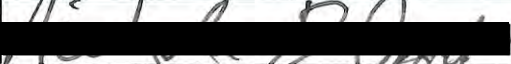
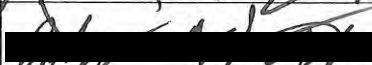
COMPLETION DOCUMENTATION

Performance Measures

- Evidence of a comprehensive critical components and salient characteristics are identified in WMATA's Enterprise Data services in accordance to actionable items 1 and 2.



RESPONSIBLE PARTIES

ENGA	Nicholas Gardner	
CMO	John Doherty	

SECOND LEVEL RESPONSIBILITY

Chief Engineer (DECO)	John D. Thomas	 11.7.18
AGM (RAIL)	Andrew Off	 8 NOV 17

**CORRECTIVE ACTION PLAN****Purpose and Scope**

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PMIM-17-04.

QICO Finding	QICO Recommendation
F-PMIM-17-04: Clear definition of roles, responsibilities, and functions within MIPN is required to ensure activities are carried out consistently and in coordination with other departments.	- Establish governing documentation to define roles and responsibilities for the office of MIPN to ensure clear departmental duties across the supply chain.

Required Action

QICO-PMIM-17-04: Establish governing documentation to define roles and responsibilities for the office of MIPN to ensure clear departmental duties across the supply chain.

(Risk Rating: High) ■

ACTION PLAN

Description

The Office of Material and Inventory Planning (MIPN) will establish governing documentation with emphasis on planning, Pre/Post-Solicitation Management, Material Inspection, Data Management and Maintenance Logistics support.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Approval of Organizational Structure	Approval of MIPN's organizational structure and functions from the RAIL AGM and Chief Operating Officer.	MIPN	12/01/2017	01/31/2018
2) Roles and Responsibilities	MIPN will establish governing documentation defining roles and responsibilities, align job positions to the new org structure, create new Job Descriptions, decision rights, and the collaborated efforts required with RAIL offices, SCES, and PRMT. (Dependency on #1)	MIPN	2/01/2018	7/31/2018
3) Policies and Procedures	MIPN will establish business governing and operating policies, Standard Operating Procedures and Service Level Agreements with and the collaborated efforts required with RAIL offices, SCES, and PRMT	MIPN	8/1/2018	9/30/2018
4) Establish an organizational communication plan to announce newly established policy and inform WMATA staff, stakeholders and end users	The communication plan will ensure effective information sharing of newly established organizational policies to include outreach engineering, maintenance, procurement and supply chain personnel in adoption of new policies. The plan will also include methods, upon adoption, to communicate and inform the wider WMATA community and end users.	MIPN	9/30/2018	11/1/2018
5) Key Performance Indicators	Develop internal key performance indicators (KPI's), based on MIPN's business plan and the Office of RAIL, to measure future performance.	MIPN	10/1/2018	12/31/2018
6) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	1/1/2019	2/28/2019

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.





COMPLETION DOCUMENTATION

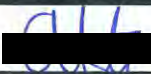
Performance Measures

- Signature approval of MIPN's organization structure and functions as outlined in actionable item 1.
- Signature acknowledgement from 95% of active MIPN personnel of roles, responsibilities, policies and procedures as developed under actionable items 2 and 3.

RESPONSIBLE PARTIES

MIPN	Prasant Bai Reddy	 11/6/2017
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SECOND LEVEL RESPONSIBILITY

AGM RAIL	Andrew Off	 8 Nov 17
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CORRECTIVE ACTION PLAN

Purpose and Scope

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PMIM-17-05.

QICO Finding	QICO Recommendation
F-PMIM-17-05: Requiring the communication of expected delivery dates from suppliers is necessary to improve inventory planning for scheduled maintenance activities.	- Establish and clarify requirements vendors must follow to ensure WMATA has clear supplier promised date and ship date used to update WMATA's data enterprise services.

Required Action

QICO-PMIM-17-05: Establish and clarify requirements vendors must follow to ensure WMATA has clear supplier promised date and ship date used to update WMATA's data enterprise services.

(Risk Rating: Moderate)

ACTION PLAN

Description

Develop/revise procedures for maintaining/updating supplier promise dates on purchase orders within WMATA's data enterprise systems.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items		Description	Responsible Party	Estimated Start	Estimated Completion
1)	Hiring of Procurement Manager	Currently the position is vacant, new hire is expected to start on 11/13/2017.	Suzette Moore	11/13/2017	11/14/2017
2)	Evaluate and Analyze Current Procedures	Perform an overview of current procedures to identify how initial promise dates are determined	Fifi Magiosi	11/13/2017	11/24/2017
3)	Develop Procedure for Promise Date Adjustment	Develop/revise procedure that provides clear direction and communication between suppliers and WMATA procurement regarding adjustment of the promise dates.	Fifi Magiosi	11/27/2017	12/08/2017
4)	Training Procurement Staff	Train all staff on the new/revised procedures and communicate WMATA's expectation to Suppliers.	Fifi Magiosi	12/11/2017	12/15/2017
5)	Implementation of Procedures	Implement the procedures and track/measure compliance as identified in actionable item 3.	Fifi Magiosi	01/02/2018	01/31/2018
6)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	02/01/2018	03/31/2018

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.

COMPLETION DOCUMENTATION

Performance Measures

- 90% of active PRMT employee acknowledgement of training/retraining in actionable item 4.



RESPONSIBLE PARTIES

Deputy Chief
Procurement Officer

Daniel Smith

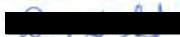


4/13/17

SECOND LEVEL RESPONSIBILITY

Chief Procurement Officer

Suzette Moore



4/13/17

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 20, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PMIM-17-06.

QICO Finding	QICO Recommendation
F-PMIM-17-06: Identifying the reason Purchase Requisitions are aging beyond 30-days is required to maximize efforts to diminish the Procurement PR backlog.	- Procurement must identify and evaluate PR's that have been aging greater than 30 days in order to maximize efficiency and eliminate the continuing growth of the PR backlog.

Required Action

QICO-PMIM-17-06: Procurement must identify and evaluate PR's that have been aging greater than 30 days in order to maximize efficiency and eliminate the continuing growth of the PR backlog.

(Risk Rating: High) ■

ACTION PLAN

Description

Map and Analyze the Purchasing Requisition Process from initial generation to Purchase Order Award in order to identify unnecessary impediments and opportunities to use technology to eliminate them.

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Identify Purchase Requisition Process	Identify steps, systems, positions, and timeframe each Purchasing Requisition touches before it is delivered to the Purchasing Agent for Sourcing Action.	PRMT	11/15/2017	12/01/2017
2) Identify Purchasing Process	Identify all steps and systems a purchasing agent must take to move a Purchase action from the Requisition Stage to the Award Stage.	PRMT	11/20/2017	12/08/2017
3) Analyze Purchase Requisition and Purchasing Process	Analyze the processes mapped in actionable item 1 and 2 to identify areas of improvement, create and develop an implementation plan.	PRMT	12/11/2017	12/15/2017
4) Train Procurement Purchasing Agents	Train or re-train Purchasing Agents on changed/improved processes as identified in actionable item 3.	PRMT	01/02/2018	01/23/2018
5) Technology Changes	Develop and implement a plan based upon the intelligence acquired in actionable items 1 through 3 to make technological changes which reduce or eliminate the need to manually modify Purchasing Requisitions before they are sourced.	PRMT	12/18/2017	03/01/2018
6) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	04/01/2018	05/31/2018

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.

COMPLETION DOCUMENTATION

Performance Measures

- 90% of active PRMT employee acknowledgement of training/retraining in actionable item 4.



RESPONSIBLE PARTIES

Deputy Chief
Procurement Officer

Daniel Smith

[REDACTED]

11/13/17

SECOND LEVEL RESPONSIBILITY

Chief Procurement Officer

Suzette Moore

[REDACTED]

11/13/17

POST-SAFETRACK: ASSESSMENT OF NEXT-LEVEL MAINTENANCE REQUIREMENTS CAPS

[\(Summary of Required Actions\)](#)

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 6, 2017 QICO issued a comprehensive Report from an internal review of Metrorail's Post-SafeTrack: Assessment of Next-Level Maintenance Requirements. This Corrective Action Plan (CAP) has been developed to address the following findings and required action per QICO-STP-17-01.

QICO Finding	QICO Recommendation
F-STP-17-01: There was no specific requirement to develop a complete scope or plan prior to the launch of the emergency SafeTrack program.	- To improve the planning and execution of future maintenance initiatives, establish policy requiring the development of plans and scopes prior to execution of work. This policy should establish the minimum required elements for maintenance program plans to ensure consistency in implementation.
F-STP-17-03: Formal processes are required to govern changes in scope and schedule for Metro's future capital renewal activities.	- To improve control of changes in scope, schedule and implementation of future maintenance initiatives, define clear requirements for change management processes that ensure all impacts to critical areas are reviewed, approved and shared with key project stakeholders.
F-STP-17-05: Identification and classification of program risks (i.e. program delays, material deficiencies, weather, etc.) is essential to effective management and execution of future capital renewal activities.	- To reduce the impact of future program risks, establish a risk management structure to ensure risks and opportunities are identified and analyzed, resulting in response development and continuous monitoring.

Required Action

QICO-STP-17-01: To promote the effective execution of future maintenance initiatives, establish or revise policy to indicate the minimum requirements for program documentation (plan, scope, schedule, etc.) and control mechanisms (change management), including development and approval timelines.

Risk Rating: Elevated ■

ACTION PLAN

Description

F-STP-17-01: MOWE will establish minimum planning requirements to govern future maintenance programs, leveraging asset information to guide planning activities.

F-STP-17-03: MOWE will develop a standard operating procedure regarding a change management process to govern changes during a program for internal stakeholder coordination.

F-STP-17-05: MOWE Work Planning group will establish a process for a closed loop solution at weekly meetings.

