QICO 2018 INTERNAL REVIEW

Washington Metropolitan Area Transit Authority
WMATA

April 27, 2018

Engineering & Maintenance

1. *Metrobus Maintenance and Engineering*
2. *Metrobus Parts and Materials Inventory Management*
3. *Metrorail Vehicle Maintenance and Engineering*
4. *Metrorail Vertical Transportation: Elevators*
5. *Metrorail Fare Collection Maintenance*

ENGINEERING & MAINTENANCE

SERVICE DELIVERY

CAPITAL PROGRAM – MANAGEMENT & EXECUTION

INTERNAL SAFETY & SECURITY REVIEW

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

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WHAT WE DO

What is QICO?

- The Office of Quality Assurance, Internal Compliance & Oversight (QICO) is an internal management function that partners with other departments to provide an objective review. Authorized by the General Manager as outlined in the Quality Management System Plan (QMSP).

Why QICO Performed This Review:

- These internal reviews are intended to provide Metro senior management with an assessment of the state of Maintenance & Engineering within five distinct areas (three within Metrorail and two within Metrobus) and promote the actions needed to address any concerns.

QICO's Methodology:

- Develop relevant review activities by identifying and assessing risks to policies, procedures & standards, quality & compliance, and traceability.
- Review documentation, observe processes and interview key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

Note: An itemized internal Corrective and Preventive Action (iCAPA) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of iCAPA implementation go to: www.wmata.com/initiatives/transparency/.

WHAT WE FOUND | ENGINEERING & MAINTENANCE

April 2018

1. Metrobus Maintenance & Engineering

Wins:

- ✓ At Bladensburg bus garage, leadmen used handheld radios to assist one another allowing for efficient and effective communication.
- ✓ The Bus Maintenance group has an intranet repository of governing maintenance and engineering documentation that provides all recent revisions promoting effective maintenance practices.

Items Resolved During Review:

- ✪ At the Montgomery bus garage it was observed that oxygen and acetylene cylinders were stored out of compliance with OSHA 29 CFR 1910. Maintenance personnel separated these cylinders according to standards.
- ✪ At all bus garages assessed there were expired electrical gloves and maintenance issues with fire extinguishers. Expired gloves were discarded, new gloves were purchased, and fire extinguishers were replaced, inspected and tagged.
- ✪ At all bus garages assessed there were uncovered anti-freeze, diesel fuel drums and buckets. Personnel mitigated these issues by providing covers for anti-freeze drums and removing diesel fuel drums and buckets.
- ✪ At all bus garages assessed there were fluid drums with no spill containment. Drums were placed on spill containment dollies and spill containment palettes.
- ✪ At Bladensburg bus garage jib cranes with expired certifications were observed. Personnel immediately took the cranes out of service, tagged them, and scheduled them to be re-certified.

2. Metrobus Parts & Material Inventory Management

Wins:

- ✓ At Bladensburg and Carmen Turner Facility (CTF) bus parts are bundled together in advance of scheduled overhauls streamlining workloads and increasing the efficiency of bus maintenance activities.
- ✓ The number of operating purchase requisitions greater than 30 days has decreased by 96% in three months leading to the increased availability of parts for use.

Items Resolved During Review:

- ✪ At the Bladensburg and CTF storerooms inventory discrepancies were identified for engine oil filters. The storeroom supervisor identified the issue using Maximo and made the necessary corrections.
- ✪ At Montgomery and Shepherd Parkway storerooms, damage to packaging and improper parts storage was observed. Parts were immediately placed into correctly labeled storage boxes.

3. Metrorail Vehicle Maintenance & Engineering

Wins:

- ✓ Personal protective equipment (PPE) at all rail facilities visited was readily available and properly used promoting safe work practices.
- ✓ Preventive maintenance (PM) documentation at all facilities visited was readily available to the technicians and had proper document controls in place allowing for consistent maintenance activities.
- ✓ Precision measuring devices at New Carrollton, Shady Grove, and West Falls Church facilities were secured and managed properly fostering positive quality control.

Items Resolved During Review:

- ✪ At the Greenbelt facility the shelf life management program had not been implemented. The superintendent initiated the shelf life program and appointed an individual responsible for oversight.
- ✪ At Greenbelt and West Falls Church facilities, shop safety devices were damaged or missing. Repairs were made right away to door obstruction, machine guard, and shop power safety devices.
- ✪ Improper maintenance of eye wash stations and fire extinguishers at Greenbelt, New Carrollton, and West Falls Church facilities was observed. Eye wash station and fire extinguisher issues were corrected immediately.

4. Metrorail Vertical Transportation: Elevator Maintenance & Inspections

Wins:

- ✓ At visited sites elevator barricades were used to prevent unauthorized access into work areas protecting technicians and the riding public.

Items Resolved During Review:

- ✪ At Franconia-Springfield, Eastern Market, and Friendship Heights discarded material, debris and trash were observed. Supervisors and technicians at these locations took immediate action to remove discarded materials, debris and trash.

5. Metrorail Automatic Fare Collection (AFC) Inspection & Maintenance

Wins:

- ✓ AFC Engineering has developed a web based application (AFC Listener) to provide real time monitoring and failure reporting of AFC assets.

WHAT WE WILL DO MOVING FORWARD

Key Takeaway

Continuing to enhance supervisory controls will contribute towards improving WMATA's quality, safety and reliability of service.

Through the implementation of 19 internal Corrective and Preventive Actions (iCAPAs) we are committed to driving quality improvement initiatives with the objective of safeguarding the mission success of the agency while enhancing customer experience. These strategic plans to address issues of concern, required actions and recommendations are intended to drive real progress that is measureable and verifiable.

1. Metrobus Maintenance & Engineering

- Revise and implement sustainable safety and preventive maintenance program requirements adhering to industry best practices for asset management.
- For details on the committed action plans see the following iCAPAs: QICO-BME-18-01, BME-18-02, BME-18-03, BME-18-04, BME-18-05, & BME-18-06.

2. Metrobus Parts & Material Inventory Management

- Identify opportunities to streamline the inventory management strategy with regard to supply chain tracking and identification, and the removal of outdated inventory.
- For details on the committed action plans see the following iCAPAs: QICO-BMI-18-01 & BMI-18-02.

3. Metrorail Vehicle Maintenance & Engineering

- Update and implement procedures to improve safety, work quality and parts management.
- For details on the committed action plans see the following iCAPAs: QICO-RCM-18-01, RCM-18-02, RCM-18-03, RCM-18-04, RCM-18-05, & RCM-18-06.

4. Metrorail Vertical Transportation: Elevator Maintenance & Inspections

- Incorporate adequate controls and methodology for records management.
- For details on the committed action plans see the following iCAPAs: QICO-ELES-18-01, ELES-18-02, ELES-18-03, & ELES-18-04.

5. Metrorail Automatic Fare Collection (AFC) Inspection & Maintenance

- Review and update the Maintenance Control Plan (MCP) and implement processes to improve reliability reporting.
- For details on the committed action plans see the following iCAPA: QICO-AFCS-18-01.

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2018

Internal Review: Engineering & Maintenance

(1) Metrobus Maintenance and Engineering

April 27, 2018

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Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the state of Bus Maintenance & Engineering and promote the actions needed to address any concerns.

QICO's Methodology:

- Develop relevant review activities by identifying and assessing any risks to policies, procedures & standards, quality & compliance, and traceability.
- Review documentation, observe processes and interview key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

INTERNAL REVIEW SUMMARY

March 2018

(1) Metrobus Maintenance & Engineering

Wins:

- ✓ At Bladensburg bus garage, leadmen used handheld radios to assist each other, allowing for efficient and effective communication.
- ✓ The Bus Maintenance group has an intranet repository of governing maintenance and engineering documentation promoting effective maintenance practices.

Items Resolved During Review

- ✪ At the Montgomery bus garage it was observed that oxygen and acetylene cylinders were stored out of compliance with OSHA 29 CFR 1910. Maintenance personnel separated these cylinders in accordance with OSHA 29 CFR 1910.
- ✪ At all bus garages assessed there were expired electrical gloves and maintenance issues with fire extinguishers. Expired gloves were discarded, new gloves were purchased, and fire extinguishers were replaced, inspected and tagged.
- ✪ At all bus garages assessed there were uncovered anti-freeze, diesel fuel drums and buckets. Personnel mitigated these issues by providing covers for anti-freeze drums and removing diesel fuel drums and buckets.
- ✪ At all bus garages assessed there were fluid drums with no spill containment. Drums were placed on spill containment dollies and spill containment palettes.
- ✪ At Bladensburg bus garage jib cranes with expired certifications were observed. Personnel immediately took the cranes out of service, tagged them, and scheduled them to be re-certified.

Areas for Improvement

- Training personnel on the use of safety equipment and maintaining a hazard free workplace promotes a safe and reliable work environment.
- Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analyzing of performed maintenance.
- Developing written requirements for parts management, workplace organization and housekeeping is vital for safe and reliable bus operations.
- Establishing inventory and equipment calibration control procedures are essential to completing effective maintenance activities.
- Implementing a Quality Control Plan (QCP) for bus corrective and preventive maintenance will promote consistent maintenance practices.
- Providing updated diagnostic computers and troubleshooting software are essential for effective and efficient bus repair activities.

Required Actions:

- **QICO-BME-18-01:** Incorporate a sustainable maintenance plan to monitor the condition and safety of all bus maintenance equipment. *(Risk Rating: High)*
- **QICO-BME-18-02, BME-18-03, BME-18-04, & BME-18-05:** Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration. *(Risk Rating: Elevated)*
- **QICO-BME-18-06:** Revise procedures for diagnostic equipment to include software expiration, hardware condition, and equipment assignment. *(Risk Rating: Moderate)*

Note: An itemized internal Corrective and Preventive Action (iCAPA) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of iCAPA implementation go to https://www.wmata.com/initiatives/transparency/.

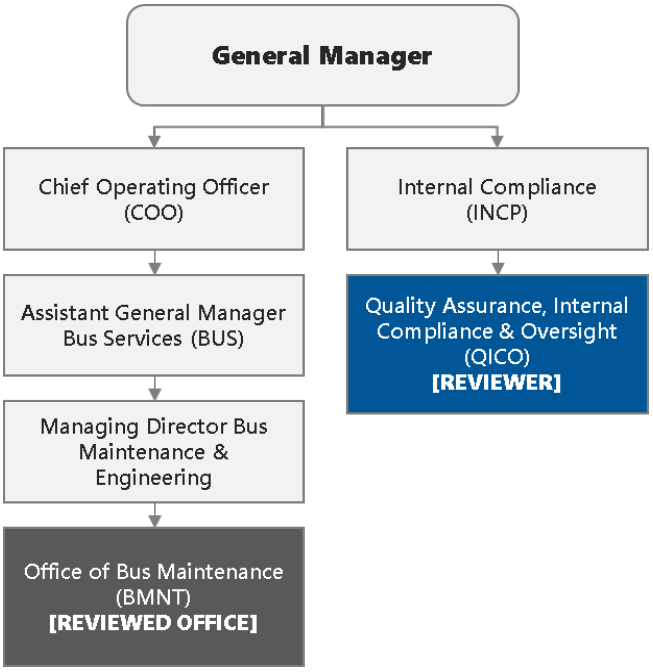
1.1. FUNCTIONAL OVERVIEW AND STRUCTURE

Metrobus Maintenance & Engineering

Metrobus provides more than 400,000 trips each weekday serving 11,500 bus stops in the District of Columbia, Maryland, and Virginia. It is the sixth busiest bus agency in the United States, with a fleet of more than 1,500 buses operating on 325 routes. Metrobus is responsible for procuring, operating, and maintaining a mixed fleet of diesel, compressed natural gas (CNG), electric and hybrid rolling stock; the fleet also comprises of both standard 40-ft and articulated 60-ft buses.

Within WMATA, the Bus Services (BUSV) reports to the Chief Operating Officer (COO). As shown in the organization chart, QICO is independent of this function, reporting to the General Manager through Internal Compliance (INCP).

Buses are stored at nine (9) bus divisions spread across Washington DC, Maryland, and Virginia; the agency is planning on opening two more bus garages (Cinder Bed and Andrews Federal Campus) in the near future. At each division garage, WMATA's Office of Bus Maintenance (BMNT) has a dedicated team of maintenance personnel to address preventative and corrective maintenance of the agency's buses. Within BMNT, engineering services are provided by the Office of Bus Engineering (BENG). BENG collaborates with BMNT to address their engineering concerns, procure buses with sound engineering design and robust manufacturing processes, and ensure bus designs meet federal and local regulations.



In this internal review, QICO is assessing the following functions:

Bus Engineering (BENG)	Bus Maintenance Training (BMTR)	Bus Maintenance Operations
- Develops and manages bus specifications for the procurement of new bus rolling stock - Produces Engineering Modification Instructions (EMI) when a bus sub-system requires alteration - Supports day-to-day maintenance and troubleshooting activities - Manages/administers bus/component warranty program	- Provides training and testing for all levels of mechanic promotions. - Conducts all levels of field and classroom training including technical, safety, team building, performance management, and personnel development - Produces individual skills assessments and development plans	- Conducts preventative and corrective inspections & maintenance on all bus types - Executes large-scale retrofits (e.g. manufacturer's recalls) - Ensures safe, clean, and reliable buses are available to meet ridership demands

1.2. REVIEW SCOPE

Documentation Review

- Bus Standard Operating Procedures (SOPs): 1.2, 1.7, 1.28, 1.21, 1.27, 1.8, 1.4, 1.16, 1.23, 1.19, 1.15, 1.18, 1.17, 1.13, 1.22, 1.14, 1.24, 1.9, 3.24, 1.3, 2.22, 1.5, 2.16, 1.13, 3.16, 3.29, 3.15, 3.6, 3.8, 3.13, 3.19, 3.12, 3.1, 3.2, 3.4, 3.5, 3.21, 3.11, 3.15, 3.17, 3.23, 3.9, 3.7, 3.24, 3.28, 3.29 3.26, 4.5, 4.13, 4.6, 4.14, 4.15, 4.8, 4.11, 4.18, 4.3, 4.1, 4.2, 4.4, 4.9, 4.7, 4.19, 4.16, 4.17 & 5.6
- Staff Notices: 15-10 & 13-18
- Review of 90 randomly closed Maximo work orders; 30 from each division assessed (October 2017 – December 2017)
- Bus Maintenance Training Curriculum (BMTR) (01/24/18)
- Internal Certification Matrix (May 2013)
- BMTR Course Descriptions, BMTR 2017 Training Calendar, BMTR December 2017 Training Report
- BMNT/BENG Monthly Report (July, August, September & October 2017)
- Requirements for BMNT Positions (October 2014)
- Non Controlled Documents: BMTR Quarterly Meeting (05/14/2014), Diagnostic Laptop Process, BMNT Close Work Order Policy
- Safety/Environmental Processes and Procedures Annual Compliance
- Bus Engineering document "Low Coolant Sensor Failure"
- Service Interruptions for Fumes (11/01/2012 – 01/28/2018)
- WMATA Hybrid Failure Matrix
- Bus Maintenance Division Quality Control Inspection (October – December 2017)

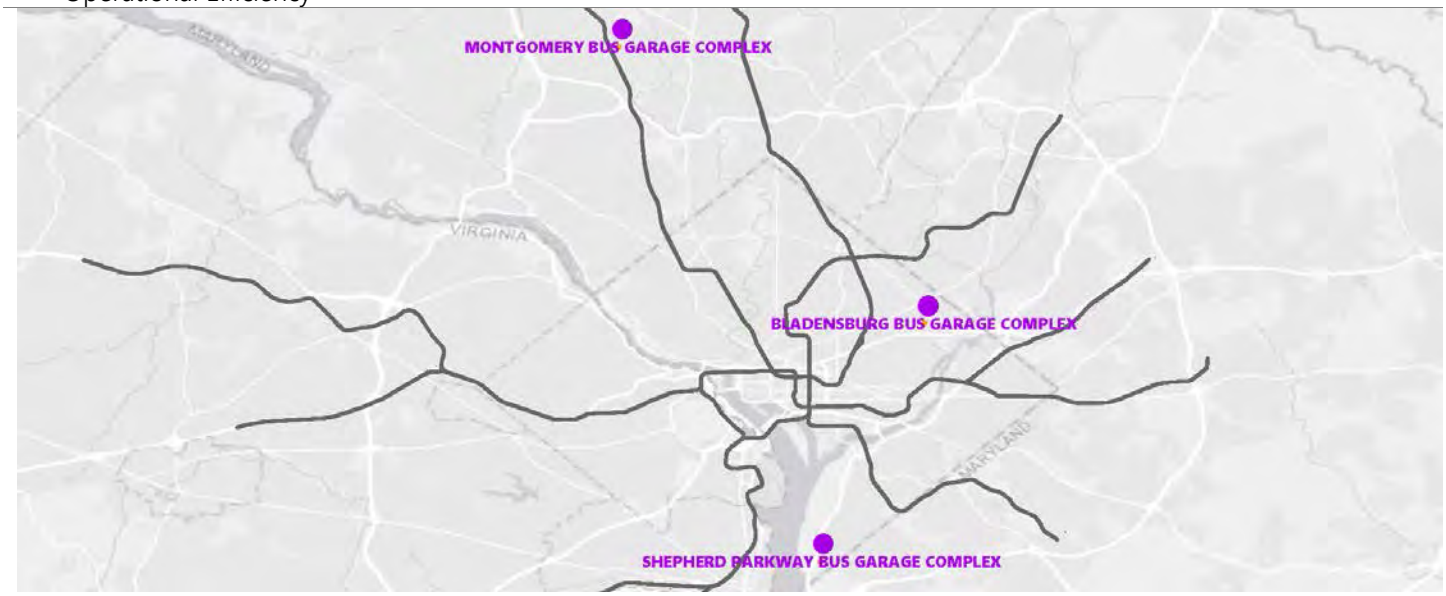
Personnel Discussions

- Chief, [redacted]
- Director, [redacted]
- Bus Maintenance Training Supervisor, [redacted]
- Montgomery BMNT
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
- Bladensburg BMNT
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
- Shepherd Parkway BMNT
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]

Field Assessments

The Bus Maintenance and Engineering Internal Review assessed Montgomery, Shepherd Parkway, and Bladensburg Metrobus divisions. Divisions were selected to produce a sample representing the diverse array of maintenance actives performed across different bus types (compressed natural gas, diesel, and hybrid). The following sujects were assessed:

- Preventative Maintenance
- Corrective Maintenance
- Quality Control
- Parts and Tools Management
- Management of Change
- Training and Skills Management
- Operational Efficiency



Shepherd Parkway Bus Garage	Montgomery Bus Garage	Bladensburg Bus Garage
		
- Maintains [redacted] buses. - Oversight provided by superintendent and 5 supervisors. - Operates 3 shifts with 66 maintenance personnel.	- Maintains [redacted] buses. - Oversight provided by superintendent and 5 supervisors. - Operates 3 shifts with 76 maintenance personnel.	- Maintains [redacted] buses. - Oversight provided by superintendent and 5 supervisors. - Operates 3 shifts with 97 maintenance personnel.

1.3. WHAT WORKED WELL (WINS)

Wins are categorized by Quality Measures and rated according to Risk Assessment

W-BME-18-01 Application and Fulfillment — *Reduces Service Delivery Risk* — **Owner – BMNT**

✓ **The usage of handheld radios by the Bladensburg Bus Garage leadmen is an effective communication system.**

Discussion

- The utilization of the handheld radios allows for immediate communication regarding the maintenance activities being performed within the garage.

W-BME-18-02 Document Control — *Reduces Service Delivery Risk* — **Owner – BMNT**

✓ **The Bus Maintenance group has an intranet repository of governing maintenance and engineering documentation that provides all recent revisions promoting effective maintenance practices.**

Discussion

- Bus technicians interviewed during field assessments were well versed in navigating the BMNT intranet. Technicians demonstrated how to retrieve maintenance manuals, parts lists, service bulletins, and MSDS/SDS information using the BMNT intranet (website).
- Maintenance manuals were available for all current fleet buses and subsystems of those buses such as different model engines, transmissions, and heating, ventilation and cooling (HVAC). These documents are managed by BENG.
- BENG and BMNT uses the site as a communication tool for Metrobus maintenance personnel across the authority.

1.4. ITEMS RESOLVED DURING REVIEW

Items are categorized by Quality Measures and rated according to Risk Assessment

The following are issues that were identified by QICO during the Internal Review process, where appropriate actions were taken to eliminate the discrepancy or nonconformance prior to the close of this review.