Business Impact – Budget/Cost Estimate

Process Execution – A current process/procedure exists that meets the QICO Required Action, but needs to be executed. This type of initiative does not need additional resources.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Maintenance Program Requirements	Define the plan and scope documentation required to initiate a new maintenance program or initiative.	Laura Mason (MOWE)	07/03/17	12/27/17
2) Issue Asset Condition Data SOP	Develop SOP to establish accurate and timely asset condition information & development of associated management reports for MOWE Assets.	Laura Mason (MOWE)	07/03/17	12/27/17
3) Issue Emergency Maintenance Thresholds	Develop SOP that establishes maintenance thresholds and process to communicate and coordinate between MOWE, TRST and TRPM.	Laura Mason (MOWE)	01/01/18	06/28/18
4) Establish Framework for Change Management SOP for Maintenance of Way	SOP for Change Management process for internal stakeholders when changes affect: Revenue Rail Operations; Changes in Program SOW; Track Time and Additional Support from Other Offices	Laura Mason (MOWE)	07/03/17	12/28/17
5) Issue Change Management SOP(s) for Maintenance of Way	- Work with ROCC to amend SOP for requesting RSA - Create SOP for program changes made with associated engineering department's acceptance - Create template which will be required when additional track time is needed to complete work that exceeds initial estimate by more than 25% with justification, (for future forecasting purposes) to be approved by Deputy Chief of MOWE Work Planning - Create SOP to manage a change in scope that will require additional support from other offices. SOP will include flow of communication.	Laura Mason (MOWE)	01/01/18	06/28/18



PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
6) Issue SOP for Risk Management and continuous improvement for MOWE and SOGR Work	MOWE work planning group to establish procedure for closed loop solution at weekly meetings.	Tiffani Rhodes (MOWE Planning)	07/01/17	06/28/18
7) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	06/28/18	07/30/18

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COMPLETION DOCUMENTATION

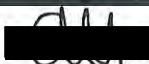
Performance Measures

- Clear definition of required documentation for future maintenance initiatives as detailed in actionable item #1.
- Evidence of change management implementation as specified in actionable item #5.
- Evidence of risk management implementation as described under actionable item #6.

RESPONSIBLE PARTIES

MOWE	Laura Mason	 11/15/17
MOWE Work Planning	Tiffani Rhodes	 11/15/17

SECOND LEVEL RESPONSIBILITY

AGM Rail Services	Andrew Off	 15 NOV 17
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**CORRECTIVE ACTION PLAN****Purpose and Scope**

On October 6, 2017 QICO issued a comprehensive Report from an internal review of Metrorail's Post-SafeTrack: Assessment of Next-Level Maintenance Requirements. This Corrective Action Plan (CAP) has been developed to address the following findings and required action per QICO-STP-17-02.

QICO Finding**QICO Recommendation**

F-STP-17-02: Consistent practices for data capture are necessary to ensure traceability of work completed during future routine maintenance and capital renewal activities.

- To improve the integrity of maintenance records, establish uniform requirements for the use of Maximo in the documentation of work activities, including applicable nomenclature and data fields for traceability.

Required Action

QICO-STP-17-02: To improve the integrity of maintenance records, establish uniform requirements for the use of Maximo in the documentation of work activities, including applicable nomenclature and data fields for traceability.

Risk Rating: Low 

ACTION PLAN

Description

The Reliability Centered Maintenance Planning Group (RCMP) will work with Maintenance-of-Way groups (TRST, TRPM, ATCM) to develop consistent processes for Maximo incidents and work orders, with the goal of establishing consistent fields and improving maintenance planning efforts. *Note that Maintenance-of-Way Engineering (MOWE) is concurrently developing a Maximo Data Business Plan for its responsible unit (TRST) as part of Track Inspection Internal Review CAPS (QICO-TIP-01 through QICO-TIP-04).*

Approved corrective action plans in the QICO 2017 Track Inspection Internal Review (QICO-TIP-01 through QICO-TIP-04) will address deficiencies in the integrity of track defect data provided by daily track inspection groups. These CAPs will establish a track assessment business plan to direct collection, analysis, and storage of data.

Business Impact – Budget/Cost Estimate

This project will be funded with Capital Funds under CIP-139_S12, \$1.1M in funding to hire the additional consultant support necessary to support RCMP.

PLAN STRUCTURE

Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1) Issue Task Order Contract	Issue a task order utilizing an existing IT contract and hire additional Business Analysts to support RCMP.	Francesco Palmeri (RCMP)	09/01/17	12/27/17
2) Develop a Maximo Work Order Usage policy for Track and Structures (TRST)	Develop a consistent process for Maximo incidents and work orders to establish consistent fields and assist MOWE in maintenance planning efforts.	Francesco Palmeri (RCMP)	12/15/17	04/05/18
3) Develop a Maximo Work Order Usage policy for Traction Power Maintenance (TRPM)	Develop a consistent process for Maximo incidents and work orders to establish consistent fields and assist MOWE in maintenance planning efforts.	Francesco Palmeri (RCMP)	12/15/17	02/05/18
4) Develop a Maximo Work Order Usage policy for Automatic Train Control Maintenance (ATCM)	Develop a consistent process for Maximo incidents and work orders to establish consistent fields and assist MOWE in maintenance planning efforts.	Francesco Palmeri (RCMP)	12/15/17	04/05/18
5) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	04/05/18	05/07/18

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COMPLETION DOCUMENTATION

Performance Measures

- 90% of active TRST, TRPM, ATCM, & MOC (Maintenance Operations Control) personnel responsible for entering Maximo incident and work order data provide signature acknowledgement of updated usage policies as developed under actionable items #2, 3, & 4.
- Evidence of implementation and compliance with Maximo usage policies as developed under actionable items #2, 3, & 4.

RESPONSIBLE PARTIES

RCMP

Francesco Palmeri

*On behalf of
RCMP*

SECOND LEVEL RESPONSIBILITY

AGM Rail Services

Andrew Off

15 Nov 17

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 6, 2017 QICO issued a comprehensive Report from an internal review of Metrorail's Post-SafeTrack: Assessment of Next-Level Maintenance Requirements. This Corrective Action Plan (CAP) has been developed to address the following findings and required action per QICO-STP-17-02.

QICO Finding	QICO Recommendation
F-STP-17-04: Quality control measures are necessary to consistently identify and correct material deficiencies future routine maintenance and capital renewal activities.	- To improve the quality and execution of future maintenance initiatives, establish formal quality control measures for use in corrective maintenance and rehabilitation activities that ensure identification and remediation of deficiencies prior to returning assets to passenger service.

Required Action

QICO-STP-17-03: To improve the quality and execution of future maintenance initiatives, establish formal quality control measures for use in corrective maintenance and rehabilitation activities that ensure identification and remediation of deficiencies prior to returning assets to passenger service.

Risk Rating: Medium



ACTION PLAN

Description

Establish quality control measures for all maintenance groups within Rail Services to ensure that discrepancies in workmanship or material quality are identified and corrected prior to returning assets to revenue service

Business Impact – Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process.

PLAN STRUCTURE

Actionable Items	Description	Responsible Party	Estimated Start	Estimated Completion
1) ATCM Maintenance Control Policy	Update Maintenance Control Policy, making specific references to different methods used in preventative and corrective/remedial maintenance activities.	Michael Cooper (ATCM)	09/01/17	12/27/17
2) TRST Maintenance Control Policy Update	Update Maintenance Control Policy, making specific references to different methods used in preventative and corrective/remedial maintenance activities.	Mike Davis (TRST)	09/01/17	12/27/17
3) TRPM Maintenance Control Policy Update	Update Maintenance Control Policy making specific references to different methods used in preventative and corrective/remedial maintenance activities.	Mike Hass (TRPM)	09/01/17	12/27/17
4) QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	12/21/17	01/24/18

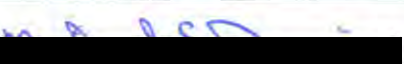
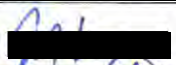
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COMPLETION DOCUMENTATION

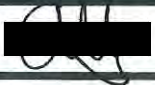
Performance Measures

- 100% of active supervisory personnel under TRST, TRPM, & ATCM provide signature acknowledgement of updated practices as prescribed in actionable items #1, 2, & 3.

RESPONSIBLE PARTIES

TRST	Mike Davis	 11-15-17
TRPM	Mike Hass	 11/15/17
ATCM	Michael Cooper	 11/15/2017

SECOND LEVEL RESPONSIBILITY

AGM Rail Services	Andrew Off	 15 NOV 17
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SUPPLEMENTAL MATERIALS

APPENDIX A: REVIEW CRITERIA AND RISK ASSESSMENT

INTERNAL REVIEW CRITERIA

Quality Measures		Definition
Compliance with Standards	Business Practices	The existence of sufficient, necessary, and/or compliant policies, procedures, work instructions, requirements, and training programs to define departmental activities and processes. This may include determination that existing practices fall short of, or exceed, industry standard practices and/or regulatory requirements.
	Procedural Requirements	Adherence to, or non-compliance with, existing/adopted procedures applicable to work activities (e.g. Standard Operating Procedures, Administrative Procedures, Work Instructions, MSRPH, etc.).
	Technical Specifications	Adherence to, or non-compliance with, applicable engineering or other technical requirements that specify material and/or workmanship standards. This includes assessment of the applicability of operational and maintenance procedures/processes, and instances of asset modification as they relate to governing engineering documentation.
	Applicable Job Safety Requirements	The existence of, and/or adherence to, safety requirements applicable to specific work performed, including those established by enterprise-wide governing standards (e.g. MSRPH, RWPM, etc.) or those specific to a particular type of work (e.g. PPE).
Quality of Work	Performance of Work	Objective determination of whether actions taken to complete work were performed effectively and in accordance with applicable standards. This may include either the assessment of individual work activities and/or the assessment of aggregated work over a period of time or across multiple locations.
	Quality Control Measures	The existence of, and/or effectiveness/adequacy of, internal management controls that ensure the consistency and reliability of work performed.
	Materials and Tooling	Availability of the correct and approved materials and/or tooling necessary to perform work, including currently calibrated equipment, and materials/parts that are compliant with specifications and within lifecycle requirements (not-expired).
	Housekeeping	The overall assessment of conditions at work sites, i.e. the organization and cleanliness of work zones, facilities and repair shops.
Records Management	Work Order Management	Assessment of the protocols, standards, and practices in place to control the scheduling, documentation, and tracking of work activities performed on assets.
	Document Control	Assessment of the protocols, standards, and practices in place to control authoritative version-control, ownership, and dissemination of business-critical documents; including, but not limited to, policies, procedures, work instructions, material/asset specifications, safety/data sheets, etc.
	Records Storage and Retention	Assessment of the protocols, standards, and practices in place to control the storage and catalog of defined records and/or documentation for specified periods of time, to be available for later retrieval and/or archive.

RISK ASSESSMENT SUMMARY

Note: Required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale.

Definitions

Insignificant	Low	Moderate	Elevated	High
Reasonable assumption that this risk will not occur and unlikely to cause the activity to fail to meet part of its objective.	Reasonable assumption that this risk will likely not occur & may cause a failure of the business process to meet part of its objectives.	Reasonable assumption that this risk may occur & may cause a failure of the business process to meet a significant part of its objectives.	Reasonable assumption that this risk will likely occur & likely to cause a failure of the business process to meet a significant part of its objectives.	Reasonable assumption that this will occur & will cause a failure of the business process to meet its objectives or cause objective failure in other activities.

RISK ASSESSMENT

Risk Assessment Methodology

Risk is defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on the organization's objectives and operations (both threats and opportunities). It is assessed on the combination of the probability of occurrence of risk and the severity of the risk. Risk management is an attempt to answer the following questions:

- What can go wrong? – The Risk
- How often does/will it happen? – The Probability of Occurrence
- How bad are the consequences? – The Impact
- Is the risk acceptable? – The Risk Treatment, Remediation

Categories of Risk

- *Service Delivery* – A broad range of risks with direct or indirect impact on daily transit and / or business operations. The risk of direct or indirect losses or other negative effects due to inadequate or failed internal business or transit operations, or from external events that impair internal processes, people, or systems.
- *Financial* – The risk to achievement of the Authority's mission arising from an inability to manage credit, debt and financial leverage, and other financial resources. Financial risk would also include risk arising from adverse movements in market rates or the Authority's inability to meet its obligations.
- *Legal & Compliance* – Risks arising from a failure to comply with applicable laws and regulations and a failure to detect and report activities that are not compliant with statutory, regulatory, or internal policy requirements. Failure to comply with prescribed guidelines and established practices. This would also include a lack of awareness or ignorance of the relevant standards, guidelines or regulations.
- *Reputation* – The risk to the achievement of the Authority's mission arising from negative internal or external stakeholder opinion. Reputation risk affects the Authority's ability to establish new and /or sustain existing relationships.
- *Safety* - The risk of achievement of the Authority's mission arising from failures to prevent hazards that may cause harm to human, equipment, or the environment. This would also include risk arising from the Authority's inability to comply with safety-related legal or regulatory standards.
- *Strategic* – Risks arising from failure to achieve strategic or tactical objectives, an adverse business decision, or a lack of strategic direction and leadership. This would also include the ineffective implementation of the strategic plans, a lack of business strategies developed to achieve goals, and inadequate resources deployed against the achievement of those goals. Strategic risks can be affected by changes in the political environment such as changes in administration and resulting changes in strategic priorities. Strategic risks can also be triggered by actions of key stakeholders such as the Tri-Jurisdictional law makers or the Federal Transit Authority (FTA).
- *Technology* – The risk of unexpected losses from inadequate systems, breaches in information technology security, and inadequate business continuity planning. This would also include risks to the achievement of the Authority's mission arising from the inability of networks, security, and technologies to meet Metro's evolving needs.

Risk Assessment

The following risk matrix (Figure 1) was used to assess risks within the universe of review areas. The universe (see Table 1) is comprised of the potential range of all review activities and review business units (or departments) that fall within QICO's scope and oversight authority. These business units consist of programs, processes, assets and people which together contribute to the fulfilment of the departments' strategic goals (Goal 1 - Build Safety Culture; Goal 2 - Deliver Quality Service; Goal 3 - Improve Regional Mobility; and Goal 4 - Ensure Fiscal Stability).

Risks are assessed based on the probability of occurrence (see vertical axis in Figure 1) and the significance of their impact (see horizontal axis in Figure 1). The probability ratings are rated on a scale of 1 (minimum) to 5 (maximum) and are driven by the metrics shown on the next page. The impacts ratings are also rated on a scale of 1 (minimum) to 5 (maximum) and are driven by the category of risks, which are then aligned on the metrics shown on the next page.

Each finding is given a severity rating of Insignificant, Low, Moderate, Elevated or High. All areas with Elevated / High ratings are considered to be high risk to the organization's objectives; and need to be mitigated/ reduced in severity at the earliest. The risk ratings to the findings are provided as "Type of Risk" followed by "Severity Rating (Impact, Probability)" (e.g. a finding with "Elevated (4,3)" would mean a 'significant (4)' impact along with a 'possible (3)' probability of occurrence).

RISK ASSESSMENT

Risk Assessment Methodology

Figure 1: Risk Assessment Matrix					
Almost Certain (5)	↑ Probability of Occurrence ↓	Low	Moderate	Elevated	High
Likely (4)		Low	Low	Moderate	Elevated
Possible (3)		Low	Low	Moderate	Elevated
Unlikely (2)		Insignificant	Low	Low	Moderate
Rare (1)		Insignificant	Insignificant	Low	Moderate
Probability		← Potential Impact of Risk →			
Impact		Negligible (1)	Minor (2)	Moderate (3)	Significant (4)
					Major (5)

Probability of Occurrence of Risk Events Defined

Rare | 1 – Reasonable assumption that this risk will not occur

Likely | 4 – Reasonable assumption that this risk will likely occur

Unlikely | 2 – Reasonable assumption that this risk will likely not occur

Almost Certain | 5 – Reasonable assumption that this will occur

Possible | 3 – Reasonable assumption that this risk may occur

Potential Impact of Risk Events Defined

Negligible | 1 – Unlikely to cause the activity to fail to meet part of its objectives.

Minor | 2 – May cause a failure of the business process to meet part of its objectives, which may expose Metro to minor financial losses, less- effective or efficient operations, some non- compliance with laws and regulations, waste of resources, etc.

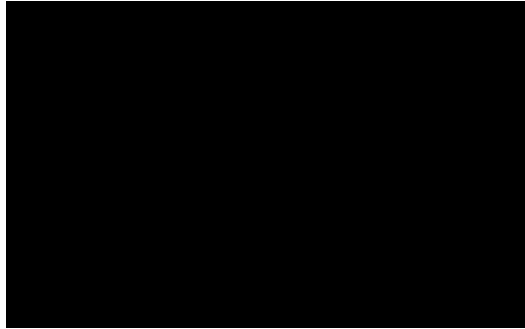
Moderate | 3 – May cause a failure of the business process to meet a significant part of its objectives, or negatively impact the objectives of other activities, which may expose Metro to moderate financial losses, reductions to or ineffectiveness of operations, non- compliance with laws and regulations, sizable waste of resources, etc.

Significant | 4 – Likely to cause a failure of the business process to meet a significant part of its objectives, or negatively impact the objectives of other activities, which may expose Metro to significant financial losses, reductions to or ineffectiveness of operations, non-compliance with laws and regulations, sizable waste of resources, etc.

Major | 5 – Will cause a failure of the business process to meet its objectives, or cause objective failure in other activities, which may cause or expose Metro to major financial losses, interruptions in operations, failure to comply with laws and regulations, major waste of resources, failure to achieve stated goals, etc.

APPENDIX B: DEFINITIONS

DEFINITIONS

Terms and Description	Photos
Administrative Lead Time The time it takes from the date a Purchase Request is created to the date the purchase order is issued to the vendor.	
Air Release Valve An automatic device that allows rapid evacuation of water when water is introduced into an empty piping system, such as dry standpipe. Once the water reaches the valve it closes automatically to prevent water from escaping.	
Automatic Train Control (ATC) Automatic Train Control (ATC) is a general class of train protection systems for railways that involves a speed control mechanism in response to external inputs. At WMATA, ATC is comprised of three subsystems: Automatic Train Protection (ATP), Automatic Train Operation (ATO), and Automatic Train Supervision (ATS).	
Automatic Train Operation (ATO) The Automatic Train Operation (ATO) System is that part of the ATC System which provides automatic train stopping and starting at passenger station platforms and provides speed control compensation for varying conditions of grade and curvature. The programmed station stop speed profile is generated in the train based on proximity sensors in the track wayside that signal to the train the presence of and distance to an upcoming station platform. As a train approaches a station, ATC data are supplemented with data from a wayside marker system (part of the ATO subsystem).	

DEFINITIONS

Terms and Description

Photos

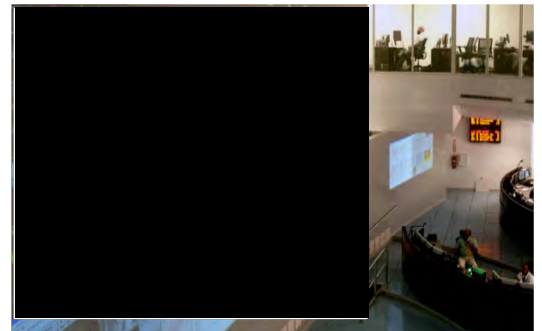
Automatic Train Protection (ATP)

The Automatic Train Protection (ATP) System is that part of the ATC System whose primary purpose is to maintain train separation through the Automatic Block Signalling System and issue limiting speed commands. These commands are generated by the local Train Control Room (TCR).



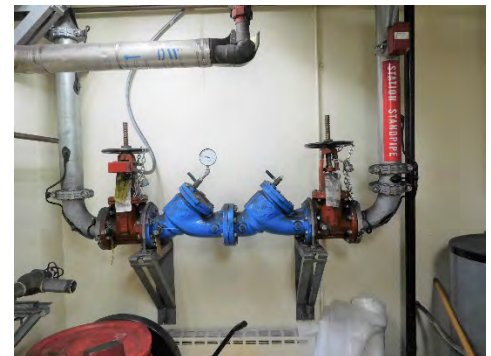
Automatic Train Supervision (ATS)

The ATS system is designed to control train routing and scheduling. Scheduling is accomplished first by automatic equipment at the wayside, then, second, by computer programs at the OCC, which are automatically triggered when necessary to provide for minor schedule adjustments to maintain traffic flow and scheduling.