R-BME-18-01 Job Safety — Safety – Moderate (5,2) — **Owner – BMNT**

✪ **QICO discovered an oxygen and acetylene cylinder stored side by side in the Montgomery Division welding room.**

Actions Taken

- Division management was immediately notified on the day of the assessment (2/6/18) and QICO verified the discrepancy resolved, mitigating this hazard in accordance with OSHA 29 CFR 1910.253 (b) (4) (iii) acetylene and cylinders oxygen must be separated by five (5) ft. high, fire resistant barrier or be separated by more than twenty (20) ft.
- In addition, this is part of the Tri State Safety Over-Site Committee (TOC) CAP #TOC-OSP-15-007.

R-BME-18-02 Job Safety — Safety – Moderate (5,2) — **Owner – BMNT**

✪ **QICO observed [redacted] Electrical Gloves two (2) at Shepherd, one (1) at Bladensburg, and one (1) at Montgomery Divisions that are expired.**

Actions Taken

- Division management at each location was notified and has discarded the expired electrical gloves. Replacement gloves have been ordered [redacted] and are awaiting delivery. These electrical gloves are required by to be electrically tested every six (6) months in accordance with ASTM F496 and per OSHA 1910.137, "Standard Specification for In Service Care of Insulating Gloves and Sleeves" at an authorized safety equipment testing facility and meet ASTM D120, IEC EN60903, and NFPA 70E standards.

R-BME-18-03 Job Safety — Safety – Moderate (4,2) — **Owner – BMNT**

✪ **At Montgomery Bus Garage, QICO observed and reported to division management uncovered 55 gallon drums used to collect spent anti-freeze. At Bladensburg Bus garage, QICO observed an uncovered five (5) gallon bucket containing diesel fuel located in the service lane area.**

Actions Taken

- Montgomery division management was immediately notified on the day of the assessment (02/06/18).
  - QICO revisited Montgomery Bus garage on 2/22/18 and found the discrepancy has been resolved. A plastic cover is being used to cover the drum when not in use.
- Bladensburg division management was immediately notified on the day of the assessment (02/07/18).
  - QICO re-inspected the service lane area on 02/15/18 and found the discrepancy has been resolved. Five (5) gallon bucket has been removed from the service lane area.

R-BME-18-04 Job Safety — Safety – Moderate (4,1) — **Owner – BMNT**

✪ **At all the Bus divisions assessed, QICO discovered 55 gallon drums sitting on portable dollies and/or palettes with no spill containment.**

Actions Taken

- All division management team was immediately notified on the day of their assessment.
  - QICO revisited Montgomery Bus garage on 2/22/18 and found the discrepancy has been resolved. 55 gallon oil drum dollies have been replaced with portable oil spill containment dollies.
  - QICO revisited Shepheard Parkway Bus garage on 2/15/18 and found the discrepancy has been resolved. Drums of anti-freeze was placed on spill containment palette and a palette jack is used to move drums.

1.4. ITEMS RESOLVED DURING REVIEW

Wins are categorized by Quality Measures and rated according to Risk Assessment.

R-BME-18-05 Job Safety — Safety – Moderate (4,2) — **Owner – BMNT**

✪ **At Bladensburg Bus garage, QICO discovered two (2) jib cranes with expired annual rigging inspection.**

Actions Taken

- Bladensburg division management was immediately notified on the day of the assessment (02/07/18).
    - QICO re-inspected both jib cranes on 02/15/18 and found the cranes were tagged and removed from service. PLNT has been notified to re-certify the cranes for usage.

R-BME-18-06 Job Safety — Safety – Low (2,2) — **Owner – BMNT**

✪ **QICO recorded eight (8) discrepancies with fire extinguishers throughout the internal review .**

Actions Taken

- Montgomery division management was notified of three (3) fire extinguishers located throughout the facility on 02/06/18, one (1) fire extinguisher was rusting from moisture exposure and the other two (2) had no monthly inspection tag.
    - QICO re-inspected fire extinguishers on 02/13/18 and found the fire extinguishers had been tagged and inspected.
- Bladensburg division management was notified of two (2) fire extinguishers located in the service area with no monthly inspection tag on 02/07/18.
    - QICO re-inspected fire extinguishers on 02/16/18 and found the fire extinguishers had been tagged and inspected.
- Shepherd Parkway division management was notified on 02/08/18 of three (3) fire extinguishers with no monthly inspection tag, one (1) located in the body shop area, one (1) stored on the forklift, and one (1) stored on the Tug.
    - QICO re-inspected fire extinguishers on 02/16/18 and found the fire extinguishers had been tagged and inspected.

1.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-BME-18-01 Job Safety — *Safety* – High (5,4) — **Owner – BMNT**

- **Finding: Training personnel on the use of safety equipment and maintaining a hazard free workplace promotes a safe and reliable work environment.**

Discussion

- At all locations QICO observed that while bus bays were unoccupied, in-ground floor lifts ([redacted]) were not covered creating a tripping hazard which could potential lead to injury. During field assessments and discussions with BMNT management, it was reported the covers are damaged at the hinge locations preventing them from lying flat to conceal the opening in the ground. After a review of the Office of System Maintenance (SMNT)/ Office of Plant Maintenance (PLNT) Work Request Logs provided by each division, this defect is not being reported to PLNT as required in SOP 5.1 – Facilities Maintenance Request Procedures.
- During the field assessment at Bladensburg Bus garage, QICO discovered two (2) jib cranes with expired annual rigging inspections. As a short term action, BMNT management immediately tagged and removed cranes from service, refer to R-BME-18-05. However, a long term solution is required to maintain crane certification.
- At each Bus garage assessed, QICO discovered employees are not receiving training on how to use and inspect fall protection equipment. Fall protection harnesses observed had no accompanying inspection records available for review. Per OSHA 1926.503 (a) (1), the employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards.

Recommendation

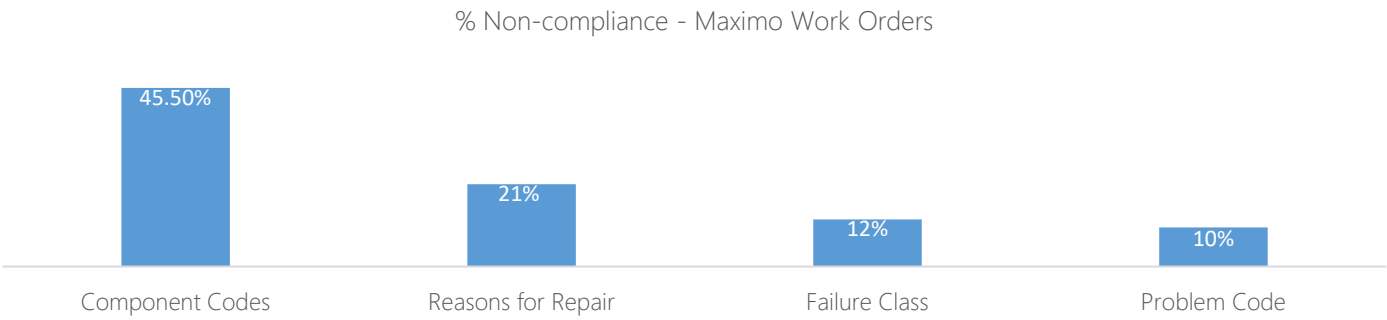
Assess the safety compliance and state of the garages facility equipment, and take immediate corrective actions. Develop a sustainable preventive program to internally monitor and maintain the safety condition of the equipment.

F-BME-18-02 Data Assurance — Service Delivery – Elevated (4.4) — **Owner – BMNT**

- **Finding: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analyzing of performed maintenance.**

Discussion

Maximo work orders discrepancies:



- Using Maximo, QICO reviewed 90 closed Metrobus work orders, 30 from each division assessed as follows:
  - 45.5% of component codes entered were inaccurate and/or generic across the three (3) Divisions assessed (Shepherd Parkway Division 55.2%, Montgomery Division 34.5% and Bladensburg Division 46.7%). This presents unreliable data to identify repeat failures of specific assets and track overall failure trends. For example, work orders 13992579, 13992099, 13902408, 13903657, 13990304, 13835239, 13994154, 13988991 and 13900702.
  - 21% of the reasons for repair entered were insufficient across the three (3) Divisions assessed (Shepherd Parkway Division 16.7%, Montgomery Division 26.7% and Bladensburg Division 20%). For example, work orders 13904215, 13898857, 13835004, 13990304, 13989605, 13901100, 13994154, 13988991 and 13902527.
  - 12% of the failure classes entered were insufficient across the three (3) Divisions assessed (Shepherd Parkway Division 13.3%, Montgomery Division 16.7% and Bladensburg Division 6.7%). For example, work orders 13992099, 13989014, 13902174, 13903657, 13899972, 13899231, 13994154 and 13898483.
  - 10% of the problem codes entered were insufficient across the three (3) Divisions assessed (Shepherd Parkway Division 20%, Montgomery Division 6.7% and Bladensburg Division 3.3%). For example, work orders 13992099, 13989014, 13904215, 13903657, 13899972 and 13996103.
- Although BMNT has Maximo processes, work instructions and guidelines available through their intranet, the documents available are not controlled, which poses the risk of personnel using outdated/modified versions.
- The reported failures from Bus Operations Communication Center (BOCC) through MAXIMO and from Bus Operators through shop cards do not provide sufficient failure description for technicians to allow for timely and efficient troubleshooting and repair. Technicians have to fully troubleshoot components or subsystems prior to return to service.
- Garage clerks, which may not have the technical proficiency needed, are often designated to review and validate work orders.
- During desk discussions with Division Superintendents, it was reported that the closing of work orders is delegated from the Superintendents to the Supervisors and/or clerks. This removes a layer of review if the supervisor or clerk has to 'complete' and 'close' the work orders.
- During desk discussions, it was reported that BMNT and BENG are unable to rely on work order data to establish failure trends and proactively manage maintenance activities.
- Bus Maintenance Training (BMTR) does not have a formal Maximo training program for technicians or supervisors. Most technicians are learning to use Maximo through informal on-the-job (OJT) training.

Recommendation

Develop, train on, and implement a standardized and controlled procedure for Maximo data entry and validation, including quality control checks to promote consistency and reliability of work being performed.

F-BME-18-03 Quality Control — Service Delivery – Elevated (4,4) — **Owner – BMNT**

- **Finding: Developing written requirements for parts management, workplace organization and housekeeping is vital for safe and reliable bus operations.**

Discussion

- During field assessments QICO found 37 occurrences of used and unlabeled parts stored across the shop floor area as follows:
  - Montgomery Division: 9 occurrences.
  - Bladensburg Division: 22 occurrences.
  - Shepherd Parkway Division: 6 occurrences.

  Components were found sitting out without proper identification (work order documents, failure tag, etc.), making the status of the material unclear.
- At the three (3) bus garages assessed, new inventory parts were observed stored outside the controlled division store rooms.
- Through field observations and discussions conducted with BMNT and BENG management, there is currently no criteria in place for salvaging and requalifying parts for usage at the garage level.
- Parts removed from buses for scrap and parts salvaged, have no dedicated storage area and are being left sitting in hallways, on the floor, or on push carts.
- Proper parts management and storage is critical for inventory tracking. The reuse of parts without appropriate identification and serialization will impact inventory traceability and overall reliability.
- The re-use and refurbishment of parts without appropriate identification and serialization will impact parts traceability especially for repeater failed parts.
- Expired and unusable adhesives and lubricants were detected in a flame resistant cabinet.
- There is currently no procedure in place for BMNT to manage and control shelf life of parts and materials.

Recommendation

Develop a standard operating procedure for parts identification, traceability, requalification, handling and storage on the shop floor.

F-BME-18-04 *Quality Control* — Service Delivery – Moderate (3,4) — **Owner – BMNT**

- **Finding: Establishing inventory and equipment calibration control procedures are essential to completing effective maintenance activities.**

Discussion

- BMNT does not maintain a current inventory list to track tools that require calibration.
- Torque wrenches maintained by BMNT are not labeled with calibration dates.
- QICO observed at each location assessed that torque wrenches are not being properly stored and technicians are not resetting the torque wrenches to zero post usage.
- At each location assessed, QICO observed peg boards for hanging specialty tools not being utilized or missing several items. Tools were stored in the same area just lying on push carts.

Recommendation

Develop a tool management procedure for specialty tools and bench testing equipment (BTE) including calibration management, labelling and identification, appropriate storage and periodic reviews.

F-BME-18-05 Quality Control — Service Delivery – Moderate (3,4) — **Owner – BMNT**

- **Finding: Implementing a Quality Control Plan (QCP) for bus corrective and preventive maintenance will promote consistent maintenance practices.**

Discussion

- Through document request, QICO received a sample of quality control inspection forms labeled 'Bus Maintenance Division Quality Control Inspection Hoses, Lines, Cables, - Compatibility – Routing – Clamping'. After reviewing the samples provided by BMNT, it was discovered that this form is not associated with any Standard Operating Procedure and does not have a criteria checklist. This form only pertains to the engine compartment and is carried out monthly on 5% of the division's assigned fleet.
- Per BMNT service bulletin 12-P-007 "all Division Superintendents or designees are required to perform a Quality Control Inspection on 5% of their assigned fleet each month. The Engine Compartment Inspection will require a visual examination of all hoses, lines, and cables for proper application, routing, clamping and compatibility."

Recommendation

Develop a quality control plan (QCP) for BMNT corrective and preventative maintenance to promote consistent application of work, and ensure compliance and adherence to maintenance practices and procedures.

F-BME-18-06 Assets and Activities — Service Delivery – Moderate (3,4) — **Owner – BMNT**

- **Finding: Providing updated diagnostic computers and associated troubleshooting software are essential for effective and efficient bus repair activities.**

Discussion

- BMNT does not currently have a formal procedure controlling the handling of diagnostic hardware.
- The number of assigned diagnostic equipment is not proportional to the fleet size serviced per garage as follows:
  - Bladensburg Bus garage [redacted] had 4 laptops
  - Montgomery Bus garage [redacted] had 5 laptops
  - Shepherd Parkway Bus garage [redacted] had 3 laptops
- At Shepherd Parkway Bus Garage, QICO detected a diagnostic laptop with an expired software license [redacted] At Bladensburg Bus Garage, QICO discovered two (2) diagnostic laptops with expired software license [redacted].
- During field assessments, it was noted that diagnostic laptops do not have access to the internet. Some software has links to additional information located on the manufacturer's website, which is essential for troubleshooting.

Recommendation

Develop a diagnostic equipment tracking standardized process that tracks software expiration, hardware condition, and equipment assignment based on maintenance work needs per division.

1.6. SUMMARY OF REQUIRED ACTIONS

Findings are categorized by Quality Measures and rated according to Risk Assessment.

QICO-BME-18-01 **Action Owner – BMNT** *Overall Risk – High (Average Score)*

Required Action: Incorporate a sustainable maintenance plan to monitor the condition and safety of all bus maintenance equipment.

Applicable Findings

- **F-BME-18-01:** Training personnel on the use of safety equipment and maintaining a hazard free workplace promotes a safe and reliable work environment.
  - *Measure: Job Safety. Risk: Safety – High (5,4)*

QICO-BME-18-02 **Action Owner – BMNT** *Overall Risk – Elevated (Average Score)*

Required Action: Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Applicable Findings

- **F-BME-18-02:** Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analyzing of performed maintenance.
  - *Measure: Data Assurance. Risk: Service Delivery Risk – Elevated (4,4)*

QICO-BME-18-03 **Action Owner – BMNT** *Overall Risk – Elevated (Average Score)*

Required Action: Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Applicable Findings

- **F-BME-18-03:** Maintaining controlled parts management, workplace organization and housekeeping is vital for reliable and safe operations.
  - *Measure: Quality Control. Risk: Service Delivery Risk – Elevated (4,4)*

QICO-BME-18-04 **Action Owner – BMNT** *Overall Risk – Moderate (Average Score)*

Required Action: Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Applicable Findings

- **F-BME-18-04:** Establishing inventory and equipment calibration control procedures are essential to completing effective maintenance activities.
  - *Measure: Quality Control. Risk: Service Delivery Risk – Moderate (3,4)*

QICO-BME-18-05 **Action Owner – BMNT** *Overall Risk – Moderate (Average Score)*

Required Action: Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Applicable Findings

- **F-BME-18-05:** Implementing a Quality Control Plan (QCP) for bus corrective and preventive maintenance will promote consistent maintenance practices.
  - *Measure: Quality Control. Risk: Service Delivery Risk – Moderate (3,4)*

QICO-BME-18-06 **Action Owner – BMNT** *Overall Risk – Moderate (Average Score)*

Required Action: Revise procedures for diagnostic equipment to include software expiration, hardware condition, and equipment assignment.

Applicable Findings

- **F-BME-18-06:** Providing updated diagnostic computers and troubleshooting software are essential for effective and efficient bus repair activities.
  - *Measure: Assets and Activities Risk: Service Delivery Risk – Moderate (3,4)*

Internal Corrective and Preventive Actions (iCAPAs) are designated to address each Required Action listed above.

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2018

Internal Review: Engineering & Maintenance

(2) Metrobus Parts & Material Inventory Management

April 27, 2018

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

ENGINEERING & MAINTENANCE

SERVICE DELIVERY

CAPITAL PROGRAM – MANAGEMENT & EXECUTION

INTERNAL SAFETY & SECURITY REVIEW

INTERNAL REVIEW SUMMARY

March 2018

(2) Metrobus Parts & Material Inventory Management

Wins:

- ✓ At Bladensburg and Carmen Turner Facility (CTF) bus parts are bundled together in advance of scheduled overhauls streamlining workloads and increasing the efficiency of bus maintenance activities.
- ✓ The number of operating purchase requisitions greater than 30 days has decreased by 96% in three months leading to the increased availability of parts for use.

Items Resolved During Review

- ✪ At the Bladensburg and CTF storerooms inventory discrepancies were identified for engine oil filters. The storeroom supervisor identified the issue using Maximo and made the necessary corrections.
- ✪ At Montgomery and Shepherd Parkway storerooms, damage to packaging and improper parts storage was observed. Parts were immediately placed into correctly labeled storage boxes.

Areas for Improvement

- Effective management of supply chain systems, including maintaining and updating lead times, will assure the availability of parts and materials.
- Tracking and managing shelf life limitations is essential to assure availability of parts and materials for use.
- Separation of discrepant material and approved material is necessary to reduce the risk of non-compliant parts being installed on buses.

Required Actions:

- **QICO-BMI-18-01:** Identify opportunities to implement sustainable methods for reducing inventory inaccuracies and lead time variances. *(Risk Rating: Elevated)*
- **QICO-BMI-18-02:** Incorporate a process to assure discrepant material cannot be mistaken for approved material. *(Risk Rating: Moderate)*

Actions Underway:

- Parts & Materials Inventory Management Internal Review (November 2017):

  QICO-PMIM-17-02: WMATA must continue to develop a shelf life policy to address tracking and managing of shelf life limitations.

What is QICO?

- The Office of Quality Assurance, Internal Compliance & Oversight (QICO) is an internal management function that partners with other departments to provide an objective review. Authorized by the General Manager as outlined in the Quality Management System Plan (QMSP).

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 within the Bus Division and promote the actions needed to address any concerns.

QICO's Methodology:

- Develop relevant review activities by identifying and assessing any risks to policies, procedures & standards, quality & compliance, and traceability.
- Review documentation, observe processes and interview key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

Note: An itemized internal Corrective and Preventive Action (iCAPA) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of iCAPA implementation go to https://www.wmata.com/initiatives/transparency/.

2.1. FUNCTIONAL OVERVIEW AND STRUCTURE

Metrobus Parts and Material Inventory Management

Parts and Material Inventory Management is responsible for the acquisition, planning, forecasting, managing, shipping, receiving, and storage/warehousing of parts and material.