Backflow Preventer (BFP)

A device to prevent water flow back to the source (water main) to prevent cross-contamination. BFP must consist at a minimum of two (2) check valves installed in series. Shut off valve on both ends are also usually provided to facilitate BFP maintenance.



Ballasted Track

Track structure consisting of ballast (rock), timber ties, and tie-plates clipped to the running rails.



DEFINITIONS

Terms and Description

Photos

Balustrade

The balustrade is the support structure for the escalator handrails. In the Metrorail system there are metal (left) and glass (right) type balustrades. Metal balustrades are more robust and allow for escalator wiring and components to run through them making for easier maintenance. Escalators with a glass balustrade have all the wiring and components running beneath the surface structure of the unit making maintenance more difficult.



Bid

The response submitted by a bidder to an Invitation for Bid ("IFB") or to a multi-step bid. Sometimes the complete bid document may be referred to as "the bid." The response to a Request for Proposal ("RFP") is called a proposal.



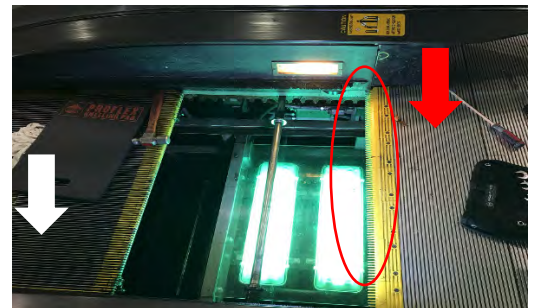
Bill of Material (BOM)

A listing of subassemblies, parts and materials that go into a parent assembly, showing the quantity of each that is required to repair, overhaul or manufacture an assembly.



Comb Plate

Comb plates (red circle) are found at the ends of the stationary floor plate (red arrow) that leads into the moving escalator steps (white arrow). They are often painted yellow for increased visibility. The comb plate and steps interlock to minimize the spacing between the moving steps and stationary floor plate. Minimizing this space prevents objects and people from becoming caught. Comb impact testing is done to verify the required forces to shut down the escalator are within tolerance (taken as comb impact readings) ensuring proper escalator functionality.

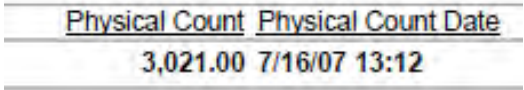


Contact Rail (Third Rail)

The Contact Rail is an electrical conductor for the purpose of supplying 750 VDC traction power to railcars. It is sometimes referred to as the "Third Rail." Shown to the right is the contact rail, the contact rail coverboard assembly, and contact rail heater tape, which is installed and activated to de-ice certain segments of contact rail (outdoor areas with steep grade).



DEFINITIONS

Terms and Description	Photos
Corrective Maintenance Maintenance which is carried out after "failure" of an asset and is aimed at restoring an asset to a condition in which it can perform its intended function reliably (state of good repair). With regards to track, "failure" refers to both defective components and track geometry outside of tolerances set forth within governing maintenance documentation (e.g. TRST-1000). Note that "Emergency Maintenance" is an extreme form of corrective maintenance, requiring track be taken out of service.	
Chain Marker (CM) WMATA's rail system consists of 234+ miles of mainline track, almost half of which is underground. Chain makers answer the question: "How many feet are we from the start of the track?" from a known starting location. For example, B2 132+00 is 13,200 feet from the starting point of track B2.	
Cycle Count An inventory counting process where a percentage of the inventory items are counted over a designated time period, such as daily, monthly or annually. These periods of time are determined by the usage of an item. The more it is used the more it is counted.	
Defect (Rail) Cracks or defects can develop and grow internally in the rail from the repetition of wheel loads rolling over the rail, or metal fatigue. One of the most common rail defects caused by metal fatigue is called the detail fracture, which originates in the upper gauge corner of the rail head near the running surface.	

DEFINITIONS

Terms and Description

Demand

The request is made at a storeroom for an item that has previously been accepted as an inventory tem and has been entered into Maximo using a PAF. D3emands may be made at a satellite storeroom or at MSF. It is possible to categorize demands as "recurring" (used by Maxmio for storeroom stockage level calculations) or "non-recurring" (a special one-time requirement that is not included in the storeroom stockage level calculations.) A history of demands is displayed for each stocking storeroom on the 24 month demand screen in Maximo.

Photos



Direct Fixation Track

Unlike ballasted track, direct fixation uses elastomer fasteners to secure the running rails to a concrete slab (through the grout pad). Typical of tunneled and aerial Metrorail track.



Direct Fixation Fastener

A track superstructure component that transfers vertical, lateral, and longitudinal forces from the running rails to the stiffer concrete slab below, while providing some deflection for mitigating impact forces. Shown to the right are typical "F-20" fasteners. As stated in WMATA's Track Inspection and Maintenance Manual (WMATA-1000 Revision 6, January 2015), fasteners are spaced at 30" on direct fixation track (Section 7.1). In practice, fasteners are often spaced less than 30".

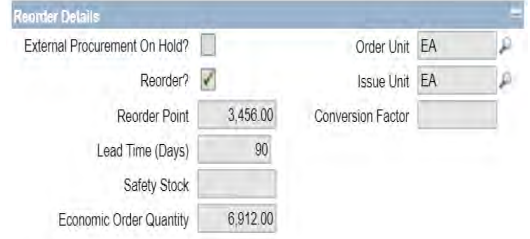
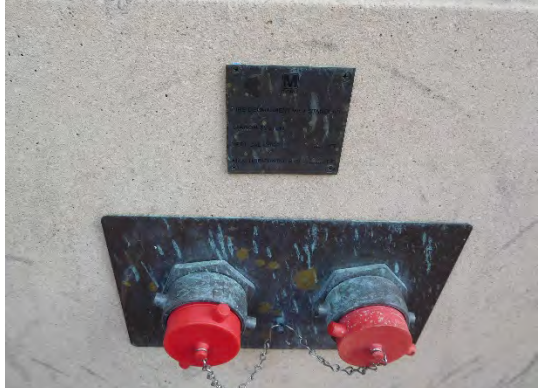


Dry Pipe Fire Riser (Dry System Riser)

Usually vertical piping arrangement consisting of UL Listed and FM Global approved quick opening control valve, pressure gauges, water supply piping, fire department connection supply piping, compressed air piping and air compressor, drainage piping, test and shut-off valves, etc. for the purpose of providing water into normally dry distribution piping upon the loss of internal piping air pressure and/or additional control devices.



DEFINITIONS

Terms and Description	Photos
Economic Order Quantity (EOQ) Calculated inventory measure to establish the quantity which will be reordered when a reorder point threshold is met.	
Emergency Corrective Maintenance Corrective maintenance initiated through an incident, requiring reduced performance or removal of track from service to remediate issues. Typically occurs from defect clustering (e.g. consecutive broken grout pads), tolerance issues with track geometry (e.g. wide gauge), or other events (e.g. electrical tracking).	
Fire Department Connection (FDC) – Wall Mounted FDC is a hose attachment device connected to the fire water supply system, for use by the firefighters during a fire emergency. Firefighters will connect appropriate size hoses from the fire pumper truck or directly from the street hydrant. The intent is to introduce additional water volume as required, and to pressurize the interior fire suppression piping inside the building. FDC are used for standpipe and for sprinkler systems.	
Fire Department Connection (FDC) – Free Standing FDC is a hose attachment device connected to the fire water supply system, for use by the firefighters during a fire emergency. Firefighters will connect appropriate size hoses from the fire pumper truck or directly from the street hydrant. The intent is to introduce additional water volume as required, and to pressurize the interior fire suppression piping inside the building. FDC are used for standpipe and for sprinkler systems.	

DEFINITIONS

Terms and Description	Photos
Fire Department Connection (FDC) – Wall Mounted (Standpipe and Sprinkler) FDC is a hose attachment device connected to the fire water supply system, for use by the firefighters during a fire emergency. Firefighters will connect appropriate size hoses from the fire pumper truck or directly from the street hydrant. The intent is to introduce additional water volume as required, and to pressurize the interior fire suppression piping inside the building. FDC are used for standpipe and for sprinkler systems.	
Fire Pump A pump meeting strict fire protection criteria as to the type of construction, performance and reliability used to boost incoming water pressure to meet fire suppression pressure criteria.	
Flow Test Code mandated periodic fire pump or any other system water discharge test. Fire pump flows are usually discharged to the closest available drain due to the large volume of water.	

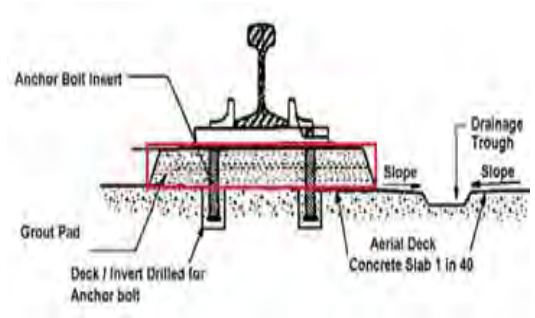
DEFINITIONS

Terms and Description

Photos

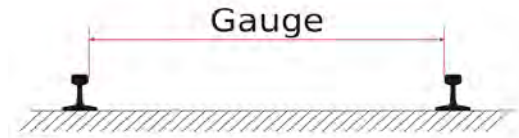
Grout Pad

In Metrorail direct fixation (concrete slab) track, rail fasteners sit upon grout pads, typically 2" in depth and up to 20 feet in length. Grout pads act as a leveling course between the underside of the fastener and the reinforced concrete deck (or invert) below; anchor bolts anchor the fastener, through the grout pad, to better anchoring conditions in the reinforced concrete deck/invert, designed to meet specific elevation and angle of design specifications. Remediated grout pads mixtures consist of repair mortar, pea-gravel and water, mixed in accordance with manufacturer's specifications with tolerances for workability.



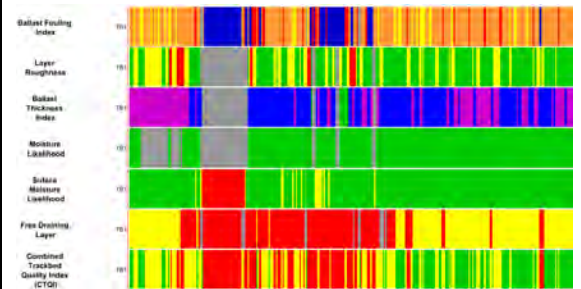
Gauge

Track gauge is distance between inside faces of rail. It is measured between the heads of the rails at right-angles to the rails in a plane 5/8". Standard gauge is 56.5 in = 4' 8 1/2" = 1435 mm. On tangent track, WMATA runs narrow (56.25 in), opening out to standard in tight radius curves (r<1425-ft).



Ground Penetrating Radar (GPR)

Ground Penetrating Radar uses radar pulses to scan integrity issues with the Track Substructure (Ballast, Sub-ballast, and the interface with the Subgrade). Six different metrics are scanned (ballast fouling, layer roughness, ballast thickness, moisture likelihood, surface moisture, free draining layer rating) and averaged into a Combined Trackbed Quality Index (CTQI).



Handrail

Handrails (red arrows) provide support for passengers to hold onto while riding an escalator. Handrails are pulled along at the same speed as the steps via a chain connected to the main drive gear and a series of pulleys.



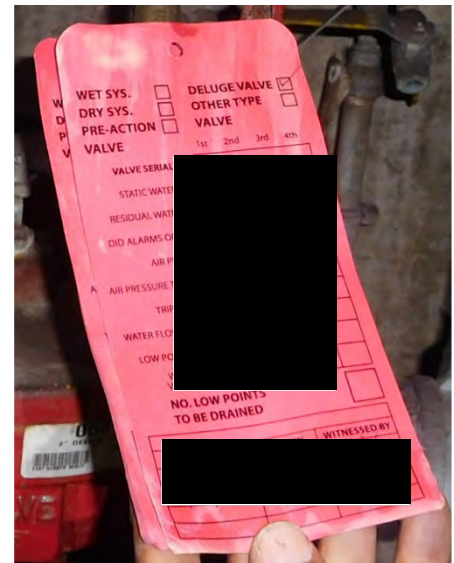
DEFINITIONS

Terms and Description

Photos

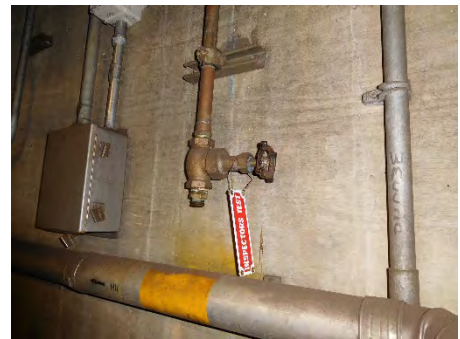
Inspection Tag

Inspection tags are used for inspection recordkeeping purposes. They are used on fire extinguishers and any other for fighting device requiring periodic inspection.



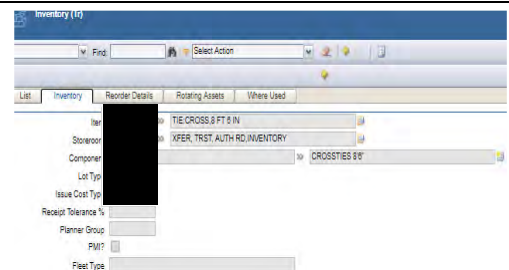
Inspector Test Connection

The valve and hose outlet is used for periodic testing of wet sprinkler system. The hose outlet may have a calibrated orifice or a test hose with a calibrated outlet may be used to simulate discharge from a single sprinkler head, typically 20 GPM. The inspector test connection is located at the most remote location from a system riser.



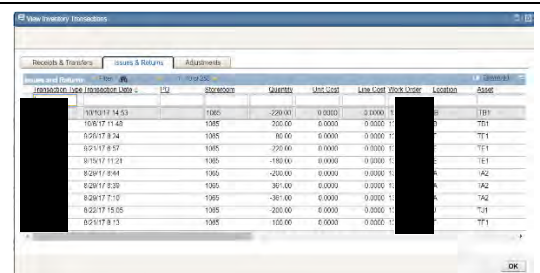
Inventory

All goods, materials and supplies used to support the business and the activities of the Authority.



Issue

The act of giving an item to a customer to meet the need requested from a storeroom.



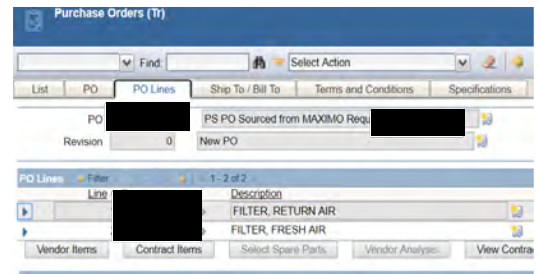
DEFINITIONS

Terms and Description

Line Item

One item on an order regardless of the quantity of that item requested.

Photos



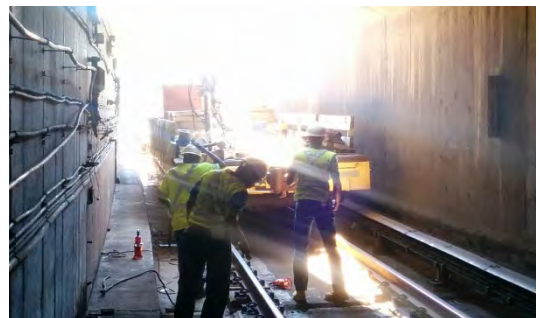
Lock Out - Tag Out (LOTO)

LOTO is a safety procedure used to remove power from equipment that is being temporarily taken off line for maintenance. OSHA 1910.147 governs the proper procedure when performing LOTO.



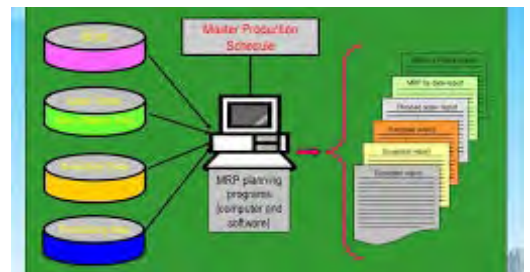
Maintenance-of-Way Engineering (MOWE)

MOWE leads three initiatives: Track Engineering, Traction Power Operations Engineering and Work Planning. MOWE reports to the Assistant General Manager of Rail Services (RAIL).



Material Requirement Planning (MRP)

A production planning and inventory control system. An MRP integrates data from production schedules with that from inventory and the bill of materials (BOM) to calculate purchasing and shipping schedules for the parts or components required to build a product.



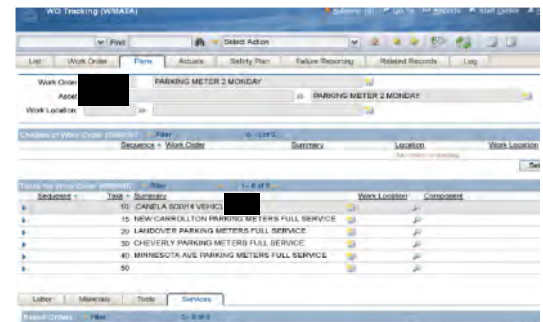
DEFINITIONS

Terms and Description

Maximo

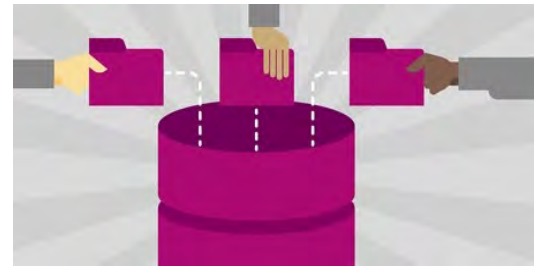
Maximo is WMATA's enterprise asset management (EAM) system used for work order, incident, and track defect tracking. Maximo Work Orders (WO) specify one or more particular tasks and the labor, materials, services, and tools associated with each task.

Photos



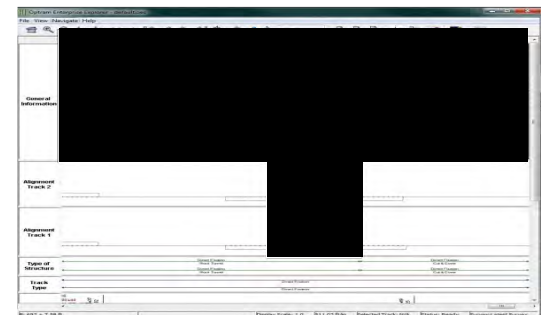
Obsolete Items

Items for which there is no foreseeable need because they are technically obsolete as determined by appropriate technical specialists. They may have also been rendered obsolete because the system(s) they were used on have been phased out.



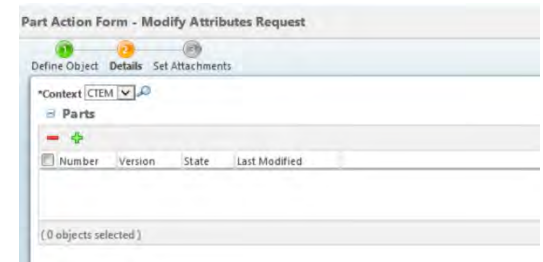
Optram

Optram is a track and structures linear asset viewer. It shows track alignment, stationing, type of structure, vertical and horizontal profiles, traction power zones, train control circuits, and historical as-built drawings for the entire Metrorail system. Work order history from Maximo is imported as well as track geometry vehicle data to aid track maintenance and engineering planning.