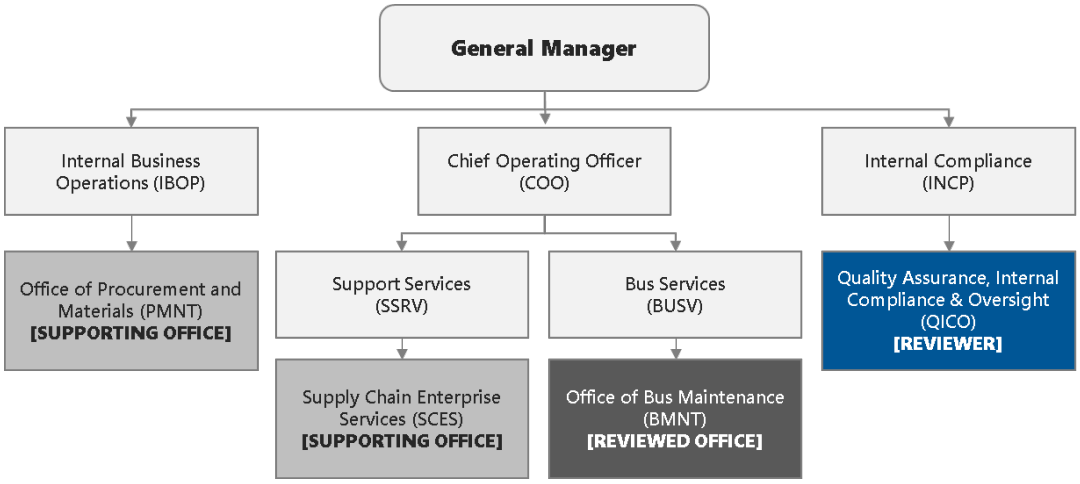
Bus Engineering (BENG) and Bus Storerooms and Material Logistics all reside under the Bus Maintenance (BMNT) department. The following describes the different departmental functions:

Bus Maintenance (BMNT)	Bus Engineering (BENG)	Bus Storerooms and Material Logistics
- Coordinate, plan, and administer all preventative and corrective maintenance - Major repair and overhaul - Engineering modification activities - Manage/administer bus/component warranty program	- Reviews and approves Part Action Forms (PAF) - Responsible for dispositioning Material Discrepancy Reports (MDR) - Provides clarification and specification of bus vehicle parts - Supporting the day-to-day maintenance activities - Introduces and manages Engineering Modification Instructions (EMIs) - Manage and administer bus component warranty program	- Provides material planning and forecasting to ensure inventory is maintained - Manage daily storeroom activities at 11 sub-storerooms

Organizational Structure and Background

The offices of Bus Engineering and Bus Material and Logistics report through the office of Bus Maintenance (BMNT), which reports up to the Chief Operating Officer (COO).

Parts and Material Inventory Management requires support from both Supply Chain Enterprise Services (SCES) and the office of Procurement (PRMT) to ensure parts are available to support scheduled Bus activities.



Supply Chain Enterprise Services (SCES) is primarily responsible for the receiving, receipting, stocking or storing, and issuing of materials required by Bus storerooms to complete necessary, builds, rebuilds, repairs and/or maintenance.

Procurement (PRMT) is primarily responsible for efficiently and effectively managing the acquisition of supplies, materials, and services in support of WMATA. Also, responsible for issuing purchase orders (PO's), developing contract terms; and ensuring supplies, materials, and/or services are acquired that meet the Clients requirements.

2.2. REVIEW SCOPE

Documentation Review

- BMNT Storerooms and Logistics SOP's 4.14, 4.17, 4.18, 4.5, 4.7, 4.8
- Supply Chain Enterprise Services Manual (March 2017)
- Maximo – Purchase Orders, Receipts, Purchase Requisitions, and Lead times (February 2017 – February 2018)
- Procurement Procedure Manual (August 2017 version 7.4)

Personnel Discussions

- Senior Vehicle Engineer BENG, [redacted]
- Procurement Manager PRMT, [redacted]
- QC Inspector Bus, [redacted]
- Logistics Coordinator SCES, [redacted]
- Inventory Planning Manager Bus, [redacted]
- Warehouse and Logistics Manager Bus, [redacted]
- Main Supply Facility-SCES
  - [redacted]
  - [redacted]
- Shepherd Parkway - Bus
  - [redacted]
  - [redacted]
- Montgomery - Bus
  - [redacted]
  - [redacted]
- Carmen Turner Facility - Bus
  - [redacted]
  - [redacted]
- Bladensburg - Bus
  - [redacted]
  - [redacted]

Field Assessments

- Five different locations around the core of the Bus system were used to assess storerooms and inventory practices within. Divisions are selected to produce a sample representing the diverse storeroom activities. Three locations were major receiving the other two contain satellite storeroom. Storeroom assessments were held at **Main Supply Facility (MSF)**, **Bladensburg**, **Carmen Turner Facility (CTF)**, **Montgomery**, and **Shepard Parkway**.
- Field assessments covered overall shop adherence to standards and procedures and were also inclusive of Inventory Counts, Storage Conditions, and Expired Material verification for the specific parts noted below.
- Parts selected for this review were picked based on the following criteria; Safety, Lead time, Shelf Life, High Usage, Critical to operations, and High Dollar.

Part / Selection Criteria	(p/n 881550367) Light, LED Headlights	(p/n 882550085) Connect Switch	(p/n 882550065) Proximity Sensor	(p/n 921720035) Caliper Assembly Disc Brake	(p/n 836700015) Turbo Engine	(p/n 824720042) Hose Assembly	(p/n 853700001) Oil Filter	(p/n 835720002) Fuel Filter
Safety	✓	✓	✓					
Long Lead Time		✓		✓	✓			
Shelf Life						✓		
High Usage							✓	✓
Critical to Operations	✓						✓	✓
High Dollar				✓	✓			
Original Equipment Manufacturer		✓	✓					

2.3. WHAT WORKED WELL (WINS)

Wins are categorized by Quality Measures and rated according to Risk Assessment.

W-BMI-18-01 Work Standards *Reduces Strategic Risk* **Owner – BMNT**

✓ **At Bladensburg and Carmen Turner Facility (CTF) bus parts are bundled together in advance of scheduled overhaul streamlining workloads and increasing the efficiency of bus maintenance activities.**

Discussion

- Bladensburg and CTF are major overhaul shops where planned activities require advanced scheduling.
- Maintenance Planning identifies and pulls all necessary parts for scheduled overhaul as kits, per bus, based on requirements from Maximo work orders.
- As kits are built, the part transactions are processed through Maximo as to reflect true storeroom inventory, and staged awaiting for overhaul to take place.
- Bundling together overhaul parts into kits is a good example of industry best practices. This practice functions well due to Bus Planning, Storerooms, and Maintenance all being within the same group (BMNT).

W-BMI-18-02 Work Standards *Reduces Strategic Risk* **Owner – PRMT**

✓ **The number of operating purchase requisitions greater than 30 days has decreased by 96% in three months leading to the increased availability of parts for use.**

Discussion

- As of 2/12/18 there are total of 135 open approved requisitions, of those only 7 are beyond 30 days.
- Between 11/20/17 and 2/12/18 the number of operating requisitions greater than 30 have dropped from 189 to 7, (a 96% decrease).
- The increase of contracts being awarded was the leading driver of this reduction. These parts were originally purchased as spot buys, which meant that all POs needed to be manually set out for bids and processed. By converting to contract buys the POs are automatically generated alleviating manual processing, which in turn lowers the number of outstanding POs.

2.4. ITEMS RESOLVED DURING REVIEW

Items are categorized by Quality Measures and rated according to Risk Assessment.

The following are issues that were identified by QICO during the Internal Review process, where appropriate actions were taken to eliminate the discrepancy or nonconformance prior to the close of this review.

R-BMI-18-01 Data Assurance — Service Delivery – Moderate (3,3) — **Owner – BMNT**

✪ **At the Bladensburg and CTF storerooms inventory discrepancies were identified for engine oil filters. The storeroom supervisor identified the issue using Maximo and made the necessary corrections.**

Actions Taken

- Inventory discrepancies were discovered at both Bladensburg and Carmen Turner Facility on Engine Oil Filters (WMATA p/n 853700001).
- Inventory discrepancy was initially discovered at MSF, where this part was 24 pieces fewer than records showed.
- At Bladensburg 18 more pieces than records showed were identified.
- At Carmen Turner Facility 4 more parts than records indicated were found.
- The root cause of both items was they were not properly transacted through the Maximo supply chain system.
- Upon discovery at both locations (Bladensburg and CTF) the storeroom supervisor traced the transactions in Maximo, identified the root cause, and made the necessary corrections.

R-BMI-18-02 Quality Control — Service Delivery – Moderate (3,3) — **Owner – BMNT**

✪ **At Montgomery and Shepherd Parkway storerooms, damage to packaging and improper parts storage was observed. Parts were immediately placed into correctly labeled storage boxes.**

Actions Taken

- While QICO was performing bus storeroom assessments parts at two different locations were identified with damaged packaging. Both locations immediately corrected the issue.
- A box of washers (p/n 1229Z1560) at Montgomery were found to have damage to the original packaging and parts were no longer contained within the packaging. Personnel responded by placing parts in an extra bin storage box with proper identification.
- Front axle spring bolts (p/n 955-70-0013) at Shepherd Parkway were found to have damage to the original outside packaging as well as the individual part package. Personnel responded by placing parts in an extra bin storage box with proper identification.

2.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

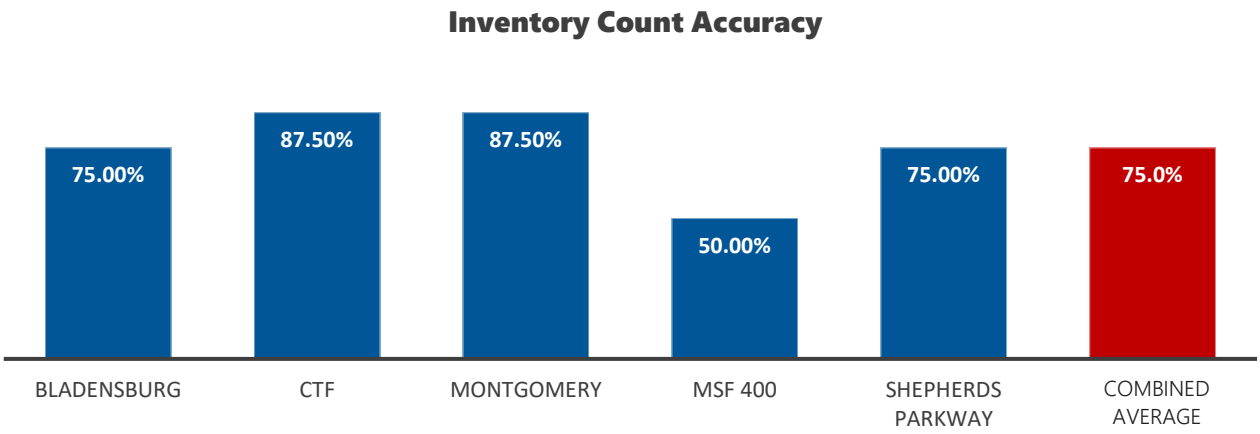
F-BMI-18-01 Change Management — Strategic – Elevated (4,4) — **Owner – BMNT**

- **Finding: Effective management of supply chain systems, including maintaining and updating lead times, will assure the availability of parts and materials.**

Discussion

Inventory Accuracy

- QICO conducted an inventory count of 8 different parts at 5 locations. The inventory accuracy average for the five locations is 75%:



- Inventory inaccuracies put the authority at risk of having out of stock parts and/or too much inventory which can have a direct impact on service reliability and fiscal responsibility.

Maximo Data Accuracy

- 3 of the 8 parts reviewed the supplier delivered within 30 days despite having lead times up to 236 days longer as noted in the table below:

Part Name	WMATA P/N	Maximo Lead Time	Actual Lead Time	Difference	Purchase Requisition #'s	Purchase Order #'s
Battery Disconnect Switch	882550085	120	30	90	547916	121328
Brake Disc Caliper Assembly	921720035	250	14	236	555784	122631
Turbo Engine ([redacted])	836700015	200	14	186	533575	115375

- 2 of the 8 parts reviewed, LED Headlights (881550367) and Hose Assemblies (824720042) had the requisition generation date and the required date as the same day due to the lead time being set to zero. Without understanding and acknowledging proper lead time, WMATA cannot ensure parts are available in the correct timeframe.

Part Name	WMATA P/N	Maximo Lead Time	Actual Lead Time	Difference	Purchase Requisition #'s	Purchase Order #'s
LED Headlight	881550367	0	53	53	546155	121885
Hose Assembly	824720042	0	14	14	545712	120881

F-BMI-18-01 Change Management — Strategic – Elevated (4,4) — **Owner – BMNT**

(continued discussion from previous page)

- Parts not being purchased according to true lead time dates can have a significant impact on inventory as well as service reliability. When lead times are set shorter than the time it takes the supplier to provide the parts it increases the risk of out of stock parts. This can directly impact repairs on Buses which in turn can directly impact the availability of Buses ready for service.
- Parts that have lead times set longer than what a supplier can actually deliver may cause purchasing to order more parts than what are necessary and effects the ability to efficiently plan reorder point and economic order quantities. This can directly impact Fiscal responsibility by tying up inventory dollars, shelf space, and increase slow moving material, which has the potential to become obsolete.

Lead Times

- Procurement is continuing to address supplier lead time accuracy, in conjunction with how due dates are assigned to purchase orders. An iCAPA **(QICO-PMIM-17-05)** was issued to Procurement from Metrorail Parts and Material Inventory Management Internal Review dated November of 2017.

Recommendation

Identify opportunities to implement sustainable methods for reducing inventory inaccuracies and lead time variances.

F-BMI-18-02 Quality Control — Service Delivery – Moderate (3,3) — **Owner – BMNT**

- **Finding: Tracking and managing shelf life limitations is essential to assure availability of parts and materials for use.**

Discussion

This finding is consistent with iCAPA QICO-PMIM-17-02 identified in Metrorail Engineering and Maintenance Parts and Materials Inventory Management Internal Review from November 17, 2017.

- Shelf life is the period of time during which a material may be stored and remain suitable for use. This can inclusive of caulks, adhesives, sealants, and rubber products.
- All materials purchased that carry an expiration date need to be routinely monitored. Any material that has expired should be pulled from inventory and discarded.
- [redacted] caulking, WMATA part number 067000796, was found at Montgomery and Shepherd Parkway to be expired.
- During open discussion with Storeroom Clerks, it was stated that they do not routinely inspect for expired material.
- The expired material was not immediately remove from the shelves at the time it was identified.

Recommendation

Incorporate BUS into iCAPA QICO-PMIM-17-02 which specifically addresses shelf life management.

F-BMI-18-03 Quality Control — Service Delivery – Moderate (3,3) — **Owner – SCES**

- **Finding: Separation of discrepant material and approved material is necessary to reduce the risk of non-compliant parts being installed on buses.**

Discussion

- Discrepant and non-compliant materials are parts that do not meet WMATA's specifications and/or standards.
- The risk of non-compliant parts making their way into inventory and having the potential to be installed on buses during repairs increases safety concerns and impacts service reliability.
- Bus parts are received at MSF and are staged awaiting inspection. Discrepant bus material was found in the same area as parts awaiting inspection.
- At MSF 400 QICO observed that 50 pieces of discrepant material (Windshield washer pump, p/n 972550153), were stored next to 6 incoming exhaust [redacted] valve kits (p/n 842550020), this increases the risk of non-compliant material being confused with new parts.
- During an open discussion a Quality Control Inspector stated that this is the current practice.

Recommendation

Incorporate a process to assure discrepant material cannot be mistaken for approved material.

2.6. SUMMARY OF REQUIRED ACTIONS

Findings are categorized by Quality Measures and rated according to Risk Assessment.

QICO-BMI-18-01 **Action Owner – BMNT** — *Overall Risk – Elevated (Average Score)*

Required Action: Identify opportunities to implement sustainable methods for reducing inventory inaccuracies and lead time variances.

Applicable Findings

- **F-BMI-18-01:** Effective management of supply chain systems, including maintaining and updating lead times, will assure the availability of parts and materials.
  - *Measure: Change Management. Risk: Strategic Risk– Elevated (4,4)*

QICO-BMI-18-02 **Action Owner – SCES** — *Overall Risk – Moderate (Average Score)*

Required Action: Incorporate a process to assure discrepant material cannot be mistaken for approved material.

Applicable Findings

- **F-BMI-18-03:** Separation of discrepant material and approved material is necessary to reduce the risk of non-compliant parts being installed on buses.
  - *Measure: Quality Control. Risk: Safety Risk – Elevated (3,3)*

Internal Corrective and Preventive Actions (iCAPAs) are designated to address each Required Action listed above.

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2018

Internal Review: Engineering & Maintenance

(3) Metrorail Vehicle Maintenance and Engineering

April 27, 2018

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

ENGINEERING & MAINTENANCE

SERVICE DELIVERY

CAPITAL PROGRAM – MANAGEMENT & EXECUTION

INTERNAL SAFETY & SECURITY REVIEW

What is QICO?

- The Office of Quality Assurance, Internal Compliance & Oversight (QICO) is an internal management function that partners with other departments to provide an objective review. Authorized by the General Manager as outlined in the Quality Management System Plan (QMSP).

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the state of the Metrorail vehicle maintenance & engineering activities and promote the actions needed to address any concerns.

QICO's Methodology:

- Develop relevant review activities by identifying and assessing risks to policies, procedures & standards, quality & compliance, and traceability.
- Review maintenance documentation, observe processes, and interview key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

INTERNAL REVIEW SUMMARY

(3) Metrorail Vehicle Maintenance and Engineering

Wins:

- ✓ Personal protective equipment (PPE) at all rail facilities visited was readily available and properly used promoting safe work practices.
- ✓ Preventive maintenance (PM) documentation at all facilities visited was readily available to the technicians and had proper document controls in place allowing for consistent maintenance activities.
- ✓ Precision measuring devices at New Carrollton, Shady Grove, & West Falls Church facilities were secured and managed properly fostering positive quality control.

Items Resolved During Review:

- ✪ At the Greenbelt facility the shelf life management program was not implemented. The superintendent initiated the shelf life program and appointed an individual responsible for oversight.
- ✪ At Greenbelt and West Falls Church facilities, shop safety devices were damaged or missing. Repairs were made right away to door obstruction, machine guard, and shop power safety devices.
- ✪ Improper maintenance of eye wash stations and fire extinguishers at Greenbelt, New Carrollton, and West Falls Church facilities was observed. Eye wash station and fire extinguisher issues were corrected immediately.

Areas for Improvement:

- Compliance with safety requirements is essential for a safe and reliable working environment.
- Maintaining certification of lifting devices is necessary for safe and reliable maintenance operations.
- Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.
- Implementation of established quality control plans (QCPs) is vital to promote consistency and quality of maintenance activities.
- Establishing concise parts management and workplace organization requirements is vital for safe and reliable operations.
- Developing methods to assess reliability of work performed at the shop floor level will help drive performance improvements and establish fleet comparison metrics.

Required Actions:

- **QICO-RCM-18-01 & RCM-18-02:** Perform safety and equipment certification assessments at all facilities. Incorporate methods to maintain safety critical items. (*Risk Rating: High)*
- **QICO-RCM-18-03 & RCM-18-06:** Refine goals and objectives to include shop specific metrics to improve overall maintenance performance and Maximo data collection. *(Risk Rating: Elevated)*
- **QICO-RCM-18-04 & RCM-18-05:** Identify opportunities to revise and implement established procedures to improve work quality and parts management. *(Risk Rating: Elevated)*

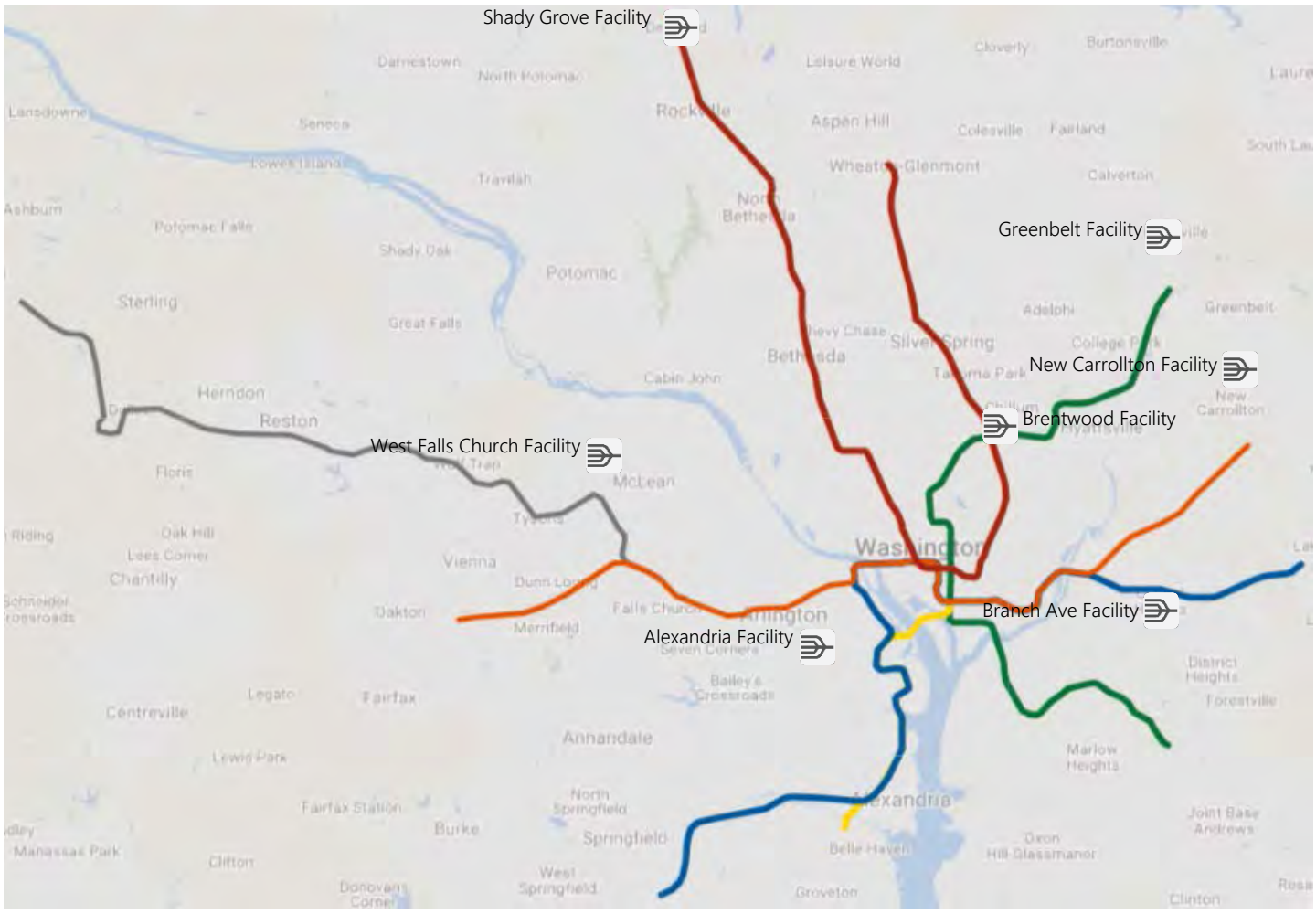
Note: An itemized internal Corrective and Preventive Action (iCAPA) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of iCAPA implementation go to https://www.wmata.com/initiatives/transparency/.

3.1. FUNCTIONAL OVERVIEW AND STRUCTURE

Office of Car Maintenance (CMNT)

The Office of Car Maintenance (CMNT) coordinates, plans, and administers all preventative and corrective maintenance, major repair and overhaul, and engineering modification activities for a fleet of 1246 rail vehicle assets comprising 500 Kawasaki 7000 series, 184 Alstom 6000 series, 192 CAF 5000 Series, and 358 overhauled Breda 2000/3000 Series rail cars.

Car Maintenance Facilities



- Alexandria Service and Inspection Facility, Alexandria VA:
  - Responsible for maintaining a fleet of 190 rail cars, 98 Kawasaki 7000 Series and 92 Breda 2000/3000 Series.
  - Supports Blue and Yellow lines service.

- Branch Ave Service and Inspection Facility, Camp Springs MD:
  - Facilitates unplanned maintenance and engineering modifications for all fleets.
  - Supports Green and Yellow lines service.

- Brentwood Service and Inspection Facility, Washington DC:
  - Facilitates unplanned maintenance, engineering modifications, and capital improvement/ rehabilitation programs for all fleets.
  - Supports Red line service.

Car Maintenance Facilities (cont.)

- Greenbelt Service and Inspection Facility, College Park MD:
  - [redacted]
  - Supports Green and Yellow lines service.

- New Carrollton Service and Inspection Facility, Hyattsville MD:
  - [redacted]
  - Supports Orange and Silver lines service.

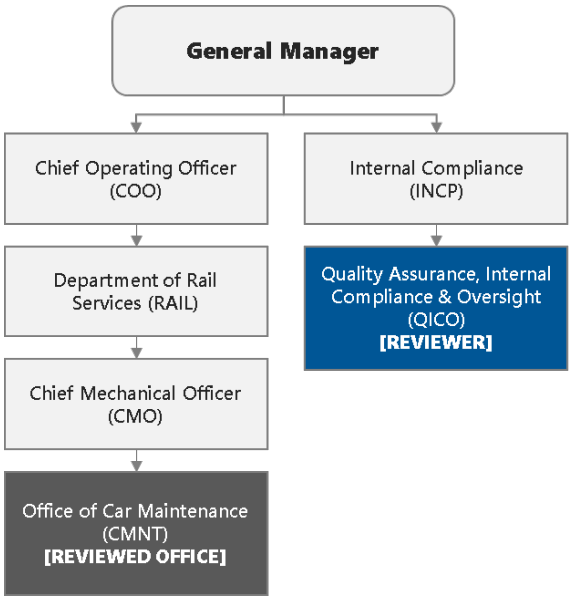
- Shady Grove Service and Inspection Facility, Rockville MD:
  - [redacted]
  - Supports Red line service.

- West Falls Church Service and Inspection Facility, Falls Church VA:
  - [redacted]
  - Supports Orange and Silver lines service.

3.2. REVIEW SCOPE

The intention of this internal review is to provide an independent evaluation of CMNT operations and management, promote compliance with internal and external regulatory requirements, and drive quality improvement initiatives that safeguard the mission success of WMATA while enhancing the customer experience. QICO performed the internal review between January 29 and February 21, 2018.

QICO reviewed documentation, performed field assessments, and interviewed personnel, noting both positive and negative findings. QICO's findings are categorized into four groups: **Policies, Procedures and Standards, Quality and Compliance**, and **Traceability**. 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.

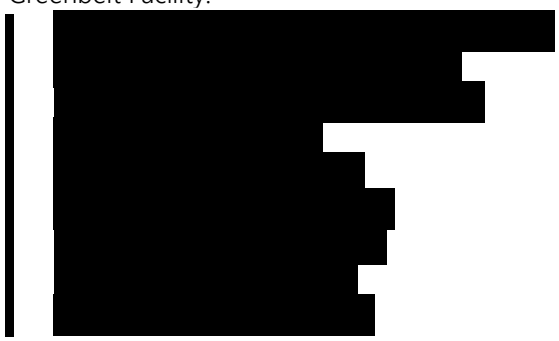


Documentation Review

- CMNT Standard Operating Procedure (SOP) 1.04, Documenting Corrective Maintenance.
- CMNT SOP 1.05, Documenting Preventive Maintenance.
- CMNT SOP 1.06, Deferred Maintenance.
- CMNT SOP 1.11, Rail Vehicle Incidents.
- CMNT SOP 1.18, Procedures for Cannibalization.
- CMNT SOP 2.04, Classification Training Requirements.
- CMNT SOP 2.09, Accessing Safety Data Sheets.
- CMNT SOP 2.10, Supervisor Responsibilities.
- CMNT SOP 2.12, Fleet Maintenance Management.
- CMNT SOP 3.04, Management of Lift Devices.
- CMNT SOP 3.05, Precision Measuring Devices.
- CMNT SOP 3.06, Portable Test Units.
- CMNT SOP 3.07, Lockout/Tagout (LOTO).
- CENV SOP 1, Engineering Modification Instructions.
- Operations Administrative Procedure (OAP) 100-19, Work Order Quality Review.
- OAP 100-20, Supervisory Inspections.
- OAP 105-01, Rail Car Engineering Change Documents.
- OAP 200-03, Revenue Vehicle Preventive Maintenance.
- OAP 600-05, Storeroom Access Control.
- Supervisory quality control audits.
- Training records.
- Calibration and weight certifications.
- Maximo data: incidents, corrective maintenance work orders, and preventive maintenance work orders
- Failure Data Tags.

Personnel Discussions

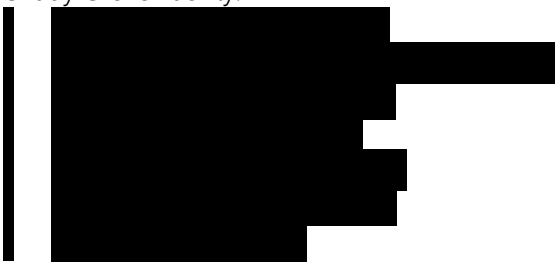
Greenbelt Facility:



West Falls Church Facility:

New Carrollton Facility:

Shady Grove Facility:



Field Assessments

The following four (4) car maintenance facilities were selected based on them being inclusive of all the rail car maintenance activities performed within Metro, as well as serving all the lines within the rail system. The assessments include evaluations of the physical condition of each facility, observations of work in progress, and inspections of tools and equipment in use.

Greenbelt Service and Inspection Facility College Park, MD	[redacted]
New Carrollton Service and Inspection Facility Hyattsville, MD	
Shady Grove Service and Inspection Facility Rockville, MD	
West Falls Church Service and Inspection Facility Falls Church, VA	

3.3. WHAT WORKED WELL (WINS)

Wins are categorized by Quality Measures and rated according to Risk Assessment.

W-RCM-18-01 Job Safety — *Reduces Safety Risk* — **Owner – CMNT**

✓ **Personal protective equipment (PPE) at all rail facilities visited was readily available and properly used promoting safe work practices.**

Discussion

- During field assessments at Greenbelt, New Carrollton, Shady Grove, and West Falls Church Service and Inspection Facilities, QICO observed consistent usage and availability of the required PPE.

W-RCM-18-02 Policies, Procedures, and Standards — *Reduces Service Delivery Risk* — **Owner – CMNT**

✓ **Preventive maintenance (PM) documentation at all facilities visited was readily available to the technicians and had proper document controls in place allowing for consistent maintenance activities.**

Discussion

- During field assessments at Greenbelt, New Carrollton, Shady Grove, and West Falls Church Service and Inspection Facilities, technicians were observed to be in possession of the correct PM documentation and procedures.

W-RCM-18-03 Quality Control — *Reduces Service Delivery Risk* — **Owner – CMNT**

✓ **Precision measuring devices at New Carrollton, Shady Grove, & West Falls Church facilities were secured and managed properly fostering positive quality control.**

Discussion

- During field assessments at New Carrollton, Shady Grove, and West Falls Church Service and Inspection Facilities, QICO observed positive control over precision measuring devices. Items were stored in a secured area and were controlled by a designated responsible staff member, which led to no major findings in calibration at these facilities.

3.4. ITEMS RESOLVED DURING REVIEW

Items are categorized by Quality Measures and rated according to Risk Assessment.

The following are issues that were identified by QICO during the Internal Review process, where appropriate actions were taken to eliminate the discrepancy or nonconformance prior to the close of this review.

R-RCM-18-01 Skills Management — Service Delivery – Low (2,4) — **Owner – CMNT**

✪ **At the Greenbelt facility the shelf life management program was not implemented. The superintendent initiated the shelf life program and appointed an individual responsible for oversight.**

Actions Taken

- QICO observed through interviews and document requests that the Greenbelt Service and Inspection Facility has not implemented the shelf life management program requirements as prescribed by CMNT SOP 1.08.
- Greenbelt Service and Inspection Superintendent issued a memorandum indicating immediate implementation of shelf life management program along with a completed OJT form demonstrating satisfactory completion of training requirements for the individual responsible for oversight.

R-RCM-18-02 Job Safety — Safety – Moderate (3,4) — **Owner – CMNT**

✪ **At Greenbelt and West Falls Church facilities, shop safety devices were damaged or missing. Repairs were made right away to door obstruction, machine guard, and shop power safety devices.**

Actions Taken

- Door bottom sensitive edge safety devices were observed to be disconnected on two (2) overhead doors at the Greenbelt Service and Inspection Facility, at locations 3-South and 5-North. A work order was immediately opened to address the concern, and Plant Maintenance (PLNT) responded and repaired both doors in a timely fashion.
- Damaged stop button "mushroom" at shop power station #17 and loose stop button "mushroom" at shop power station #18 were observed at the West Falls Church Service and Inspection Facility. A work order was opened to address the concern, and PLNT responded and repaired both buttons in a timely fashion.
- Missing safety guard was observed on a grinding machine (asset 585990) during field assessment at West Falls Church Service and Inspection Facility. Shop personnel procured and installed the missing safety guard.

R-RCM-18-03 Job Safety — Safety – Moderate (3,4) — **Owner – CMNT**

✪ **Improper maintenance of eye wash stations and fire extinguishers at Greenbelt, New Carrollton, and West Falls Church facilities was observed. Eye wash station and fire extinguisher issues were corrected immediately.**

Actions Taken

- The following eye wash station discrepancies were corrected immediately:
  - New Carrollton Service and Inspection Facility: three (3) missing refill bottles, three (3) expired refill bottles, and one (1) blocked station.
  - West Falls Church Service and Inspection Facility: six (6) bottles with no printed expiration date, eight (8) stations with inadequate quantity of refill bottles, two (2) expired refill bottles, and one (1) blocked station.
- The following fire extinguisher discrepancies were corrected:
  - Greenbelt Service and Inspection Facility: one (1) blocked, one (1) missing, and four (4) incomplete inspection records.
  - Shady Grove Service and Inspection Facility: three (3) incomplete inspection records.
  - New Carrollton Service and Inspection Facility: two (2) missing, and two (2) incomplete inspection records.

3.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-RCM-18-01 Job Safety — Safety – High (5.4) — **Owner – CMNT**

- **Finding: Compliance with safety requirements is essential for a safe and reliable working environment.**

Discussion

- QICO evaluated the high voltage gloves inspection log at each of the four (4) yards, and none were found consistently completed. This indicates that the gloves are not routinely inspected as required by OSHA 1910.137(c)(2)(ii).
- The log book for the Lockout/Tagout (LOTO) process is not maintained at each of the four (4) yards as required by CMNT SOP 3.07 (Lockout/Tagout Procedures), clause 3.4.3.
- Fire extinguishers are not consistently inspected as follows:
  - New Carrollton Service and Inspection Facility: two (2) expired and one (1) missing.
  - West Falls Church Service and Inspection Facility: three (3) expired and one (1) missing.
- First aid kits are not consistently inspected and maintained as follows:
  - Greenbelt Service and Inspection Facility: one (1) blocked and one (1) missing more than 50% of its content.
  - West Falls Church Service and Inspection Facility: All kits were missing five (5) or more items.
  - Shady Grove Service and Inspection Facility: three (3) kits were missing five (5) or more items.
- QICO was unable to locate chemical response spill kits at the West Falls Church Service and Inspection Facility despite two (2) placards indicating where the kits should be present.
- Maintenance concerns with the 750VDC shop power and traction power stinger systems were observed during field assessments as follows:
  - Greenbelt Service and Inspection Facility: loose strain relief fittings at the stinger alligator clip assembly, and stinger control cable assemblies repaired using electrical tape, which is prohibited per CMNT SOP 3.02, clause 6.2.7.
  - West Falls Church Service and Inspection Facility: inoperative status indicators at shop power control stations #17 and #18, malfunctioning key switch at station #7, and electrical tape used to repair the power cable at station #12, which is prohibited per CMNT 3.02, clause 6.5.2.
  - Shady Grove Service and Inspection Facility: shop power control station #1 has broken key switch, and stinger control pendent in blow pit area has broken protective cover over the pushbutton.

Recommendation

Assess the safety compliance and state of the different facilities, and take immediate corrective actions. Develop a sustainable preventive program to internally monitor and maintain the safety condition of the facilities.

3.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-RCM-18-02 Job Safety — Safety – High (5.4) — **Owner – CMNT**

- **Finding: Maintaining certification of lifting devices is necessary for safe and reliable maintenance operations.**

Discussion

- Annual weight certifications required per CMNT SOP 3.04, clause 3.4.4 were expired or unavailable as follows:
  - New Carrollton Service and Inspection Facility: lift device asset 585560 had an expired load test certificate, due date of 3/17/2016.
  - West Falls Church Service and Inspection Facility: CMNT was unable to produce a certificate for lift device asset 670518.
- Maximum load capacity labels required per CMNT 3.04, clauses 3.4.8 and 3.4.9 were not physically present as follows:
  - Greenbelt Service and Inspection Facility: one (1) lifting device, asset number unknown.
  - New Carrollton Service and Inspection Facility: one (1) lifting device and three (3) lifting rings, asset numbers unknown.
  - West Falls Church Service and Inspection Facility: two (2) lifting devices, assets 585547 and 585549.
  - Shady Grove Service and Inspection Facility: six (6) lifting rings, asset numbers unknown.
- Monthly inspections required per CMNT 3.04, clause 3.4.7 are not being performed consistently. Maximo maintenance records were examined for three (3) random devices at each facility, and the following assets were found non-compliant:
  - Greenbelt Service and Inspection Facility: 584975, 603804, and 572955.
  - New Carrollton Service and Inspection Facility: 611735, and 612602.
  - West Falls Church Service and Inspection Facility: 611846, 585584, and 585635.
  - Shady Grove Service and Inspection Facility: 594277, 594266, and 594278.
- Asset and serial number labels were not physically present on two (2) lift slings with unknown asset numbers at New Carrollton Service and Inspection Facility as required per CMNT SOP 3.0.4, clause 3.4.11.

Recommendation

Assess the certification status of all lifting devices and accessories and implement immediate corrective actions. Review the current inspection and certification procedures and update them accordingly to achieve a robust process, including effective visualization of the status of all covered equipment.

3.5. AREAS FOR IMPROVEMENT

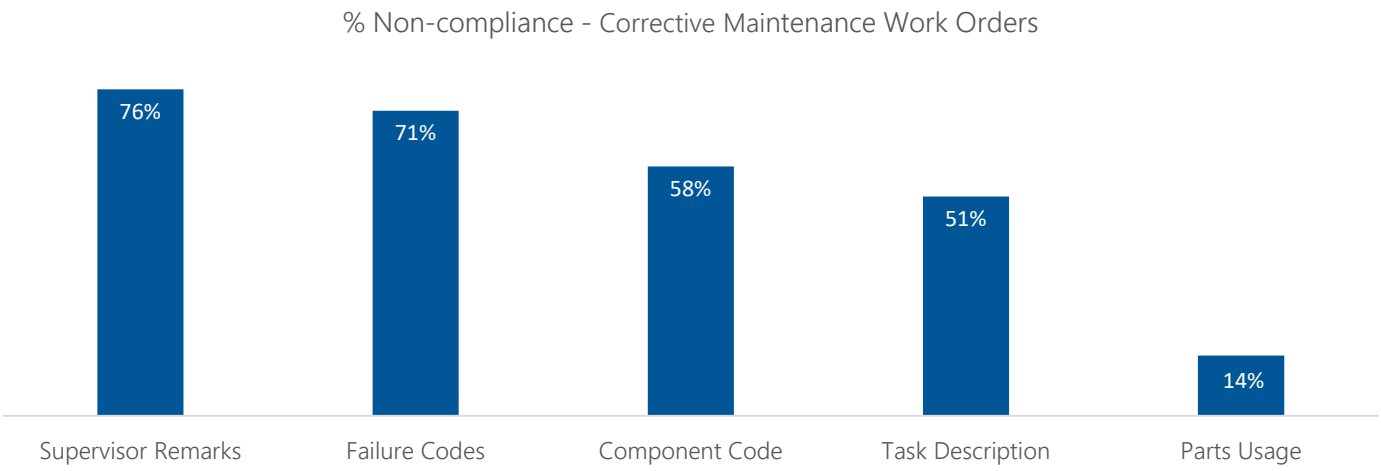
Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-RCM-18-03 Data Assurance — Service Delivery – Elevated (4.4) — **Owner – CMNT**

- **Finding: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.**

Discussion

Corrective Maintenance work orders data entry discrepancies:



- A random sample of 80 corrective maintenance (CM) work orders, 20 from each assessed facility, covering the period 01/14/2018 – 02/05/2018 have been evaluated as follows:
  - 76% of work orders assessed did not meet the established criteria for information recorded in the Supervisor Remarks field per CMNT SOP 1.04, clauses 6.5.10 and 6.5.11. The prescribed procedure requires detailed information about the specific root cause of the failure as well as justification for each part or component replaced on the work order. For example, work order numbers 14048040, 14075957, and 14050131.
  - 71% of work orders assessed did not have accurate failure information coding in the Failure Reporting tab of the work order. This data is used to facilitate reliability reporting and failure trend analysis. For example, work order numbers 14073771, 14069862, and 14076752.
  - 58% of work orders assessed had a component code that did not accurately reflect the affected system where work was performed. For example, work order numbers 14056645, 14083103, and 14060855.
  - 51% of work orders assessed did not have sufficient detail recorded in the task description narrative to reliably convey the nature of all troubleshooting efforts such as the outcome of diagnostic and track testing performed, or information about what events or faults were logged on the rail car. This may lead to duplicative efforts by technicians following up on prior tasks. For example, work order numbers 14050026, 14069862, and 14081673.
  - 14% of work orders assessed exhibited issues with the usage of parts or materials. Examples of discrepancies include records of parts charged to an asset with no supporting information about why the part was replaced, work orders that state a part was replaced but have no record of parts usage, or parts issued to an asset that are incorrect for that asset type. For example, work order numbers 14071464, 14045581, and 14046604.