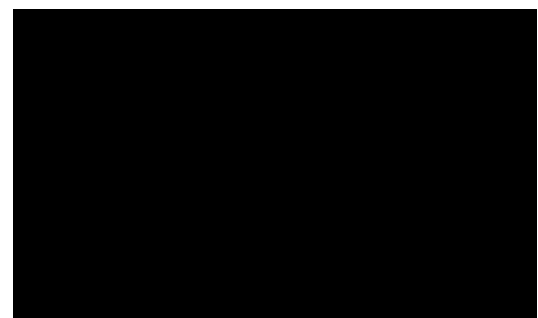
Parts Action Form (PAF)

The electronic form used to create, delete, or update an inventory item.

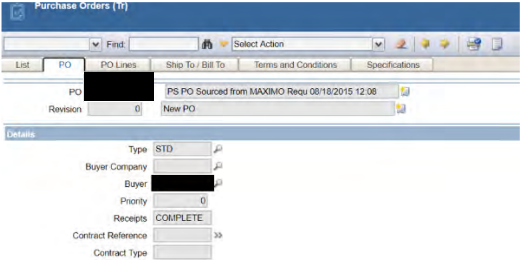


Pigtails and Contact Rail Boots

Traction power is delivered from Traction Power Substations (TPSS) to sections of third rail (contact rail) through traction power cables, which often are buried in conduit along the track. The cables exit the ground through "stub-ups." Contact rail boots (orange boots) turn the cabling 90 degrees and "pig tail" cabling connects to the third rail.



DEFINITIONS

Terms and Description	Photos
Portable Fire Extinguisher (FE) A portable fire fighting device operated by hand, containing an appropriate fire extinguishing agent that can be expelled under pressure for the purpose of suppressing or extinguishing a fire.	
Pressure Gauges Pressure gauge is a device for a visual display of the pipe or container interior pressure, commonly calibrated in PSIG (pounds per square inch gauge)	
Preventative Maintenance The care and servicing by qualified personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. A typical track example would be performing rail grinding to remove defects in the head of the running rails before they propagate to a dangerous size.	
Procurement Lead Time The time between the dates a Purchasing Agent receives a customer order (either non-stock requisition or a PR) and when the order is awarded. It is used as a measure of efficiency within the purchasing group.	
Purchase Order (PO) purchaser's written documentation to a vendor formalizing all the terms and conditions of a proposed transaction, such as a description of the requested items, delivery schedule, terms of payment, and transportation	

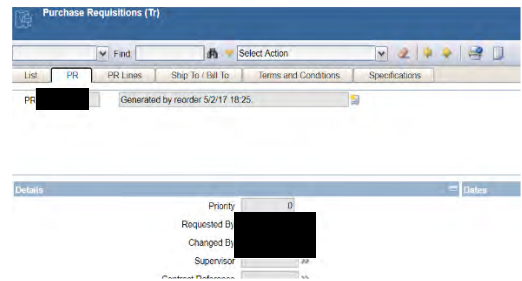
DEFINITIONS

Terms and Description

Purchase Request (PR)

PR's are automatically produced by Maximo when an inventory item has reached its reorder point (ROP) at the main storeroom. PR's are reviewed by an inventory planner and are then routed to a buyer to purchase the item.

Photos



Qualified Products List (QPL)

A list of products or families of products that have successfully completed the formal qualification process (including all specified periodic tests) that examines tests and verifies a specific product design meets all the applicable specification requirements.



Quality Assurance, Internal Compliance & Oversight (QICO)

QICO provides objective review of WMATA operational and engineering processes and assets; promotes and coordinates the implementation of compliance with internal and external regulatory requirements; furthers quality improvement initiatives and action plans that are data driven and results-centric with the objective of safeguarding the mission success of the agency while enhancing the customer experience.



Quality Assurance (QA)

Quality Assurance is the 2nd level of defense for ensuring quality. This includes identifying contradictions or omissions in governing documentation (e.g. lack of grout testing requirements), internally reviewing SafeTrack's quality control functions (e.g. checking TRST's QC coverage of surge activities), and performing spot-assessments throughout the SafeTrack surge in an oversight capacity.



DEFINITIONS

Terms and Description

Photos

Quality Control (QC)

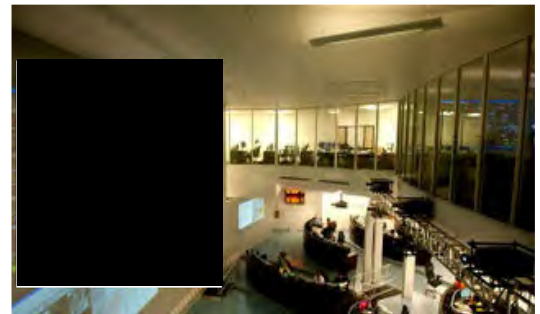
Quality control is the first line of defense for ensuring quality of work is performed in accordance with practices defined in maintenance and inspection policies (beyond asset maintainers checking their own work). As an example, Track and Structures (TRST) has a separate quality control group from the group performing track renewal. This group follows up after work has been completed and checks track geometry parameters (e.g. gauge) and flags unacceptable work.



Rail Operations Control Center (ROCC)

Train operations on the Metrorail system are carried out under the authority and supervision of the Rail Operations Control Center (ROCC), located at Carmen Turner Facility (CTF).

Maintenance Operations Control (MOC) handles the dispatching of emergency maintenance teams; for track, this includes handling emergency maintenance for speed restrictions, reporting to ROCC.



Reorder Point (ROP)

The inventory level establish in Maximo such that when inventory levels drop below the reorder point, a purchase request is generated to replenish the stock. If the reorder point is reached at a satellite storeroom, an internal purchase request will be generated for a request from the main storeroom (MSF) to replenish the stock at the satellite storeroom.

Reorder Details	
External Procurement On Hold?	☐
Reorder?	☒
Reorder Point	3,456.00
Lead Time (Days)	90
Safety Stock	
Economic Order Quantity	6,912.00
Order Unit	EA
Issue Unit	EA
Conversion Factor	

Safety Stock

A quantity of an item planned to be in inventory to protect against fluctuations in demand and/or supply.

Reorder Details	
External Procurement On Hold?	☐
Reorder?	☒
Reorder Point	3,456.00
Lead Time (Days)	90
Safety Stock	
Economic Order Quantity	6,912.00
Order Unit	EA
Issue Unit	EA
Conversion Factor	

Satellite Storeroom

A storeroom location that contains items that are frequently requested by customers in its proximity. These storerooms are designated as retail stores and are provided for direct issue capability in response to a customer. Metro Supply Facility (MSF-400) is the main supply facility.

	Storeroom Bladensburg Shop
	Storeroom Bladensburg Garage
	Storeroom Landover Garage
	Storeroom Northern Garage
	Storeroom Southeast Garage
	Storeroom Four Mile Run Garage
	Storeroom Western Garage
	OBS, DO NOT USE
	Storeroom Arlington Garage
	Storeroom Southern Avenue Garage
	Storeroom L'enfant Plaza
	Storeroom Greenbelt Shop
	Storeroom New Carrollton Yard
	Storeroom Plant Maintenance Shop
	Storeroom New Carrollton Regional

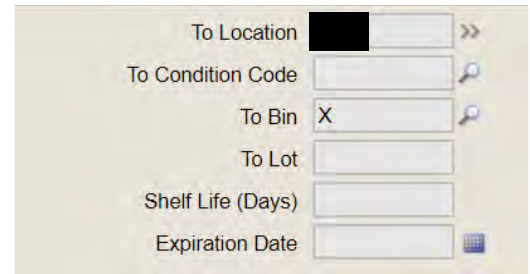
DEFINITIONS

Terms and Description

Shelf Life

The amount of time an item may be held in inventory before it becomes unusable for its intended purpose.

Photos



A screenshot of a software interface for inventory management. It features several input fields with labels: 'To Location' (with a dropdown arrow), 'To Condition Code' (with a magnifying glass icon), 'To Bin' (with a dropdown arrow and the letter 'X' entered), 'To Lot' (with a dropdown arrow), 'Shelf Life (Days)' (with a text input field), and 'Expiration Date' (with a calendar icon). The background is a light beige color.

Serviceability

There are three categories of 'limited states' for track and structures; serviceable, damaged and failed. This methodology is adapted to define three (3) distinct "operational" conditions that define the state of transit track structure at any time - Green (3), Yellow (2) and Red (1). Each color-coded condition assessment represents the prioritized order in which the corrective action(s) is performed. The fourth category prohibits service over an affected area and is described as Black (0) which represents an out of service condition.



Special Trackwork

Broadly speaking, special trackwork refers to any non-standard track arrangement. A "standard" cross section of track would involve two running rails (possibly with a guard rail or restraining rail) with ballasted or direct fixation fastening systems. At Metrorail, "switch", "turnout", "crossover", and "interlocking" are generally interchangeable special trackwork terms, although strictly refer to different things. Switches with sharper turns (No. 8 and below) have extra guard rails ("guarded" vs "unguarded") for derailment prevention.



Special Trackwork: Double Crossover

A crossover connects two parallel rail tracks, allowing a train on one track to cross to the other. Two crossovers can be arranged to allow for trains to crossover seamlessly to the other track regardless of direction of travel. A "double crossover" at Metrorail is typically used to refer to two crossovers that intersect, with a "crossing diamond" at the center.