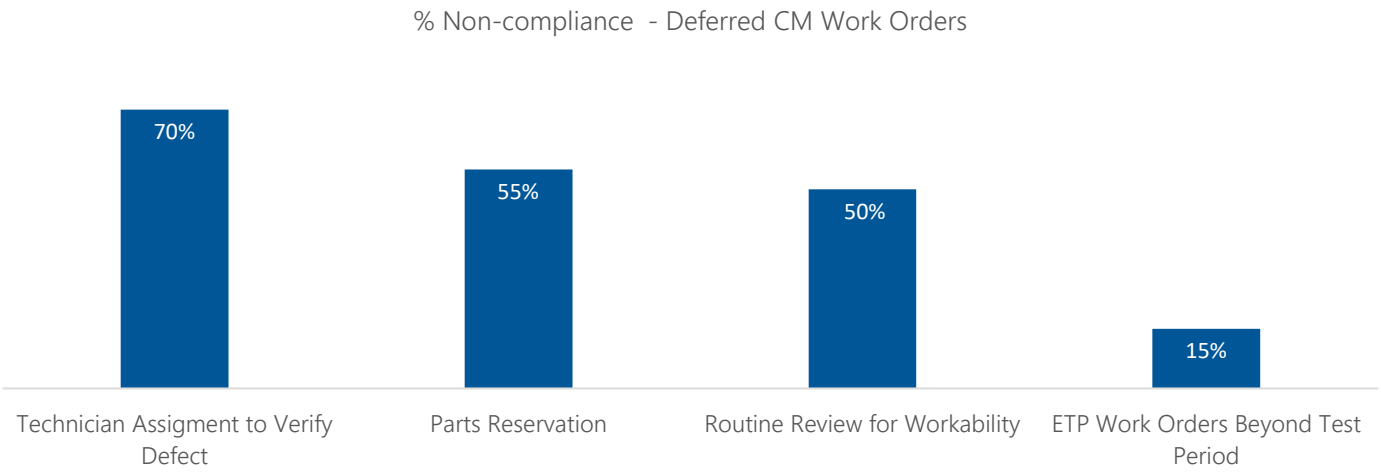
3.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-RCM-18-03 Data Assurance — Service Delivery – Elevated (4.4) — **Owner – CMNT**

(continued discussion from previous page)

Deferred CM work orders data entry discrepancies:



- A random sample of 40 deferred CM work orders, ten (10) from each assessed facility, covering the period 10/05/2016 – 02/11/2018 have been evaluated for compliance with established procedures as follows:
  - 70% of work orders assessed did not have a record indicating that a technician was assigned to verify the nature of the defect as required per CMNT SOP 1.06, clause 6.2.1. For example, work order numbers 13979086, 14087905, and 13950723.
  - 55% of work orders for assets deferred due to parts unavailability did not have the part reserved in the Plans tab of the work order as required per CMNT SOP 1.06, clause 6.2.6. For example, work order numbers 13690549, 13998084, and 13619582.
  - 50% of work orders assessed were not being routinely reviewed for workability at each preventive maintenance interval as required per CMNT SOP 1.05, clauses 6.1.4 and 6.1.5. For example, work order numbers 13619582, 13885674, and 13911238.
  - 15% of work orders assessed were for Engineering Test Plans (ETP), which are temporary modifications to the baseline configuration of a rail car asset, which remained in place beyond the approved test period. For example, work orders 13994183, 13850685, and 13745299.

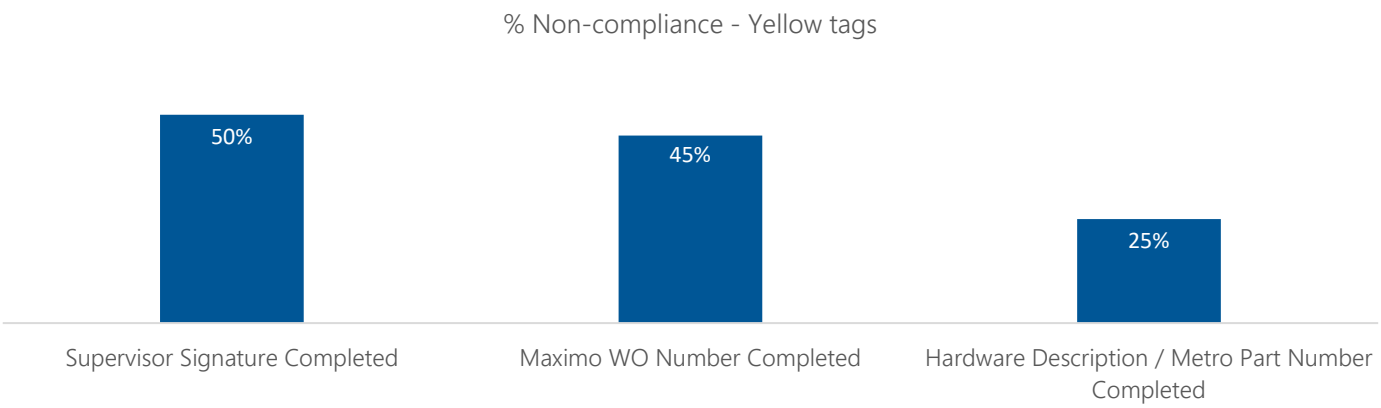
3.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-RCM-18-03 Data Assurance — Service Delivery – Elevated (4.4) — **Owner – CMNT**

(continued discussion from previous page)

Yellow tag discrepancies:



- A random sample of 40 failure data tags, or "yellow tags", which are used to convey information about failed rail car components sent from the Service and Inspection (S&I) Facilities to the Major Repair and Overhaul (MRO) Facilities were evaluated as follows:
    - 50% of the tags assessed did not have the supervisor signature field completed, indicating that the information was not reviewed for data quality or accuracy.
    - 45% of the tags assessed did not have the Maximo work order number field completed. This information is used by MRO technicians to guide their troubleshooting and repair efforts based on what was observed and recorded in Maximo by technicians condemning the part at the S&I facility.
    - 25% of the tags assessed did not have the hardware description or Metro part number fields completed. An interview with the MRO assistant superintendent indicated that tags often become dislodged or misplaced while components are in transit to the MRO facility, and without this information, the tag cannot be matched to the correct component on arrival at the MRO facility.

- Discrepancies revealed through preventive maintenance inspections are not being recorded in a consistent manner, per interviews with preventive maintenance supervisors and technicians at each facility. CMNT does not have a standard governing these records which has resulted in each shop developing their own process. The use of a single "Post PM Discrepancy" work order for each asset is a common approach in use at each facility. The use of a single work order to capture all discrepancies may exclude these discrepancies from appearing in trend analyses or repeat failure queries as they are all coded identically.

Recommendation

As part of the planned implementation of the latest revision of Maximo, establish detailed requirements for data entry and validation, incorporate those requirements in a thorough training curriculum, and establish detailed criteria for a quality control plan pertaining to preventive and corrective maintenance Maximo work order completion and closure.

3.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-RCM-18-04 Quality Control — Service Delivery – Elevated (3,5) — **Owner – CMNT**

- **Finding: Implementation of established quality control plans (QCPs) is vital to promote consistency and quality of maintenance activities.**

Discussion

- Required quality control audits are not being performed at any of the four shops assessed. Requirements for quality control audits are the following:
  - Running maintenance critical components quality control audits per CMNT SOP 2.10, clause 6.7.1.
  - Running maintenance non-critical components quality control audits per CMNT SOP 2.10, clause 6.7.2.
  - Running maintenance daily inspection quality control audits per CMNT SOP 2.10, clause 6.7.3.
- Required quality control audits are not being performed at Greenbelt, West Falls Church, or Shady Grove Service and Inspection Facilities. Governing SOPs that should be conducted are the following:
  - Periodic inspection quality control audits per CMNT SOP 2.10, clause 6.8.1.
  - Periodic inspection sign-off paperwork quality control audits per CMNT SOP 2.10, clause 6.8.3.
- Memoranda have been received from superintendents at each of the four assessed shops indicating full implementation of all quality control audit requirements will begin effective 02/20/2018.

Recommendation

Comply with the requirements established in CMNT SOP 2.10, including the proficiency and methodology reviews to be performed by the shop Superintendent and CMNT Assistant General Superintendent.

F-RCM-18-05 Quality Control — Service Delivery – Moderate (3,4) — **Owner – CMNT**

- **Finding: Establishing concise parts management and workplace organization requirements is vital for safe and reliable operations.**

Discussion

- Parts management concerns were observed during field assessments as follows:
  - Shelf life management programs have not been implemented at any of the four assessed facilities as required per CMNT SOP 1.08. Items made from or containing polymers and items with a finite shelf life such as electronic backup batteries and emergency egress glow sticks were observed in floor stock areas at each of the assessed facilities.
  - Rail car parts and components of unknown operating status were observed stored on pallets throughout the West Falls Church, New Carrollton, and Shady Grove Service and Inspection Facilities. Additionally, parts and components used exclusively on fleets which have been retired were observed in drawers and cabinets on the shop floor at these facilities.
  - There is not a sufficient range and quantity of consumables such as fasteners, cable ties, and tamper seals readily available to technicians at the Greenbelt, West Falls Church, and New Carrollton Service and Inspection Facilities. This results in inefficiencies while performing maintenance tasks as technicians spend time acquiring these items from the storeroom or wait until they are delivered from another facility.

3.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

(continued discussion from previous page)

- General housekeeping concerns were observed during field assessments as follows:
    - Greenbelt Service and Inspection Facility: blocked electrical panels, improperly stowed shop power cable and compressed air supply lines, accumulation of oily rags in wheel lathe area, unprotected used fluorescent lamp tubes, and a damaged vehicle lift cover plate presenting a tripping hazard.
    - West Falls Church Service and Inspection Facility: blocked electrical panels, obstructed exit paths, unprotected used fluorescent lamp tubes, 55-gallon drums staged with no leak protection, and unlabeled chemical products.
    - New Carrollton Service and Inspection Facility: material stored within operating area of drop table, unlabeled chemical products, and 55-gallon drums staged with no leak protection.
    - Shady Grove Service and Inspection Facility: unlabeled chemical products, and improperly stowed shop power cable.
- During field observations, QICO observed Automatic Train Protection (ATP) safety-critical vital relays of unknown operating status stored in cardboard boxes or upon open shelving at the West Falls Church, New Carrollton, and Shady Grove Service and Inspection Facilities. This is inconsistent with Metro practice of storing and transporting vital relays in hard shell cases with molded foam protective interiors.

Recommendation

Comply with the requirements prescribed in CMNT SOP 1.08, Shelf Life Management. Establish procedures to identify, tag, and organize parts stored on the shop floor, as well as housekeeping and workplace organization including implementation and periodic reviews.

F-RCM-18-06 Work Measurement — Service Delivery– Low (2,4) — **Owner – CMNT**

- **Finding: Developing methods to assess reliability of work performed at the shop floor level will help drive performance improvements and establish fleet comparison metrics.**

Discussion

- The reliability metrics and analyses used are broad and do not measure the work being performed at the shop floor level, such as indicators for mean time to repair, mean time to react, etc., that may be used to improve the reliability of the maintenance process at the shop floor level.
- The reliability metrics measuring different fleets' performance are not co-related with the shops that does the actual work, thus does not drive improvement.
- Reliability statistics used to compare the efficacy of each shop's preventive maintenance program do not break out individual fleet performance, which limits the usefulness of this indicator as different fleets have different goals.

Recommendation

Establish shop specific metrics and indicators that reflects the actual work being done within the shops and utilize it within sound management routines to drive improvement.

3.6. SUMMARY OF REQUIRED ACTIONS

Findings are categorized by Quality Measures and rated according to Risk Assessment.

QICO-RCM-18-01 Action Owner – CMNT

Overall Risk – High (Average Score)

Required Action: Assess the safety compliance and state of the different facilities, and take immediate corrective actions. Develop a sustainable preventive program to internally monitor and maintain the safety condition of the facilities.

Applicable Findings

- F-RCM-18-01: Complying with the safety requirements is necessary for a safe and reliable working environment.
  - *Measure: Job Safety. Risk: Safety– High (5,4)*

QICO-RCM-18-02 Action Owner – CMNT

Overall Risk – High (Average Score)

Required Action: Assess the certification status of all lifting devices and accessories and implement immediate corrective actions. Review the current inspection and certification procedures and update them accordingly to achieve a robust process, including effective visualization of the status of all covered equipment.

Applicable Findings

- F-RCM-18-02: Consistent inspection and certification of lifting devices and accessories are necessary to ensure a safe and reliable working environment.
  - *Measure: Job Safety. Risk: Safety– High (5,4)*

QICO-RCM-18-03 Action Owner – CMNT

Overall Risk – Elevated (Average Score)

Required Action: As part of the planned implementation of the latest revision of Maximo, establish detailed requirements for data entry and validation, incorporate those requirements in a thorough training curriculum, and establish detailed criteria for a quality control plan pertaining to preventive and corrective maintenance Maximo work order completion and closure.

Applicable Findings

- F-RCM-18-03: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of the maintenance tasks performed.
  - *Measure: Data Assurance. Risk: Service Delivery– Elevated (4,4)*

QICO-RCM-18-04 Action Owner – CMNT

Overall Risk – Elevated (Average Score)

Required Action: Comply with the requirements established in CMNT SOP 2.10, including the proficiency and methodology reviews to be performed by the shop Superintendent and CMNT Assistant General Superintendent.

Applicable Findings

- F-RCM-18-04: Implementation of a quality control plan is essential to ensure high quality work that conforms to the requirements.
  - *Measure: Quality Control. Risk: Service Delivery– Elevated (3,5)*

QICO-RCM-18-05 Action Owner – CMNT

Overall Risk – Moderate (Average Score)

Required Action: Comply with the requirements prescribed in CMNT SOP 1.08, Shelf Life Management. Establish procedures to identify, tag, and organize parts stored on the shop floor, as well as housekeeping and workplace organization including implementation and periodic reviews.

Applicable Findings

- F-RCM-18-05: Maintaining controlled parts management, workplace organization and housekeeping is vital for reliable and safe operations.
  - *Measure: Quality Control. Risk: Safety– Moderate (2,4)*

QICO-RCM-18-06 **Action Owner – CMNT** *Overall Risk – Low (Average Score)*

Required Action: Establish shop specific metrics and indicators that reflects the actual work being done within the shops and utilize it within sound management routines to drive improvement.

Applicable Findings

- **F-RCM-18-06:** The existence and effectiveness of operational goals (indicators) and sound management routines to achieve these goals are important for reliable operations.
  - *Measure: Work Measurement. Risk: Service Delivery– Low (2.4)*

Internal Corrective and Preventive Actions (iCAPAs) are designated to address each Required Action listed above.

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2018

Internal Review: Engineering & Maintenance

(4) Metrorail Vertical Transportation: Elevator Maintenance and Inspections

April 27, 2018

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

ENGINEERING & MAINTENANCE

SERVICE DELIVERY

CAPITAL PROGRAM – MANAGEMENT & EXECUTION

INTERNAL SAFETY & SECURITY REVIEW

INTERNAL REVIEW SUMMARY

April 2018

(4) Metrorail Vertical Transportation: Elevator Maintenance and Inspections

What is QICO?

- The Office of Quality Assurance, Internal Compliance & Oversight (QICO) is an internal management function that partners with other departments to provide an objective review. Authorized by the General Manager as outlined in the Quality Management System Plan (QMSP).

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's Methodology:

- Develop relevant review activities by identifying and assessing any risks to policies, procedures & standards, quality & compliance, and traceability.
- Review documentation, observe processes and interview key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

Wins:

✓ At visited sites elevator barricades were used to prevent unauthorized access into work areas protecting technicians and the riding public.

Items Resolved During Review:

✪ At Franconia-Springfield, Eastern Market, and Friendship Heights discarded material, debris and trash were observed. Supervisors and technicians at these locations took immediate action to remove discarded materials, debris and trash.

Areas for Improvement:

- Readily available elevator certificates of inspection are vital for the safe and reliable delivery of elevator services to customers.
- Compliance with Lock Out / Tag Out (LOTO) procedures minimizes job hazards and assures safe working conditions.
- Availability of maintenance records in accordance with the ELES Maintenance Control Policy (MCP) is essential for consistency and traceability of maintenance activities.
- Accuracy of the MCP assures consistency of maintenance processes and increases asset reliability.
- Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.
- Logbook recordkeeping in accordance with regulatory code A17.1 assures onsite availability of and access to maintenance history.
- Maintaining work areas free of trash and debris encourages a positive work environment and reduces job hazards.
- Enforcing established measures for approving rehabilitated equipment is vital to improved asset performance and integration with WMATA systems.

Required Actions:

- **QICO-ELES-18-01:** Identify opportunities to update the methodology for managing certification of all assets; include methods to ensure documentation is readily available on the System Asset Map.
- **QICO-ELES-18-02:** Identify opportunities to implement established safety procedures that mitigate job hazards.
- **QICO-ELES-18-03:** Review and update the MCP to reinforce established SOPs, assure accurate management and availability of records.
- **QICO-ELES-18-04:** Verify Franconia-Springfield garage elevators J03X04, J03X05 and J03X06 programmable logic controllers (PLCs) meet capital improvement project (CIP) acceptance measures and confirming all WMATA requirements are met.

Note: An itemized internal Corrective and Preventive Action (iCAPA) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of iCAPA implementation go to https://www.wmata.com/initiatives/transparency/.

4.1. FUNCTIONAL OVERVIEW AND STRUCTURE

Vertical Transportation: Elevators

The Office of Elevator Escalator Services (ELES) provides vertical transportation services, an important feature of the Metrorail system, to over 427,000 riders daily[1]. 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.

Unlike other engineering and maintenance functions, ELES consolidates all three functions - maintenance, engineering, and the capital improvement program – into one office:

ELES Maintenance	ELES Engineering	ELES Capital Improvement Program
- Execution of preventative and corrective maintenance. - Documentation and tracking of maintenance records. - Ensuring safe, clean and reliable elevators be available for WMATA ridership.	- Design, review, and approval of new construction submittals. - Support of maintenance activities and complex troubleshooting. - Execution and management of annual inspections of elevators to maintain jurisdictional compliance.	- Facilitation of the rehabilitation and replacement of elevator systems. - Monitoring of day-to-day construction activities. - Coordination with other departments to perform system tests of equipment that affects elevators.

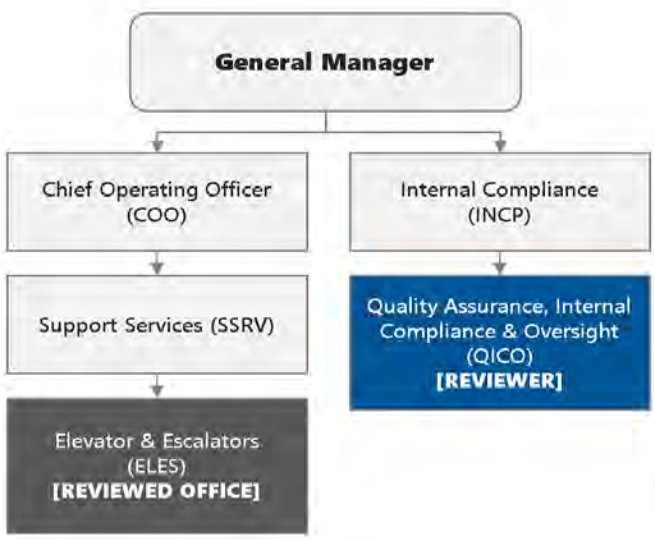
Organizational Structure and Background

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 customers through the use of technology, training, and education.

The elevator maintenance group divides maintenance work geographically and by different time shifts. Around 175 ELES journeyman technicians perform preventative and corrective maintenance tasks across three shifts: day, evening, and midnight. All technicians are trained in both elevator and escalator maintenance practices. Technicians report to maintenance supervisors, who supervise/schedule personnel and inspect maintenance and repair work. Maintenance supervisors report to five ELES superintendents representing different regions of the Metrorail system: Northeast, Southeast, Northwest, Virginia/South, and Virginia/West.



[1] Based on Transit Rail Ridership Portal data between December 1, 2017 and February 28, 2018.

4.2. REVIEW SCOPE

The intention of this internal review is to provide an objective review of Elevator 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 the customer experience. QICO performed the internal review between January 17 and March 12, 2018.

QICO reviewed documentation, shadowed field visits, and interviewed personnel, noting both wins and discrepancies. QICO's findings are categorized into three (3) groups: **Policies Procedures & Standards, Quality & Compliance,** and **Traceability**. For each finding there is an associated **Recommendation** (a suggestion for improving a process based upon QICO's review). Findings are combined into **Required Actions**, which summarize the steps actions owners must take to address discrepancies.