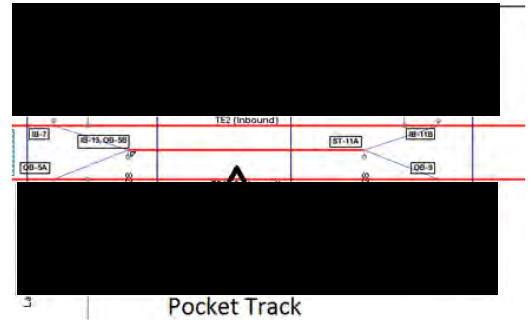
DEFINITIONS

Terms and Description

Special Trackwork: Pocket Track

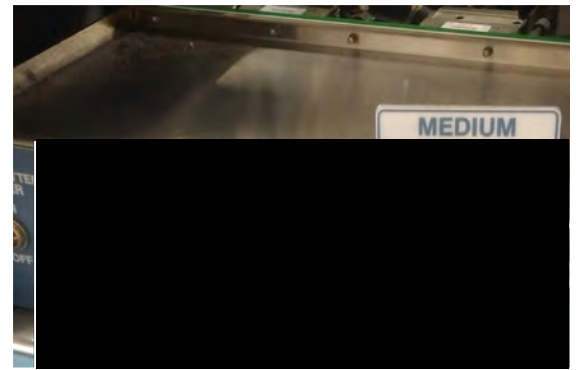
A pocket track allows trains to park in between two mainline tracks (a third track), and potentially "turn back" on the opposite track. Two sets of equilateral turnouts (switches) typically feed in/out of the track for easy access.

Photos



Speed Restriction

A given speed less than the normal operating speed for a section for track or rail vehicle/equipment. This speed is imposed by verbal communication from field personnel to MOC, written notices (i.e. temporary orders), or manual ATC module configuration and are issued by ROCC directly to train operators to mitigate special situations. Typical speed restrictions are 35mph (medium) and slow (<15mph) for hazardous conditions in the roadway.



Standpipe Hose Valve aka Standpipe Hose Connection

A normally-closed angle hose valve on a standpipe piping. The outlet has a threaded connection to allow a fire hose attachment. The depicted valve is Class I; 2-1/2" outlet and hose is supplied by firemen. This type of outlet is not meant for untrained individual use; hence it has no hose stored nearby.



Standpipe Hose Valve (Standpipe Hose Connection)

A normally-closed angle hose valve on a standpipe piping. The outlet has a threaded connection to allow a fire hose attachment. The depicted valve is Class I; 2-1/2" outlet and hose is supplied by firemen. This type of outlet is not meant for untrained individual use; hence it has no hose stored nearby.



DEFINITIONS

Terms and Description

Photos

State of Good Repair

The FTA has defined SGR as “the condition in which a capital asset is able to operate at the required level of performance and is fit for its intended purpose” (§625.41). It has also provided an additional consideration: “transit infrastructure and vehicles are well maintained and replaced before their condition deteriorates to the point of presenting a safety risk.” When considering track segments at a macro-level, QICO proposes a practical definition that utilizes both criteria – A segment of track is *not* in a state of good repair when conditions are *severely* degrading rail operations/safety, and conditions are regressing faster than routine maintenance can address.”



Station Kiosk

Station kiosks house information both electronically and in paper format for elevator and escalator units. ELES maintenance personnel and inspectors use the station kiosk computer (red arrow) to access the remote monitoring system which stores information on elevator and escalator units. Additionally, the computer is used to view live asset information via the ELES live station condition page. Also located in station kiosks are binders (orange circle) containing paper forms that are filled out by maintenance personnel and inspectors. Forms include maintenance sheets and inspection lists.



Steps

Escalators in the Metrorail system can have either die-cast aluminum or steel steps. Escalators will not have a mix of aluminum and steel steps they will only have one or the other. Steps are made in one solid piece, clasp onto rods chained together in a continuous loop, and have two wheels that help stabilize and control the positioning of the step.

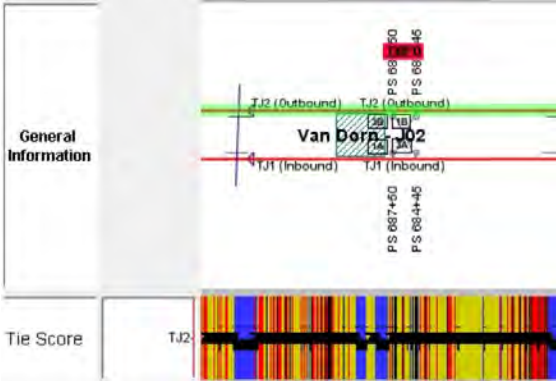


Stock Out

When on hand inventory balance falls below zero.

Current Balance	0.00
Quantity Currently Reserved	59.00
Expired Quantity in Stock	0.00
Quantity Available	-59.00
Quantity in Holding Location	0.00

DEFINITIONS

Terms and Description	Photos
Tamping In ballasted track maintenance and production activities, tamping machines lift ties upward, and through a vibratory process pack (or tamp) the track ballast underneath the cross ties, ensuring that the track structure properly transfers load from the rail vehicles to the track foundation. In addition, tampers also line the rails, or ensure that the rails are in the correct horizontal and vertical alignment as tamping is completed.	
Tie (Timber Tie, Cross Tie) Also known as "Cross-Tie" or by various sub-classifications ("Contact Rail Tie", "Switch Tie"). Responsible for providing support of the running rails and contact (third) rail, transferring load from the rail vehicles to the ballast. On mainline track, Metrorail has 8'6" standard crossties and 10' crossties (contact rail tie), which are longer to accommodate the contact rail insulator upon which the contact (third) rail rests.	
Tie Scoring For ballasted portions of track, Metrorail has utilized a third-party to provide timber tie scanning services, which scan the interior of each tie and assign a grading. The data are imported and displayed with a color scale in Optram.	
Track and Structures (TRST) A 600+ employee office, headed by the General Superintendent, responsible for three principal activities: track inspection, track maintenance, and track production (capitally funded major track work). As of August 2017, reports to the general manager through rail operations (RAIL). It should be noted that Track Engineering is a separate entity, reporting to rail operations through Maintenance-of-Way Engineering (MOWE).	

DEFINITIONS

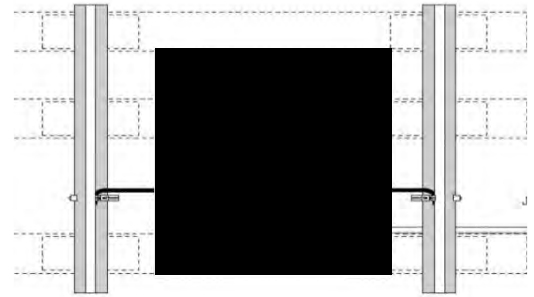
Terms and Description

Photos

Track

The Automatic Block Signalling System, which is the wayside portion of the Automatic Train Protection (ATP) System, is comprised of calculated track circuits to provide maximum capacity and safe breaking distance for following trains. Impedance bonds (Wee-Zee, or WZ Bonds) are an integral part of the track circuit. For Automatic Train Control, each impedance bond acts as a transmitter for one track circuit and a receiver for the adjacent track circuit.

Circuits



Track

Parameters defining the three-dimensional configuration of rails or track.

Geometry

Profile: changes in elevation over distance, for either track or rails

"Alignment": changes in horizontal position with regards to distance

Superelevation: vertical differences (in inches) between rails in curves

Cant: the slope/degree by which the rails are turned inward (typ. 1/40)

WMATA has strict tolerances for the various parameters defined in the WMATA-1000; geometry is measured by the TGV and recorded in Optram.



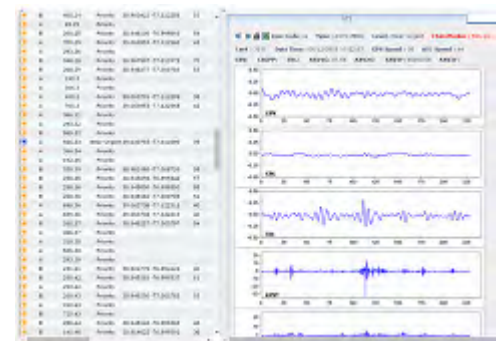
Track Geometry Vehicle (TGV)

The Track Geometry Vehicle (TGV) is an in-house inspection vehicle that continually scans the track as it travels throughout the Metrolink system; the data collected provides insights for track maintenance planning (uploaded into Optram).



TrackIT

TrackIT software is designed to point out anomalies in ride quality in the Metrolink system by utilizing sensors aboard the 7000 Series railcars. 7K cars are equipped with a system of accelerometers that are mounted on 15% of the B cars. These sensors measure carbody lateral, carbody vertical, truck lateral, and axle anomalies.



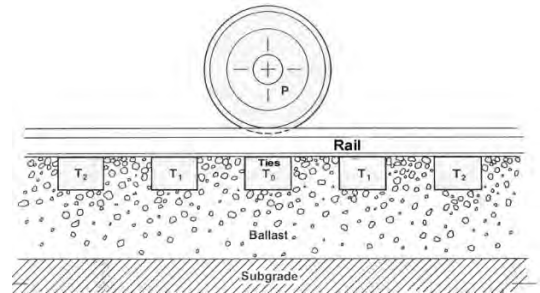
DEFINITIONS

Terms and Description

Photos

Track Structure

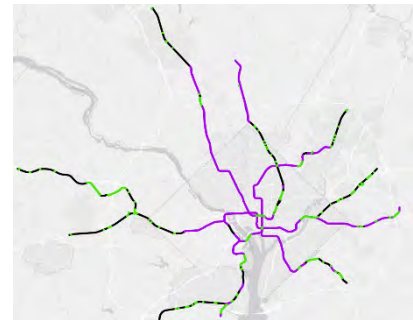
The intense vertical and horizontal loads from the steel wheels of a Metrorail train are distributed through the track structure to foundational elements (subgrade, tunnel structure, or bridge structure).



Track Type (by Structure/Alignment)

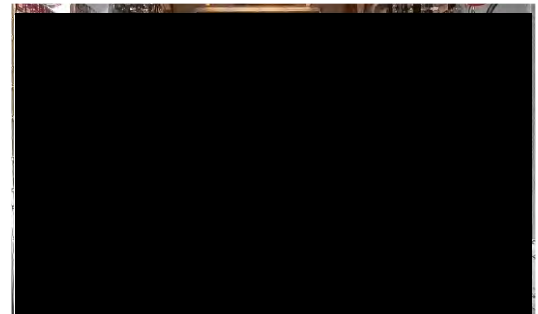
Underground track is in tunnels, typically utilizing direct fixation. Aerial track consists of outside bridge structures utilizing direct fixation. At-grade track is outside, typically at or near the surface of the surrounding environment. Most ballasted track is at-grade.