Documentation Review

- 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 Elevator data: outages, downtime reports, work orders, & maintenance schedules.
- Elevator preventative maintenance sheets of 24 assets throughout the Metrorail system.
- Operation and Maintenance (O&M) Manuals.
- Elevator inspection reports.
- FTA & TOC reports

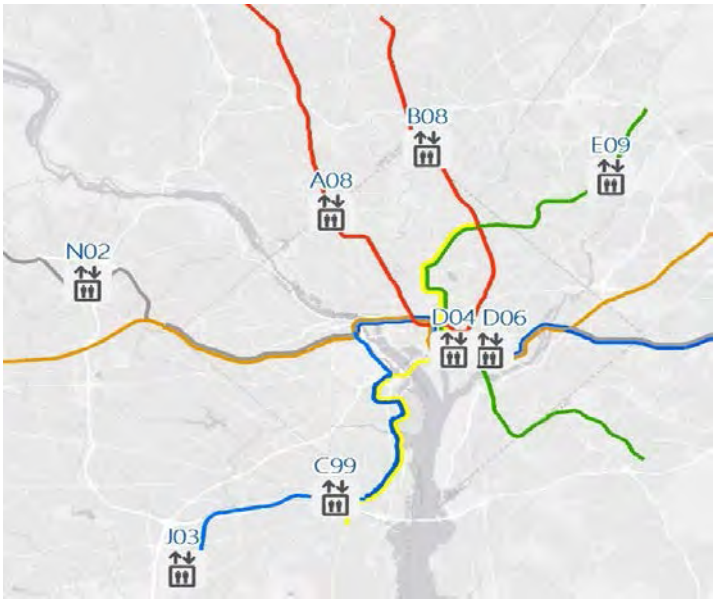
Personnel Discussions

- [redacted]

Field Assessments

QICO assessed Alexandria Yard (C99), Friendship Heights (A08), Tysons Corner (N02), Franconia Springfield (J03), Federal Center SW (D04), Eastern Market (D06), College Park (E09) and Silver Spring Transit Center (T81) locations. The locations are selected to produce a sample representing the diverse array of maintenance activities performed across different elevator types (traction and hydraulic). Each of the locations were assessed in the following areas:

- Preventative Maintenance
- Corrective Maintenance
- Quality Control
- Inspections
- Storage and Housekeeping



4.3. WHAT WORKED WELL (WINS)

Wins are categorized by Quality Measures and rated according to Risk Assessment.

W-ELES-18-01 Job Safety *Reduces Safety Risk* **Owner – ELES**

✓ **At visited sites, elevator barricades were used to prevent unauthorized access into work areas protecting technicians and the riding public.**

Discussion

- QICO performed seven field assessments observing preventative maintenance and elevator assets inspection. During each field assessment, QICO noted that maintenance personnel had barricaded each elevator, preventing unauthorized access into work areas.

4.4. ITEMS RESOLVED DURING REVIEW

Items are categorized by Quality Measures and rated according to Risk Assessment

The following are issues that were identified by QICO during the Internal Review process, where appropriate actions were taken to eliminate the discrepancy or nonconformance prior to the close of this review.

R-ELES-18-01 Application & Fulfillment Service Delivery – Moderate (2,5) **Owner – TRST**

✪ **Technicians and supervisors addressed housekeeping issues communicated by QICO during three site visits.**

Actions Taken

- The supervisor present at Friendship Heights (A08) contacted EOC and created a work order for a materials pick-up and followed-up with materials specialists to ensure the prompt removal of ELES trash inside the station entrance.
- At Franconia-Springfield (J03) the supervisor ordered trash bins to collect debris and leftover materials from a rehabilitation. The technicians began removing the materials from the EMR during maintenance.
- Technicians moved a trash bin blocking the EMR mainline disconnect switch to an adjacent mechanical equipment room at Eastern Market (D06).
- *See Daily Inspection Reports FA-ELE-20180125-002, FA-ELE-20180131-004, and FA-ELE-20180206-005 for additional details.*

4.5. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-ELES-18-01 Regulations & Oversight — Legal & Compliance – Moderate (3,3) — **Owner – ELES**

- **Finding: Readily available elevator certificates of inspection are vital for the safe and reliable delivery of elevator services to customers.**

Discussion

- Elevator certification occurs on a frequency established by the local jurisdictions. Local jurisdictions issue the certificates 3 to 4 weeks after the completion of an annual inspection without defects.
- Below is the status of QICO's review of 80 Maximo elevator Safety Work Orders (SWO) records with APPR (work order approved by supervisor) or INPRG (work order in progress) as of February 22, 2018:
  - 32 Elevators were in service beyond the 30-day deadline from the date a SWO was issued (212 SOP 30 6.3.2).
  - 14 of the 32 elevators had expired certificates and 9 of the 14 certificates were unavailable on the ELES Asset Information System Map.
- QICO inquired about the missing certificates on the Asset Information System Map, and ELES management advised that the certificates are scanned into the system as soon as they are received. QICO was not made aware of any process that confirms elevator certificate availability on the intranet (Metroweb).
- QICO reviewed records for ELES Asset Information System Map for all 278 revenue elevators on February 23, 2018:
  - 56 of the 278 elevators (20%) had no certificate posted in the database.
  - Of these 56 elevators: 26 were not identified on the Asset System Map.
- QICO performed an analysis of 41 elevator records, checking the annual inspection dates and certificate validation dates:
  - 29 records (71%) were out of compliance: 13 had no certificate information & 16 had outdated certificates.
  - Of the 16 records with outdated certificates, only eight (8) had annual inspections performed before the expiration dates.
- QICO inquired about the elevator certification tracking methodology and ELES management communicated that they use an internal "matrix" to track the inspection process.

Recommendation

Identify opportunities to update the methodology for managing certification of all assets; include methods to ensure documentation is readily available on the ELES Asset Information System Map.

F-ELES-18-02 Job Safety — Safety – Elevated (4,4) — **Owner – ELES**

- **Finding: Compliance with Lock Out / Tag Out (LOTO) procedures minimizes job hazards and assures safe working conditions.**

Discussion

- During seven (7) field assessments of elevator assets, QICO observed the following issues:
  - LOTO stations (which provide group locks, clasps and tags) were absent at Friendship Heights, Tysons Corner, Franconia-Springfield, Eastern Market, College Park and Silver Spring Transit Center (6 areas).
  - QICO observed ELES technicians not locking and tagging out disconnect switches when de-energizing equipment for maintenance and inspections on the elevator machine.

Recommendation

Reinforce LOTO procedures through supervisory audits and the installation of LOTO stations at every WMATA Station per SOP 212-23-6.14(d), assuring the consistent execution of LOTO by technicians.

F-ELES-18-03 Document Control — Service Delivery – Moderate (3,4) — **Owner – ELES**

- **Finding: Availability of maintenance records in accordance with the ELES Maintenance Control Policy (MCP) is essential for consistency and traceability of maintenance activities.**

Discussion

- QICO requested PMI documentation from July 2017 to January 2018 of 24 elevator assets:
  - A total of 168 documents should have been provided; only 110 documents (66%) were received.
  - Only three (3) elevators had completed PMI records for each month, with all the required fields filled, necessary PM items marked and signatures.
  - 12 preventive maintenance sheets were incomplete or unclearly marked.
  - Four (4) elevator assets had more than one PMI sheet for the same month: Two (2) assets had a completed PMI sheet for that particular month. The remaining two (2) assets had incomplete PMI documents.
  - 26 of the hydraulic PMI sheets had the current revision date of 01/16.
  - 68 of the received PMI sheets were missing revision dates due to poor scan alignment, cutting the bottom of the page off. Eight (8) of the traction elevator PMI sheets had a revision date of 07/11; the current revision is 06/17.
- In addition, during the field assessments PMI Check Chart records were missing or outdated at six (6) locations: Alexandria Yard, Friendship Heights, Franconia Springfield, Eastern Market, College Park, and Silver Spring Transit Center.

Recommendation

Enforce Maintenance Control Policy documentation requirements, including maintaining updated versions to assure elevator records are available and reflect all maintenance activities performed.

F-ELES-18-04 Document Control — Service Delivery– Moderate (3,4) — **Owner – ELES**

- **Finding: Accuracy of the MCP assures consistency of maintenance processes and increases asset reliability.**

Discussion

- QICO reviewed the Traction and Hydraulic Elevator Preventive Maintenance Procedures (Maintenance Control Policy) manuals.
- The Hydraulic manual has procedures pertaining to traction elevator equipment (Procedure numbers 821-823, 934, 936-940, 942 and 943 which do not apply to hydraulic elevators). In addition, procedure items enumerated in the Check Chart do not match the associated How to Guide for Procedures 8, 9, and 11.
- The procedure manuals provided to QICO for traction and hydraulic elevators do not have revision dates.

Recommendation

Update the Hydraulic Preventative Maintenance Procedures manual to remove irrelevant information, revise the Check Chart and How To Guides for proper coordination, provide revision dates, and implement these changes by disseminating the information across the department.

F-ELES-18-05 Data Assurance — Service Delivery – Moderate (3,4) — **Owner – ELES**

- **Finding: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.**

Discussion

- Assessing Maximo, QICO reviewed 100 work orders and the following was observed:
  - Six (6) Safety Work Orders (SWO) remain open after repairs were completed. New, separate work orders to address the safety issues were created and closed, but not linked to the parent work orders; as a result, the original six work orders remained unaddressed.
  - During Field Assessment FA-ELE-20180206-005, the technicians made notes in the Virtual EOC to have the LM work order statuses updated to "Complete" in Maximo; as of March 5, 2018 the LM work orders are still open.
  - ELES uses generic problem codes that do not conform to industry standards of "Problem, Cause and Remedy", failing to provide sufficient description for analysis.

Recommendation

Develop, train, and implement a standardized and controlled procedure for Maximo data entry and validation, including quality control checks to promote consistency and reliability of work being performed.

F-ELES-18-06 Data Assurance — Service Delivery – Elevated (4.3) — **Owner – ELES**

- **Finding: Logbook recordkeeping in accordance with regulatory code A17.1 assures onsite availability of and access to maintenance history.**

Discussion

- QICO observed the following discrepancies in a review of logbooks:
  - Service call entries had no further information than the work order number and generic reason for the outage reported by the station managers.
  - The Silver Spring Transit Center logbook was placed where ELES personnel had limited access: there have been no entries since November 17, 2017.

Recommendation

Reinforce ELES SOP 212-19 emphasizing on the importance of complete and accurate recordkeeping to assure maintenance crews have the necessary information to track issues and make timely repairs.

F-ELES-18-07 Application & Fulfillment — Safety – Elevated (4.4) — **Owner – ELES**

- **Finding: Maintaining work areas free of trash and debris encourages a positive work environment and reduces job hazards.**

Discussion

- During the Field Assessments, QICO observed housekeeping discrepancies:
  - At three (3) locations, materials were blocking mainline disconnect switches.
  - One location's entry/egress to the EMR was limited.
  - Two (2) locations had salamander heaters stored in the EMR, one with a propane tank and the other with an empty kerosene can.
  - At one (1) location, the EMR had an exposed electrical box.

Recommendation

Create a storage matrix for ELES materials to entail what can be stored and in what location at individual stations, focusing on those with limited space.

F-ELES-18-08 Quality Control — Service Delivery – Moderate (3,3) — **Owner – ELES**

- **Finding: Enforcing established measures for approving rehabilitated equipment is vital to improved asset performance and integration with WMATA systems.**

Discussion

- During PMI assessment, QICO discovered the Programmable Logic Controller (PLC) was reporting no date/time data with the faults. This makes it difficult to track issues and reduce outages. QICO observed a governor fault reporting on the PLC when the overhead hatch was opened instead of a hatch fault.
- Maximo records indicated the contractor that performed elevator rehabilitation was called back twice to reprogram the PLCs; however, the problem persists.
- The Live Station Condition table reported no communications to these elevators.
- During the field assessment, the emergency call function did not forward to MOC on the elevator under maintenance (technicians left the equipment out of service at the completion of the PMI).

Recommendation

Verify Franconia-Springfield garage elevators J03X04, J03X05 and J03X06 programmable logic controllers (PLCs) meet capital improvement project (CIP) acceptance measures and confirm all WMATA requirements are met.

4.6. SUMMARY OF REQUIRED ACTIONS

Findings are categorized by Quality Measures and rated according to Risk Assessment.

QICO-ELES-18-01 — *Overall Risk – Moderate (3,3)* — **Action Owner – ELES**

Required Action: Identify opportunities to update the methodology for managing certification of all assets; include methods to ensure documentation is readily available on the System Asset Map.

Applicable Findings

- **F-ELES-18-01:** Readily available elevator certificates of inspection are vital for the safe and reliable delivery of elevator services to customers.
  - *Measure: Regulations & Oversight. Risk: Legal & Compliance – Moderate (3,3)*

QICO-ELES-18-02 — *Overall Risk – Elevated (4,4)* — **Action Owner – ELES**

Required Action: Identify opportunities to implement established safety procedures that mitigate job hazards.

Applicable Findings

- **F-ELES-18-02:** Compliance with Lock Out / Tag Out (LOTO) procedures minimizes job hazards and assures safe working conditions.
  - *Measure: Job Safety Risk: Safety – Moderate (3,4)*
- **F-ELES-18-07:** Maintaining work areas free of trash and debris encourages a positive work environment and reduces job hazards.
  - *Measure: Application & Fulfillment Risk: Safety – Elevated (4,4)*

QICO-ELES-18-03

Overall Risk – Moderate (3,4) **Action Owner – ELES**

Required Action: Review and update the MCP to reinforce established SOPs, assure accurate management and availability of records.

Applicable Findings

- **F-ELES-18-03:** Availability of maintenance records in accordance with the ELES Maintenance Control Policy (MCP) is essential for consistency and traceability of maintenance activities.
  - *Measure: Document Control Risk: Service Delivery – Moderate (3,4)*
- **F-ELES-18-04:** Accuracy of the MCP assures consistency of maintenance processes and increases asset reliability.
  - *Measure: Document Control Risk: Service Delivery– Moderate (3,4)*
- **F-ELES-18-05:** Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.
  - *Measure: Data Assurance Risk: Service Delivery – Moderate (3,4)*
- **F-ELES-18-06:** Logbook recordkeeping in accordance with regulatory code A17.1 assures onsite availability of and access to maintenance history.
  - *Measure: Data Assurance Risk: Service Delivery – Elevated (4,3)*

QICO-ELES-18-04

Overall Risk – Moderate (3,3) **Action Owner – ELES**

Required Action: Verify Franconia-Springfield garage elevators J03X04, J03X05 and J03X06 programmable logic controllers (PLCs) meet capital improvement project (CIP) acceptance measures and confirming all WMATA requirements are met.

Applicable Findings

- **F-ELES-18-08** Enforcing established measures for approving rehabilitated equipment is vital to improved asset performance and integration with WMATA systems.
  - *Measure: Quality Control Risk: Service Delivery – Moderate (3,3)*

Internal Corrective and Preventive Actions (iCAPAs) are designated to address each Required Action listed above.

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2018

Internal Review: Engineering & Maintenance

(5) Metrorail Automatic Fare Collection Section Inspection & Maintenance

April 27, 2018

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

ENGINEERING & MAINTENANCE

SERVICE DELIVERY

CAPITAL PROGRAM – MANAGEMENT & EXECUTION

INTERNAL SAFETY & SECURITY REVIEW

INTERNAL REVIEW SUMMARY

April 2018

(5) Metrorail Automatic Fare Collection Section (AFCS) Inspection & Maintenance

What is QICO?

- The Office of Quality Assurance, Internal Compliance & Oversight (QICO) is an internal management function that partners with other departments to provide an objective review. Authorized by the General Manager as outlined in the Quality Management System Plan (QMSP).

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the state of Metrorail Automatic Fare Collection Section (AFCS) and promote the actions needed to address any concerns.

QICO's Methodology:

- Develop relevant review activities by identifying and assessing any risks to policies, procedures & standards, quality & compliance, and traceability.
- Review documentation, observe processes and interview key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges on a scale from "Insignificant" to "High".

Wins:

✓ AFC Systems Engineering has developed a web-based application (AFCS Listener) to provide real time monitoring and failure reporting of AFCS assets.

Areas for Improvement:

- Development of preventative maintenance Standard Operating Procedures (SOPs) and related work instructions will promote consistency of maintenance and inspection performance, resulting in improved asset reliability.
- An up-to-date Maintenance Control Policy (MCP) that includes guiding information (e.g. definitions, job aids, & flow charts) for current processes establishes clearly defined roles and responsibilities for AFCS personnel.
- Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of maintenance tasks performed.
- Utilization of a formal Quality Control Plan (QCP) is essential to assure the consistency and reliability of work being performed.

Supplementary Guidance – Quality Business Practices:
(Additional opportunities for applying quality-related standards, programs, and procedures to bring greater safety and efficiencies)

- Using AFC engineering's failure monitoring data promotes improved reliability reporting and reaction to incidents involving AFC assets.

Required Actions:

- **QICO-AFCS-18-01:** Review and update MCP in accordance with current business practices: reflecting improved quality control standards, consistent maintenance practices, and accurate asset reliability reporting.
  (Risk Rating: Moderate)

Note: An itemized internal Corrective and Preventive Action (iCAPA) is developed for each required action to achieve effective and measureable resolution of identified concerns. To check the status of iCAPA implementation go to https://www.wmata.com/initiatives/transparency/.

5.1. FUNCTIONAL OVERVIEW AND STRUCTURE

Metrorail Automatic Fare Collection Section (AFCS)

Automatic Fare Collection Section (AFCS) is the authority's system for collection of Metrorail revenue. This system includes 1000+ passenger faregates, 670+ farecard vendors and 200+ exitfare machines within Metrorail stations, as well as over 3500 meters and 50 counters at station parking lots.

The AFCS system is mantained by the maintenance section of WMATA's Office of Systems Maintenance (SMNT). Engineering services are provided by AFCS Systems Engineering within the Office of Engineering and Architecture (ENGA). Both maintenance and engineering report up to the Chief Operating Officer (COO). QICO is independent from operations and reports to the General Manager through Internal Compliance (INCP). Metrobus fare collection is addressed by a separate maintenance group within Bus Maintenance (BMNT).

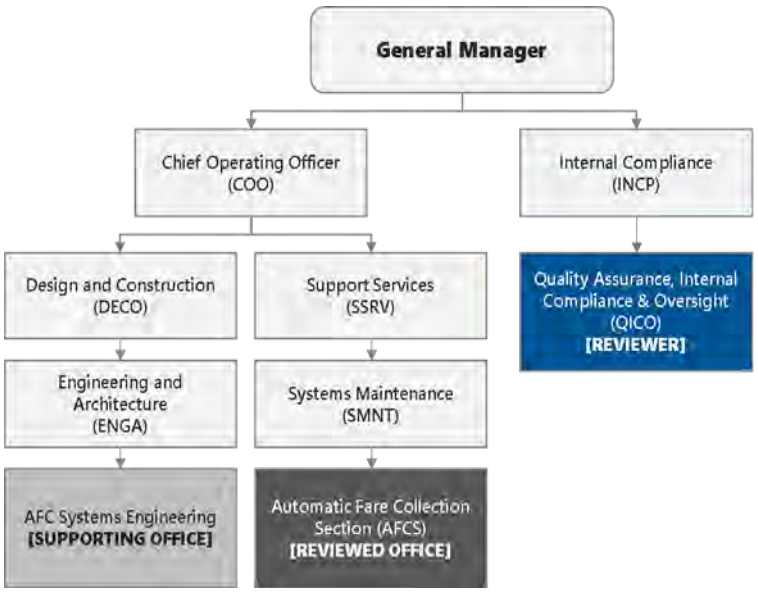
AFC Engineering (ENGA-AFCS Systems)	AFCS Maintenance (SMNT-AFCS Section)
- Development of specifications for the procurement of bus, rail and parking AFCS equipment. - Ensuring the integrity of design and configuration for AFCS equipment. - Reviewing design proposals and submittals - Management of fare changes and fare instrument changes for bus, rail, parking and regional partners (e.g. Virginia DASH). - Production of Engineering Modification Instructions (EMI) for implementation by AFCS Maintenance - Maintaining the AFCS Listener (monitoring) application and servers for AFCS equipment. - Support of AFCS Maintenance, Treasury and other WMATA offices with AFCS problems and issues.	- Responsible for corrective maintenance for rail and parking AFCS equipment. - Performing periodic preventative maintenance on rail and parking fare collection equipment. - Execution of EMIs approved by AFCS Engineering - Support the equipment relocation and installation initiatives. - Monitoring day-to-day health and operation of AFCS equipment.

Organizational Structure and Background

AFCS Maintenance has a Superintendent and an Assistant Superintendent. There are four area (regional) managers and 15 shift supervisors. Technicians work day, evening and midnight shifts.

AFCS Maintenance has three major groups:

1. AFCS Equipment group, which is responsible for inspecting and maintaining AFCS equipment located on station mezzanines (e.g. faregate, smartrip sales reload machine, Station Operator Console (SOC), exitfare machine).
2. Parking Lot Equipment (PLE) group, which is responsible for inspecting and maintaining parking lot equipment (e.g. meters, access gates).
3. Data collection group, which resposibile for Maximo, Part Action Forms (PAF), Windchill, and AFCS/PLE parts inventory management and coordinating maintenance activities.