Map: Black showing At-Grade, Green showing Aerial, Purple showing Tunnel. Note the "Aerial" underground alignment at Metro Center (one track crossing another underground).



Train Control Room (TCR)

The electronic and electrical components necessary to implement the ATP, ATS, and ATO subsystems are mounted on racks in train control rooms located at each Metrorail passenger station. Each train control room contains the electronics associated with the track circuits monitored and controlled from that location.



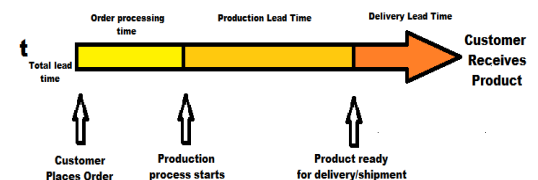
Transfer

The movement of inventoried items between any alternate store and satellite storeroom.

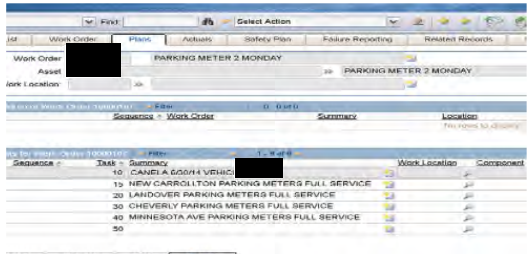
View Inventory Transactions			
Receipts & Transfers			
Filter 100%			
1 - 10 of 94			
Transaction Type	Transaction Date	PO	Quantity
TRANSFER	10/10/17 5:44		96.00
TRANSFER	10/10/17 5:42		288.00
TRANSFER	9/29/17 5:17		96.00
TRANSFER	9/27/17 5:21		216.00
TRANSFER	9/26/17 5:30		186.00

Vendor lead Time

The time from date a purchase order is printed until the vendor delivers materials and supplies to the designated delivery point(s).



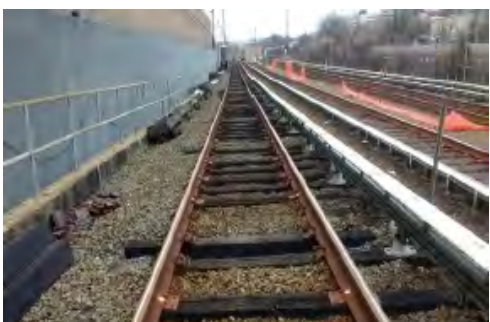
DEFINITIONS

Terms and Description	Photos
Wet Sprinkler Fire Riser (System Riser) Usually vertical piping arrangement consisting of UL Listed and FM Global approved quick opening control valve, pressure gauges, water supply, fire department connection supply piping and drainage piping, test and shut-off valves, etc. to provide water into distribution piping upon any sprinkler head fusing.	
Wide Gauge Wide gauge typically refers to a widening of track gauge (the distance between the running rails) outside intended tolerances (as set forth in WMATA-1000). A severe wide gauge condition increases the chance of a derailment.	
WMATA-1000, WMATA-2000 The Track Maintenance and Inspection Manual, also known as WMATA-1000 (TRST) is the maintenance and inspection manual for track. Not to be confused with WMATA-2000, which is the TRST Maintenance Control Policy (e.g. procedures to follow for speed-restrictions).	 Track and Structures Inspection Division WMATA-1000
Work Order (WO) Data files describing the actual work to be accomplished, including all parts and products required to do the work. Work Orders can be entered and tracking in Maximo and materials placed on Work Orders are reserved for specific jobs.	

APPENDIX C: TRACK CONDITION RATING SCALE

TRACK CONDITION RATING SCALE

Condition		Description
NEW	5.00	Brand new track, fully compliant with construction standards and specifications
	4.75	Light wear, no gauge issues, no replacements
GOOD	4.50	Light wear, isolated gauge issues, green/yellow defects, no replacements
	4.25	Light wear, isolated gauge issues, green/yellow defects, planned replacements nearing schedule, isolated corrective maintenance
	4.00	Light wear, isolated wide/narrow gauge, isolated red defects, active preventative maintenance, isolated corrective maintenance; configuration changes (jointed rail)
ADEQUATE	3.75	Medium wear (spalls), isolated wide/narrow gauge, isolated red defects, active preventative maintenance, isolated corrective maintenance;
	3.50	Isolated speed restrictions, medium wear (spalls), isolated wide/narrow gauge, isolated red defects, active preventative maintenance, isolated corrective maintenance;
	3.25	Regular speed restrictions, isolated OOS, clustering of yellow defects that will require multiple nights of corrective maintenance
	3.00	Regular speed restrictions, isolated OOS, clustering of yellow/red unaddressed defects requiring weekend single tracking
MARGINAL	2.75	Regular speed restrictions, multiple OOS, clustering of yellow/red unaddressed defects requiring multiple weekend single tracking, potentially merits larger shutdown
	2.50	Regular speed restrictions, multiple OOS, large yellow/red sections, unaddressed defects requiring multiple weekend single tracking, potential shutdown
	2.25	Permanent SPDR/OOS, systematic yellow/red sections, multiple weekend single tracking or requires shutdown
	2.00	Permanent SPDR, A more "abandoned" look, but perhaps still salvageable through shutdown
WORN	1.75	
	<i>and below</i>	Not suitable for passenger rail service. Increasing amounts of underlying structural issues which would require a complete rebuild.

QICO CONDITION RATING LEVELS					
Overview	Rating	FTA Definition	Commentary, As Applied to Track Segments	Example Direct Fixation	Example Ballasted Track
TRANSIT ASSET SCORING SYSTEM The FTA provides an asset scoring system (TERM, defined in Part.625), which contains an asset rating scale from 1 (worn) – 5 (excellent), with the threshold for “state of good repair” at three (3) or above. The definitions provided for each condition level are purposefully vague, to account for the variability across a variety of transit agencies. For the post-SafeTrack condition assessment, QICO’s Infrastructure Assurance group took into account observations from visual inspections of track, track geometry vehicle data, omissions in scopes of work, age of high-risk assets (e.g. double crossovers), and delays to revenue service to assess the condition of each route segment where SafeTrack work was conducted. QICO’s post-SafeTrack analysis provides an estimate of the overall track quality. WMATA is developing an initial Transit Asset Management (TAM) plan, which must be completed by October 1, 2018 (§625.31).	Excellent 4.7 to 5.0	• New asset, no visible defects	Requires no corrective maintenance; preventative maintenance inspections do not find any defects or items out of tolerance. Track still may be under warranty as new construction. <i>Examples: McLean Tunnel, Silver Line (left), West Falls Church Yard Track (right)</i>		
DEFINITIONS “State of Good Repair (SGR)” - The FTA has defined SGR as “the condition in which a capital asset is able to operate at the required level of performance and is fit for its intended purpose” (§625.41). It has also provided an additional consideration: “transit infrastructure and vehicles are well maintained and replaced before their condition deteriorates to the point of presenting a safety risk.” When considering track segments at a macro-level, QICO proposes a practical definition that utilizes both criteria – A segment of track is <i>not</i> in a state of good repair when conditions are <i>severely</i> degrading rail operations/safety, and conditions are regressing faster than routine maintenance can address.” Routine Maintenance - refers to maintenance that removes defects and extend asset life, before deteriorating to the point of impacting service/safety. A quintessential example is night-time rail grinding which removes rail defects before they propagate deeper into the rail head. Some routine maintenance activities are performed as a result of preventative activities (may or may not revenue service); an example is the Track Geometry Vehicle finding rail defects, which are removed by a chase unit before opening to revenue service. Capital Renewal – On a macro-level, refers to large scale, planned refurbishment of track and some outright replacement of large assets (e.g. double crossovers) in order to outpace the maintenance backlog which cannot be addressed through routine maintenance activities. Emergency Corrective Maintenance (also CM) – corrective maintenance initiated through an incident, requiring reduced performance or removal of track from service to remediate issues impacting the safe operation of the rail system. Typically occurs from defect clustering (e.g. consecutive broken grout pads), tolerance issues with track geometry (e.g. wide gauge), or other events (e.g. electrical tracking).	Good 4.0 to 4.6	• Asset showing minimal signs of wear • Some (slightly) deteriorated component(s)	Requires little to no corrective maintenance. However, weakest components in track may be approaching defective condition depending upon rates of wear and original workmanship. Preventative maintenance (e.g. rail grinding) is important for preventing defects from propagating into red conditions. <i>Examples: Blue Line aerial track, with minor rail wear on top rail (left). Renewed Green Line track, with several previously open joints in acceptable condition (right).</i>		
	Adequate 3.0 to 3.9	• Asset has reached its mid-life condition (3.5) • Some moderately defective or deteriorated component(s)	Track may require occasional spot emergency corrective maintenance from speed-restrictable defects (e.g. deteriorated rail joints). Maintenance backlog may begin to develop, and PM, planned replacements, and some corrective maintenance is being performed outside of peak periods (M-F) through weekend single-tracking. The lower end of this condition has longer-lasting or more frequent reductions in performance (speed-restrictions on the order of multiple days/weeks). <i>Examples: Grout Pad Cracking (left), Tie Splitting (right)</i>		
	Marginal 2.0 to 2.9	• Asset near end of useful life; asset not in a state of good repair.	Track is not in a state of good repair, and has degraded to the point that significantly degrades rail operations (many speed restriction and out-of-service conditions). Small (e.g. weekend) corrective maintenance events are increasingly not feasible to return the track to state of good repair, warranting a single-tracking or shutdown event encroaching on weekday rail operations. Certain track assets (e.g. double crossover) are at end-of-lifecycle. <i>Examples: degraded grout pads (left), pre-Surge 12 (right)</i>		
	Worn 1.0 to 1.9	• Asset is past its useful life and should be prioritized for repair or replacement.	Track has significant foundational or structural issues, requiring a 100% teardown and replacement. Track may require to be removed from service for months. <i>Examples: Rare for a long section of Metrorail track or aerial structure. Rhode Island Ave Platform partial demolition (left), example of complete loss of fixity and structural support (right).</i>		