5.2. REVIEW SCOPE

The intention of this internal review is to provide an independent evaluation of AFCS 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 the customer experience. QICO performed the internal review between January 17 and March 12, 2018.

QICO reviewed documentation, shadowed field visits, and interviewed personnel, noting both wins and discrepancies. QICO's findings are categorized into three (3) groups: **Policies Procedures & Standards, Quality & Compliance,** and **Traceability**. For each finding there is an associated **Recommendation** (a suggestion for improving a process based upon QICO's review). Findings are combined into **Required Actions**, which summarize the steps actions owners must take to address discrepancies.

Documentation Review

- Metrorail Automatic Fare Collection Maintenance Control Policy (MCP), 2014.
- Preventative maintenance checklists for AFCS mezzanine and parking lot equipment.
- Work orders for AFCS Preventative Maintenance (PM), Corrective Maintenance (CM), and Limited Maintenance (LM).
- AFCS metrics collected through AFCS Engineering's "AFCS Listener."

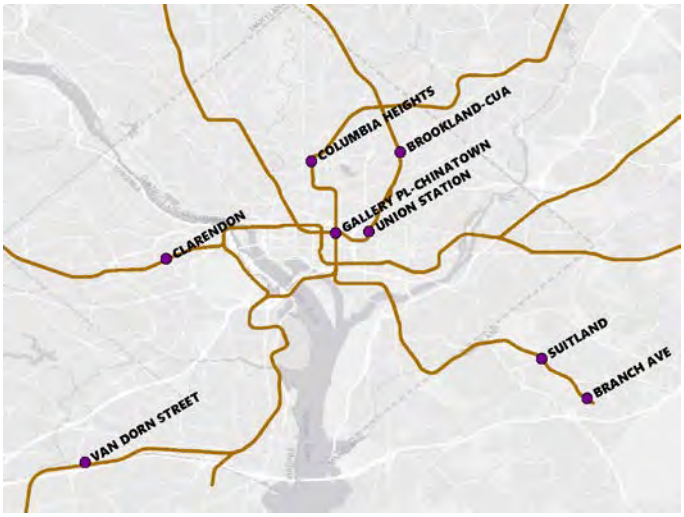
Personnel Discussions

- AFCS Superintendent:
  - [redacted]
- AFCS Area Managers:
  - [redacted]
  - [redacted]
  - [redacted]
- AFCS Engineering:
  - [redacted]
  - [redacted]

Field Assessments

QICO shadowed AFCS maintenance personnel performing Preventative Maintenance Inspections (PMI) at eight (8) metro station locations (shown on the map). Inspections were selected based on geographic distribution among the three jurisdictions (DC, Maryland, and Virginia), station layout, asset performance, and asset availability. Inspections were shadowed for the following assets:

- Station Operators Console (SOC)
- ExitFare machine
- SmarTrip Sales and Reload Machine (SSRM)
- Faregates
- Parking lot equipment (e.g. meters, access gates)



5.3. WHAT WORKED WELL (WINS)

Wins are categorized by Quality Measures and rated according to Risk Assessment.

W-AFCS-18-01 Work Measurement *Reduces Strategic Risk* **Owner – AFCS**

✓ **AFC Systems Engineering has developed a web-based application (AFCS Listener) to provide real time monitoring and failure reporting of AFCS assets.**

Discussion

- AFC Systems Engineering maintains a web-based application (AFCS Listener) which tracks the status of all rail AFCS assets. It provides information on transactions, daily device availability, daily traffic figures for the Metrorail system, equipment faults and diagnostic codes. It tracks AFCS equipment defects by monitoring error and status codes automatically generated directly by the equipment itself (e.g. Faregates, SSRM, Exitfare).
- At this time, the application does not generate Maximo work orders. The AFCS Listener web application can be accessed by all WMATA employees on the internal network.

5.4. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-AFCS-18-01 Work Standards — Service Delivery – Moderate (3,3) — **Owner – AFCS**

- **Finding: Development of preventative maintenance Standard Operating Procedures (SOPs) and related work instructions will promote consistency of maintenance and inspection performance, resulting in improved asset reliability.**

Discussion

- During field assessments, QICO observed personnel:
  - Conducting maintenance without all the requisite tools needed to perform tasks.
  - Conducting maintenance without requisite checklists.
  - Neglecting to submit completed checklists to management.
  - Using outdated checklists.
  - Using checklists that did not provide a list of requisite tools and PPE. For example, the SOC PMI checklist states "Please protect eyes for this step" but neglects to provide level of protection needed.
- In addition, checklists did not provide the purpose of inspection and desirable results.
- Without SOPs and related work instructions, QICO was unable to validate if the checklists are "CENI [sic]-approved", as required by the Maintenance Control Policy.

Recommendation

Establish and implement SOPs and related work instructions to assure all AFCS equipment has standard and consistent maintenance processes.

F-AFCS-18-02 Work Standards — Service Delivery – Low (2,4) — **Owner – AFCS**

- **Finding: An up-to-date Maintenance Control Policy (MCP) that includes guiding information (e.g. definitions, job aids, & flow charts) for current processes establishes clearly defined roles and responsibilities for AFCS personnel.**

Discussion

- QICO observed the following AFCS maintenance practices not detailed in the MCP:
  - Current weekly supervisory compliance check criteria and procedures.
  - The difference between Limited Maintenance (LM) vs. Corrective Maintenance (CM) work orders.
  - References to the existing AFCS Maximo User Manual.
- The MCP was last revised in July 2014. The first page of the MCP states that it "shall be reviewed annually."

Recommendation

Conduct annual review in accordance with the MCP and update as necessary to include current processes and business practices.

5.4. AREAS FOR IMPROVEMENT

Findings are categorized by Quality Measures and rated according to Risk Assessment.

F-AFCS-18-03 Data Assurance — Service Delivery – Moderate (3,3) — **Owner – AFCS**

- **Finding: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of maintenance tasks performed.**

Discussion

- QICO performed a search in Maximo of closed work orders (2500) from February 2016 through February 2018. Around 20% (505) were labeled with the "Won't Go / Stay in Service" problem classification (code 3416).
- QICO reviewed a sample of 35 Maximo work orders involving seven (7) metro stations: Union Station, Columbia Heights, DuPont Circle, L'Enfant Plaza, Gallery Place, Brookland-CUA, and Metro Center. Of the 35 sampled work orders, 46% had matching problem and cause error codes; the remaining 54% did not, reflecting incorrect diagnosis of asset condition on the majority of AFCS equipment.
- AFCS technicians are not updating the initial problem code on Corrective Maintenance (CM) and Limited Maintenance (LM) work orders in Maximo after an in-person inspection of asset condition.

Recommendation

Develop, train, and implement a standardized and controlled procedure for Maximo data entry and validation, including quality control checks to promote consistency and reliability of work being performed.

F-AFCS-18-04 Work Standards — Service Delivery – Moderate (3,3) — **Owner – AFCS**

- **Finding: Utilization of a formal Quality Control Plan (QCP) is essential to assure the consistency and reliability of work being performed.**

Discussion

- The AFCS maintenance control policy requires shift supervisors to conduct one on-site compliance check per week on assigned personnel performing day-to-day activities. It also requires area managers to conduct one compliance check per month to evaluate shift supervisors conducting their compliance checks. Technicians are not required to complete checklists and retain them for recordkeeping when performing preventative maintenance.
- AFCS currently conducts compliance checks differently than as stated in the MCP, and does not have an SOP, work instruction, or criteria governing the current process. Presently, shift supervisors are required to perform five inspections weekly: one in-progress and four post-pm inspections. The inspections are documented in a Weekly Activity Report (WAR) and submitted to area managers for review. Reviewed WAR reports are unclear, inconsistent and subjective.
- AFCS area managers (who oversee shift supervisors) currently do not perform compliance checks. However, they do review submitted WAR reports.
- QICO requested WAR reports from November 2017, December 2017, and January 2018.
  - A total of 182 documents were expected. QICO received 144.
  - 12 out of the 14 shift supervisors submitted WAR reports. Of those 12, only 7 shift supervisors submitted WAR reports consistently each week.

Recommendation

Develop a Quality Control Plan (QCP) for AFCS corrective and preventative maintenance to promote the consistent application of work, improve records management, and ensure compliance and adherence to maintenance practices and procedures.

5.5. SUPPLEMENTARY GUIDANCE – QUALITY BUSINESS PRACTICES

During the course of its assessments, QICO oftentimes will observe additional elements, not relating to the parameters of its review, where opportunities for applying quality related standards, programs, and procedures will bring greater safety and efficiencies.

The following item(s) are not part of the reviewed governing documentation and will not be included into the official corrective action plans. Their inclusion herein is due to the belief by QICO that by being addressed and incorporated into its quality business practices, the department will experience an overall benefit.

G-AFCS-18-01 Data Assurance **Will Reduce** Service Delivery Risk **Owner – AFCS**

- **Using AFC engineering's failure monitoring data promotes improved reliability reporting and reaction to incidents involving AFC assets.**

Discussion

- The AFCS Listener application displays the current AFCS equipment status, refreshing in real time. This results in a more accurate diagnosis of equipment (See "Wins" for more detail).
- AFCS maintenance currently does not utilize AFCS listener data to validate equipment failure when issues are reported via AFCS helpdesk. Currently, maintenance relies on technicians performing daily tasks and station managers to report issues with equipment.

Recommendation

Develop an integrated process between enterprise-wide failure monitoring system data and current maintenance practices to improve reliability reporting to meet industry best practices.

5.6. SUMMARY OF REQUIRED ACTIONS

Findings are categorized by Quality Measures and rated according to Risk Assessment.

QICO-AFCS-18-01 **Action Owner – AFCS** *Overall Risk – Moderate (Average Score)*

Required Action: Review and update MCP in accordance with current business practices: reflecting improved quality control standards, consistent maintenance practices, and accurate asset reliability reporting.

Applicable Findings

- **F-AFCS-18-01:** Development of preventative maintenance Standard Operating Procedures (SOPs) and related work instructions will promote consistency of maintenance and inspection performance resulting in improved asset reliability.
  - *Measure: Work Standards. Risk: Service Delivery – Moderate (3,3)*
- **F-AFCS-18-02:** An up-to-date Maintenance Control Policy (MCP) that includes guiding information (e.g. definitions, job aids, & flow charts) for current processes establishes clearly defined roles and responsibilities for AFCS personnel.
  - *Measure: Work Standards. Risk: Service Delivery – Low (2,4)*
- **F-AFCS-18-03:** Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of maintenance tasks performed.
  - *Measure: Data Assurance. Risk: Service Delivery – Moderate (3,3)*
- **F-AFCS-18-04:** Utilization of a formal Quality Control Plan (QCP) is essential to assure the consistency and reliability of work being performed.
  - *Measure: Work Standards. Risk: Service Delivery – Moderate (3,3)*

Internal Corrective and Preventive Actions (iCAPAs) *are designated to address each Required Action listed above.*

ENGINEERING & MAINTENANCE INTERNAL CORRECTIVE AND PREVENTIVE ACTIONS (iCAPAs)

INTERNAL REVIEW

Engineering & Maintenance

In response to the internal review of Engineering and Maintenance, including review of Metrobus Maintenance and Engineering, Metrobus Parts and Material Inventory Management, Metrorail Vehicle Maintenance and Engineering, Metrorail Vertical Transportation: Elevator Maintenance & Inspections, and Metrorail Automatic Fare Collection (AFC) Inspection & Maintenance, the office of Quality Assurance, Internal Compliance & Oversight (QICO) has coordinated the development of twenty (20) iCAPAs. Each iCAPA outlines the findings, recommendation and requirements to be addressed, and a detailed action plan outlining responsible parties and specific actionable items.

EXECUTIVE LEADERSHIP OF RESPONSIBLE PARTIES

internal Corrective and Preventive Action (iCAPA) Commitment

[redacted]

Joseph Leader
Chief Operating Officer (COO)

4/26/18
Date

WMATA INTERNAL OVERSIGHT

internal Corrective and Preventive Action (iCAPA) Acknowledgement

[redacted]

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

4/26/18
Date

[redacted]

Eric Christensen
Chief of Internal Compliance (INCP)

4/27/18
Date

[redacted]

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

4/27/18
Date

METROBUS MAINTENANCE AND ENGINEERING iCAPAs

Return to Summary of Required Actions

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-BME-18-01

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance and Oversight (QICO) issued an internal review report regarding Metrobus Maintenance & Engineering. This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action BME-18-01 and the associated finding(s).

Required Action

QICO-BME-18-01 ***Office of Bus Maintenance (BMNT)***
Office of Plant Maintenance (PLNT)
Department of Bus Services (BUSV)

High

Incorporate a sustainable maintenance plan to monitor the condition and safety of all bus maintenance equipment.

Applicable Finding(s)

- **F-BME-18-01:** Training personnel on the use of safety equipment and maintaining a hazard free workplace promotes a safe and reliable work environment.
    - *Measure: Job Safety. Risk: Safety – High (5,4)*

Action Plan Overview

Bus Maintenance (BMNT) will remind all staff of reporting procedures for facility equipment issues. BMNT will review the existing Annual Safety Training Curriculum and make necessary updates to include Fall Protection which will be incorporated into the existing annual certification training schedule. Plant Maintenance (PLNT) will identify equipment requiring repair or calibration and take necessary action. PLNT will also implement an annual Maximo inspection plan for all jib cranes.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Revision of SOP 5.1	BMNT will revise Standard Operating Procedure (SOP) 5.1 and distribute a staff notice on proper procedure for reporting facility issues. BMNT will submit the SOP and evidence of distribution of the staff notice.	Raphael Alfred (BMNT)	04/02/18	07/11/18
2.	Repairs or Inspections Identified to Facility Equipment	PLNT will review the identified equipment requiring repair or calibration and take necessary action. PLNT will submit related Maximo work orders for affected assets identified in the internal review.	Charles Campbell (PLNT)	03/19/18	07/11/18
3.	Maintenance Planning Implementation for Jib Cranes	Plant Maintenance, using Maximo will implement an annual inspection plan for all jib cranes. PLNT will submit Maximo records showing inspection plan.	Charles Campbell (PLNT)	03/19/18	05/02/18
4.	Review Annual Safety Training Curriculum	BMNT will submit updated curriculum that includes Fall Protection and training plan/certification schedule.	Raphael Alfred (BMNT)	04/02/18	01/02/19
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	01/02/18	1/30/19

Completion Documentation & Performance Measures

- Fall Protection and training plan & Enterprise Learning Management (ELM) training records for active bus technicians six months after curriculum implementation.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

BMNT	Raphael Alfred	[redacted]	4/17/18 (Signature/Date)
PLNT	Charles Campbell	[redacted]	4/17/18 (Signature/Date)

Second-Level Responsibility

BMNT	David Michels	[redacted]	4-17-18 (Signature/Date)
PLNT	Leroy Jones	[redacted]	4-17-18 (Signature/Date)
BUSV	Robert Potts	[redacted]	4/20/18 (Signature/Date)

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-BME-18-02

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance and Oversight (QICO) issued an internal review report regarding Metrobus Maintenance & Engineering. This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action BME-18-02 and the associated finding(s).

Required Action

QICO-BME-18-02 ***Office of Bus Maintenance (BMNT)***
Department of Bus Services (BUSV)

Elevated

Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Develop, train on, and implement a standardized and controlled procedure for Maximo data entry and validation, including quality control checks to promote consistency and reliability of work being performed.

Applicable Finding(s)

- **F-BME-18-02:** Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analyzing of performed maintenance.
  - *Measure: Data Assurance. Risk: Service Delivery Risk – Elevated (4,4)*

Action Plan Overview

Bus Maintenance (BMNT) will review and update the Maximo standard operating procedure to incorporate a specific minimum requirement of data entry and quality control plan to measure and improve compliance. BMNT will analyze the workload requirements and consider if additional positions are needed to maintain the quality program. BMNT will incorporate a new or revised Maximo work order training course for employees responsible for Maximo work order data.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Develop Standard Operating Procedure for Maximo Work Order Data Entry and Management	BMNT will review current process to include responsibilities of the maintenance personnel, their supervision and senior management and will create a standard operating procedure (SOP). BMNT will submit new SOP.	Raphael Alfred (BMNT)	04/15/18	08/01/18
2.	Establish Quality Management Program that will Monitor Maximo Work Order Data and Direct Corrective Actions	BMNT will establish specific guidelines for supervision in their review of work order data prior to closeout and steps to be taken when corrections are needed. These guidelines will mirror Service Bulletin 12-P-007 – Engine Compartment Inspections. BMNT will submit new SOP.	Raphael Alfred (BMNT)	04/30/18	01/02/19
3.	Quality Management Staff Assessment	Staffing analysis to determine BMNT's need for a quality control manager to ensure consistency in its improvement efforts and data entry on work performed.	Raphael Alfred (BMNT)	04/30/18	01/02/19
4.	Train Appropriate Bus Maintenance Personnel on New Standard Operating Procedure	BMNT will train maintenance personnel (bus technicians, clerks and supervisors) responsible for entry and review of Maximo work order data as per actionable item #1. BMNT will submit curriculum and training records.	Raphael Alfred (BMNT)	09/01/18	03/06/19
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	03/06/19	04/03/19

Completion Documentation & Performance Measures

- SOP curriculum for Maximo work order data entry & management associated with actionable item 4.
- Training records pertaining to SOP for Maximo work order data entry & management as per actionable item 4.
- Evidence of Maximo records showing compliance with minimum data entry requirements & quality control checks for a three month period.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Party

BMNT	Raphael Alfred	[redacted]	4/17/18
			(Signature/Date)

Second-Level Responsibility

BMNT	David Michels	[redacted]	4-17-18
			(Signature/Date)
BUSV	Robert Potts	[redacted]	4/20/20
			(Signature/Date)

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-BME-18-03

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance and Oversight (QICO) issued an internal review report regarding Metrobus Maintenance & Engineering. This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action BME-18-03 and the associated finding(s).

Required Action

QICO-BME-18-03 ***Office of Bus Maintenance (BMNT)***
Office of Bus Services (BUSV)

Elevated

Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Develop a standardized procedure for parts and materials identification and traceability, requalification, handling and storage on the shop floor.

Applicable Finding(s)

- **F-BME-18-03:** Developing written requirements for parts management, workplace organization and housekeeping is vital for safe and reliable bus operations.
  - *Measure: Quality Control. Risk: Service Delivery Risk – Elevated (4,4)*

Action Plan Overview

Bus Maintenance (BMNT) will assess the current conditions around parts stored outside of storerooms and establish new or revised standard operating procedures on management of parts outside of storerooms and train staff to these revisions. Provide training to all impacted employees for existing policies and procedures specific to actionable item one. Provide training on any new/revised procedures as documented in action item two.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Create BMNT Standard Operating Procedure (SOP)	Review Operations Administrative Procedure (OAP) 600-04 and create a new BMNT procedure to include procedure for parts and materials identification and traceability, requalification, handling and storage on the shop floor. BMNT will submit the new SOP in coordination with OAP 600-04.	Timothy St. John (BMNT)	04/02/18	08/01/18
2.	New SOP Training	BMNT will train maintenance personnel (bus technicians, clerks and supervisors) on the new implemented procedure(s). BMNT will create a checklist to track compliance as identified in actionable item #1. BMNT will submit training curriculum.	Timothy St. John (BMNT) Raphael Alfred (BMNT)	08/01/18	10/31/18
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	10/31/18	11/28/18

Completion Documentation & Performance Measures

- Evidence of two quarterly audits to determine compliance with new SOP.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

BMNT	Raphael Alfred	[redacted]	4/17/18 (Signature/Date)
BMNT	Timothy St. John	[redacted]	4/17/18 (Signature/Date)

Second-Level Responsibility

BMNT	David Michels	[redacted]	4-17-18 (Signature/Date)
BUSV	Robert Potts	[redacted]	4/20/18 (Signature/Date)

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-BME-18-04

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance and Oversight (QICO) issued an internal review report regarding Metrobus Maintenance & Engineering. This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action BME-18-04 and the associated finding(s).

Required Action

QICO-BME-18-04 ***Office of Bus Maintenance (BMNT)***
Office of Bus Engineering (BENG)
Department of Bus Services (BUSV)

Moderate

Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Develop a standardized procedure for tools and bench testing equipment (BTE) including calibration management, labelling and identification, appropriate storage and periodic reviews.

Applicable Finding(s)

- **F-BME-18-04:** Establishing inventory and equipment calibration control procedures are essential to completing effective maintenance activities.
    - *Measure: Quality Control. Risk: Service Delivery Risk – Moderate (3.4)*

Action Plan Overview

Bus Maintenance (BMNT) currently tracks and conducts calibration of some tools through use of Maximo and the process is standardized in Standard Operating Procedure (SOP) 5.6 – Torque Wrench Calibration. A training video on the BMNT website details the procedures. This procedure will be reviewed and updated to ensure all appropriate tools are included and establish new preventative maintenance work orders, if needed. BMNT will update SOP 3.21 – Housekeeping Policy to include requirements for put away of tools and equipment in their designated areas.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Update SOP 5.6	BMNT will update SOP 5.6 to include requirement of calibration test labels from outside vendors and labels on tools calibrated internally within BMNT. Bus Engineering (BENG) will submit updated SOP.	Barry Goldman (BENG)	04/02/18	07/11/18
2.	Update SOP 3.21	BMNT will submit revised SOP 3.21 and compliance plans to include requirements to store tools and equipment to their designated areas, including a log of tools within the storage areas.	Barry Goldman (BENG) Bruce Hobbs (BMNT)	04/02/18	07/11/18
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	07/11/18	08/08/18

Completion Documentation & Performance Measures

- QICO field assessment of BMNT facilities to check compliance with calibration labels.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

BENG	Barry Goldman	[redacted]	4/17/18 (Signature/Date)
BMNT	Bruce Hobbs	[redacted]	4-17-18 (Signature/Date)

Second-Level Responsibility

BMNT	David Michels	[redacted]	4-17-18 (Signature/Date)
BUSV	Robert Potts	[redacted]	4/20/18 (Signature/Date)

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-BME-18-05

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance and Oversight (QICO) issued an internal review report regarding Metrobus Maintenance & Engineering. This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action BME-18-05 and the associated finding(s).

Required Action

QICO-BME-18-05 ***Office of Bus Maintenance (BMNT)***
Office of Bus Engineering (BENG)
Department of Bus Services (BUSV)

Moderate

Identify opportunities to update requirements for data entry, parts identification, storage, equipment testing, and calibration.

Develop a Quality Control Plan (QCP) for BMNT corrective and preventative maintenance to promote consistent application of work and promote compliance and adherence to maintenance practices and procedures.

Applicable Finding(s)

- **F-BME-18-05:** Implementing a Quality Control Plan (QCP) for bus corrective and preventative maintenance will promote consistent maintenance practices.
    - *Measure: Quality Control. Risk: Service Delivery Risk – Moderate (3,4)*

Action Plan Overview

Bus Maintenance (BMNT) and Bus Engineering (BENG) will develop a Standard Operating Procedure (SOP) detailing the quality control checks of the engine compartment as well as other maintenance activities including the associated checklist and forms. This procedure will provide a standardized criteria checklist to be completed by the designee conducting the inspection as well as detail the requirements for documenting the inspection and retention of associated documents. The results of the quality control test will be documented through the forms and referenced in the associated Maximo work orders.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Develop SOP for Monthly 5 percent Engine Compartment Inspections	BENG will develop an SOP detailing the requirements of the required 5 percent quality control engine compartment inspections. This SOP will provide a standardized criteria checklist to be completed by the designee conducting the inspection. This SOP will ensure quality, consistency and standardization of the required inspection. BENG will submit the new SOP.	Barry Goldman (BENG)	04/16/18	08/01/18
2.	Establish Quality Management Program that will Monitor Maximo Work Order Data and Direct Corrective Actions	BMNT will establish specific guidelines for supervision in their quality control of work order data prior to closeout and steps to be taken when corrections are needed. These guidelines will mirror Service Bulletin 12-P-007 – Engine Compartment Inspections. BMNT will submit the new SOP.	Raphael Alfred (BMNT)	04/30/18	01/02/19
3.	Quality Management Staff Assessment	Staffing analysis to determine BMNT's need for a quality control manager to ensure consistency in its improvement efforts and data entry on work performed.	Raphael Alfred (BMNT)	04/30/18	01/02/19
4.	Train Bus Maintenance Personnel on New SOP	BMNT will train supervisors responsible for 5% engine compartment inspections and Maximo work order closure. BMNT will submit the training curriculum.	Raphael Alfred (BMNT)	04/16/18	01/02/19
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	01/02/18	1/30/19

Completion Documentation & Performance Measures

- Training records for all active BMNT supervisors on quality control plan SOP.
- QICO will conduct an assessment for compliance with Quality Control forms and associated Maximo work orders.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

BMNT	Raphael Alfred [redacted]	4/17/18	(Signature/Date)
BENG	Barry Goldman [redacted]	4-17-18	(Signature/Date)

Second-Level Responsibility

BMNT	David Michels [redacted]	4-17-18	(Signature/Date)
BUSV	Robert Potts [redacted]	4/20/18	(Signature/Date)

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-BME-18-06

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance and Oversight (QICO) issued an internal review report regarding Metrobus Maintenance & Engineering. This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action BME-18-06 and the associated finding(s).

Required Action

QICO-BME-18-06 ***Office of Bus Maintenance (BMNT)*** *Moderate*

Department of Information Technology (OIT)

Bus Technology System Support (BTSS)

Department of Bus Services (BUSV)

Revise procedures for diagnostic equipment to include software expiration, hardware condition, and equipment assignment.

Applicable Finding(s)

- **F-BME-18-06:** Providing updated diagnostic computers and troubleshooting software are essential for effective and efficient bus repair activities.
    - *Measure: Assets and Activities Risk: Service Delivery Risk – Moderate (3,4)*

Action Plan Overview

Bus Technology System Support (BTSS) will evaluate the requirements, cost and timeline of ensuring appropriate access levels as well as acquiring new troubleshooting laptops to ensure hardware meets all Bus Maintenance (BMNT) requirements. BTSS will evaluate alternative software license purchasing process and develop a software expiration tracking standard operating procedure.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Evaluate the Existing Diagnostic Hardware	Determine the scope, requirements, cost and timeline of ensuring appropriate access levels as well as acquiring new troubleshooting laptops to ensure hardware meets all BMNT requirements. BMNT will submit the viable options, recommendations and funding information.	Raphael Alfred (BMNT) Zafar Chaudhry (IT DCI)	04/01/18	06/06/18
2.	Alternative Software Licensing Process	Evaluate alternative software license purchasing process and implement accordingly. BTSS will submit the licensing process plan.	Raphael Alfred (BMNT)	04/30/18	08/01/18
3.	Develop a Software Expiration Tracking Procedure	Develop a software expiration tracking SOP to make certain licenses are renewed prior to expiration. BTSS will submit new SOP.	Raphael Alfred (BMNT)	04/30/18	08/01/18
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	08/01/18	09/05/18

Completion Documentation & Performance Measures

- QICO will conduct an assessment for 100 percent software license compliance (in-service laptops).

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

BMNT	Raphael Alfred	[redacted]	4/17/18 (Signature/Date)
IT DCI	Zafar Chaudhry	[redacted]	4/20/2018 (Signature/Date)

Second-Level Responsibility

OIT	Albert Short	[redacted]	4/20/18 (Signature/Date)
BMNT	David Michels	[redacted]	4-17-18 (Signature/Date)
BUSV	Robert Potts	[redacted]	4/20/18 (Signature/Date)

METROBUS PARTS & MATERIAL INVENTORY MANAGEMENT iCAPAs

Return to Summary of Required Actions

Purpose and Scope

On March 8, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action **QICO-BMI-18-01** and the associated finding.

Required Action

QICO-BMI-18-01 ***Bus Maintenance (BMNT)*** *Elevated*

Identify opportunities to implement sustainable methods for reducing inventory inaccuracies and lead time variances.

Applicable Finding(s)

- **F-BMI-18-01:** Effective management of supply chain systems, including maintaining and updating lead times, will assure the availability of parts and materials.
  - *Measure: Change Management. Risk: Strategic Risk– Elevated (4,4)*

Action Plan Overview

PLAN OVERVIEW

Bus Maintenance (BMNT) will submit a report outlining its plan to develop and implement sustainable methods for reducing inventory inaccuracies and lead time variances and provide training to all impacted employees on new methods. They will track decreases in inventory inaccuracies for three quarters.

Business Impact - Budget/Cost Estimate

- **Process Improvement** – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Approach Plan	BMNT will submit the Approach Plan to develop and implement sustainable methods for reducing inventory inaccuracies and lead time variances. Included in the plan will be: • Review of current procedures and count book results identifying weaknesses that led to inaccuracies in inventory. • Comprehensive list of action items required to decrease inventory inaccuracies.	Timothy St. John (BMNT)	04/13/18	05/30/18
2.	Implementation of Procedures	Implement the procedures and track/measure compliance as identified in actionable item 1. BMNT will submit three quarterly reports summarizing changes in inventory accuracies.	Timothy St. John (BMNT)	05/01/2018	03/27/19
3.	Staff Training	BMNT will provide training to all impacted bus maintenance storeroom and material logistics personnel on SOPs specific to maintaining inventory accuracy and plans included in actionable item 1. BMNT will submit evidence of personnel training.	Timothy St. John (BMNT)	07/02/2018	05/29/2019
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	05/29/19	06/26/2019

Completion Documentation & Performance Measures

- 95 percent of active personnel trained.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

BMNT	Timothy St. John	[redacted] 4/24/2018 (Signature/Date)
BMNT	David Michels	[redacted] 4/24/18 (Signature/Date)

Second-Level Responsibility

BUSV	Robert Potts	[redacted] 4/25/18 (Signature/Date)

Purpose and Scope

On March 8, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding the current policies, procedures, and practices associated with WMATA's Parts & Materials Inventory Management. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action **QICO-BMI-18-02** and the associated finding.

Required Action

QICO-BMI-18-02 ***Bus Maintenance (BMNT)*** ***Moderate***

Supply Chain Enterprise System (SCES)

Incorporate a process to assure discrepant material cannot be mistaken for approved material.

Applicable Finding(s)

- **F-BMI-18-03:** Separation of discrepant material and approved material is necessary to reduce the risk of non-compliant parts being installed on buses.
  - *Measure: Quality Control. Risk: Safety Risk – Elevated (3,3)*

Action Plan Overview

PLAN OVERVIEW

Bus Maintenance (BMNT) will submit a report outlining the plan to develop and implement a process to assure the discrepant material cannot be mistaken for approved material. BMNT will revise procedures to provide clear direction on how and where to store non-compliant material to eliminate the risk of being mixed with incoming material at supplying storerooms 100, 110, and 400. If necessary, a procurement package will be developed to purchase the necessary physical barrier. BMNT will implement the procedures and track/measure material storage compliance.

Business Impact - Budget/Cost Estimate

- **Process Improvement** – A current process/procedure needs to be optimized to address the FTA 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[1]	Est Start[2]	Est End[3]
1.	Approach Plan	BMNT will submit the Approach Plan to develop and implement a process to assure the discrepant material cannot be mistaken for approved material. Included in the report will be: • Overview of current procedures identifying how non-compliant material is handled and stored at supplying storerooms 100, 110, and 400. • Comprehensive list of action items required to assure material storage compliance.	Timothy St. John (BMNT) Supporting Office[4]: Rodolfo Bitar (SCES)	04/19/18	05/30/18
2.	Material Storage SOP	Develop and distribute procedure providing direction on how and where to store non-compliant material to eliminate the risk of being mixed with incoming material at supplying storerooms 100, 110, and 400. BMNT will submit the SOP and evidence of distribution.	Timothy St. John (BMNT) Supporting Office[4]: Rodolfo Bitar (SCES)	05/01/18	01/30/19
3.	Implementation of SOP	Implement Material Storage SOP and track/measure compliance as identified in actionable item #2. BMNT will submit three quarterly reports summarizing material storage compliance.	Timothy St. John (BMNT) Supporting Office[4]: Rodolfo Bitar (SCES)	07/02/18	03/27/19
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	03/27/2019	04/24/2019

Completion Documentation & Performance Measures

- 95 percent intermixed material storage compliance as per action item #2.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.
[4] Offices designated as supporting roles provide subject matter expertise to responsible parties during action development and are not directly responsible for delivery of actionable items listed above.

Responsible Parties

BMNT	Timothy St. John	[redacted] 4/25/2018 (Signature/Date)
BMNT	David Michels	[redacted] 4-25-18 (Signature/Date)

Supporting Role Acknowledgement

SCES	Rodolfo Bitar	[redacted] (Signature/Date)
BUSV	Robert Potts	[redacted] 4/25/18 (Signature/Date)

METRORAIL VEHICLE MAINTENANCE & ENGINEERING iCAPAs

Return to Summary of Required Actions

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding Metrorail Vehicle Maintenance & Engineering. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-RCM-18-01 and the associated finding(s).

Required Action

QICO RCM-18-01 ***Office of Car Maintenance (CMNT)*** *High*

Perform safety and equipment certification assessment at all facilities. Implement methods to maintain safety critical items.

Assess the safety compliance and state of the different facilities, and take immediate corrective actions. Develop a sustainable preventive program to internally monitor and maintain the safety condition of the facilities.

Applicable Finding(s)

- F-RCM-18-01: Compliance with the safety requirements is necessary for a safe and reliable working environment. *Measure: Job Safety. Risk: Safety– High (5,4).*

Action Plan Overview

Car Maintenance (CMNT) Supervisors will inspect all in-use High Voltage insulating gloves at the beginning of each shift and document these inspections on an approved inspection log. CMNT Superintendents or Assistant Superintendents shall conduct a weekly spot checks to verify these requirements are in compliance and document these audits on a spreadsheet. The result of the Superintendent's spot check audits shall be submitted to the respective Assistant General Superintendent.

CMNT Superintendents or Assistant Superintendents shall establish a Lockout/Tagout (LOTO) log book as directed by CMNT SOP 3.07. The Superintendents or Assistant Superintendents conduct a quality control check of the LOTO log book records and protocols annually and document the audit in the log book form. The result of the Superintendent's quality control check will be submitted to the respective Assistant General Superintendent.

CMNT is responsible for the monthly inspection of fire extinguishers on movable assets such as welding carts, rail vehicle movement equipment, etc. CMNT shall inspect and complete the monthly inspections for movable asset fire extinguishers during its monthly inspection and document same in the MAXIMO work order.

District CMNT Assistant General Superintendents shall conduct an assessment of each shop under their direction to determine the appropriate quantity and placement of first aid kits for each shop location. At the conclusion of this assessment, each District Assistant General Superintendent will specify, in writing, the approved quantity and placement of first aid kits for each shop under their jurisdiction. CMNT will use the Monthly Shop Safety and Health Inspection Checklist to document the inspection of first aid kits.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	High Voltage Gloves Inspection Log Records	Superintendents or Assistant Superintendents shall conduct weekly spot checks of high voltage gloves inspection logs and document their weekly audits on a spreadsheet. CMNT will submit the spreadsheet showing three months' of inspection log records.	Larry Skelton (CMNT)	05/01/18	08/15/18
2.	Lockout/Tagout Log Book Inspection	Superintendents or Assistant Superintendents shall conduct annual reviews of the LOTO log book and protocols. CMNT will submit the log book form showing the annual review was completed.	Larry Skelton (CMNT)	05/01/18	08/15/18
3.	Non-Facility Fire Extinguisher Inspection	CMNT will provide three months' completed MAXIMO work orders for moveable assets that have fire extinguishers installed.	Larry Skelton (CMNT)	05/01/18	08/15/18
4.	Facility First Aid Kits	CMNT will conduct monthly inspections of facility first aid kits and document inspections on the Monthly Shop Safety & Health Inspection Checklist. CMNT will provide three months' completed checklists.	Larry Skelton (CMNT)	05/01/18	08/15/18
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	08/15/18	09/12/18

Completion Documentation & Performance Measures

- 95 percent compliance of all records as per actionable items 1-4.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Party

CMNT	Larry Skelton	[redacted] 4.25.18 (Signature/Date)

Second-Level Responsibility

CMO	John Doherty	[redacted] 4-25-18 (Signature/Date)
RAIL	Andrew Off	[redacted] 25 APR 18 (Signature/Date)

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding Metrorail Vehicle Maintenance & Engineering. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-RCM-18-02 and the associated finding(s).

Required Action

QICO-RCM-18-02 ***Office of Car Maintenance (CMNT)*** *High*

Perform safety and equipment certification assessments at all facilities. Implement methods to maintain safety critical items.

Assess the certification status of all lifting devices and accessories and implement immediate corrective actions. Review the current inspection and certification procedures and update them accordingly to achieve a robust process, including effective visualization of the status of all covered equipment.

Applicable Finding(s)

- F-RCM-18-02: Maintaining certification of lifting devices is necessary for safe and reliable maintenance operations.
  - *Measure:* Job Safety. *Risk:* Safety– High (5.4).

Action Plan Overview

Car Maintenance (CMNT) Precision Measuring Device (PMD) Monitors shall verify that all lifting devices and slings in use have a certificate of weight limitation uploaded to Documentum, on file, and MAXIMO per CMNT Standard Operating Procedure (SOP) 3.04.

CMNT Superintendents or Assistant Superintendents shall conduct a monthly check to verify these requirements are in compliance and document these audits on a spreadsheet. The result of the Superintendent's spot check audits shall be submitted to the respective Assistant General Superintendent.

- CMNT PMD Monitors shall verify that maximum load capacities, asset numbers and serial numbers are clearly marked on all lifting devices and slings assigned to their shop per CMNT SOP 3.04;
- CMNT Superintendents or Assistant Superintendents shall verify that monthly inspections are completed on all lifting devices and slings assigned to their shop per CMNT SOP 3.04;
- CMNT Superintendents or Assistant Superintendents shall conduct a monthly check to verify compliance with the requirements in SOP 3.04 to include a signed monthly MAXIMO report;
- CMNT PMD Monitors shall verify that all lifting device attachments that can be interchangeable with other lifting devices assigned to their shop are identified with the maximum load capacity per OSHA 1910.184 (e) (2) (i); and
- CMNT PMD Monitors shall ensure a clear path is documented to each attachment weight limitation certificate.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Weight Certifications	Superintendents or Assistant Superintendents shall conduct a monthly spot check to verify weight certifications are on file for each device in use. CMNT will submit a certificate of weight limitation and correlating asset numbers for 25 percent of lifting devices in use at each shop.	Larry Skelton (CMNT)	05/01/18	06/27/18
2.	Maximum Load, Asset and Serial Numbers are Attached to Asset	Superintendents or Assistant Superintendents shall conduct a monthly spot check to verify maximum load, asset and serial numbers are attached to each device. CMNT will submit three months of completed audits and results.	Larry Skelton (CMNT)	05/01/18	08/15/18
3.	Monthly Inspections Quality Control	Superintendents or Assistant Superintendents shall conduct a monthly spot check to verify monthly inspections are being documented in MAXIMO for each device. CMNT will submit three months of MAXIMO reports to indicate lifting device inspections are being performed when due.	Larry Skelton (CMNT)	05/01/18	08/15/18
4.	Lifting Device Attachments and Load Certificates.	Superintendents or Assistant Superintendents shall conduct a monthly spot check to verify lifting device attachments have proper load weight certificates on file. CMNT will submit three months of completed audits and results.	Larry Skelton (CMNT)	05/01/18	10/03/18
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	10/03/18	11/07/18

Completion Documentation & Performance Measures

- 95 percent audit and inspection compliance as per actionable items 2-4.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Party

CMNT	Larry Skelton	[redacted] (Signature/Date)	4-25-18

Second-Level Responsibility

CMO	John Doherty	[redacted] (Signature/Date)	4-25-18
RAIL	Andrew Off	[redacted] (Signature/Date)	25 APR 18

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding Metrorail Vehicle Maintenance & Engineering. This internal Corrective and Preventive Action (iCAPA) has been developed to address recommended action QICO-RCM-18-03 and the associated finding(s).

Required Action

QICO-RCM-18-03 ***Office of Car Maintenance (CMNT)*** *Elevated*

Establish shop specific metrics to improve maintenance performance and Maximo data collection.

As part of the planned implementation of the latest revision of Maximo, establish detailed requirements for data entry and validation, and establish detailed criteria for a Quality Control Plan (QCP) pertaining to preventive and corrective maintenance Maximo work order completion and closure.

Applicable Finding(s)

- F-RCM-18-03: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.
    - *Measure:* Data Assurance. *Risk:* Service Delivery– Elevated (4.4).

Action Plan Overview

Car Maintenance (CMNT) Superintendents or Assistant Superintendents shall verify that Shift Supervisors are adhering to the procedures outlined in CMNT Standard Operating Procedure (SOP) 1.04 when working with MAXIMO corrective maintenance (CM) work orders. CMNT Superintendents or Assistant Superintendents shall conduct quality control checks of all completed (COMP) work orders for accuracy prior to placing the work order into the closed (CLOSED) status as required by CMNT SOP 1.04.

CMNT Supervisors shall review all deferred work orders during the vehicles' unscheduled maintenance phase while the vehicle is in the shop to assess whether that particular defect can be fixed and/or troubleshot per CMNT SOP 1.06. CMNT Superintendents or Assistant Superintendents shall conduct a weekly check to verify these requirements are being met and print out and sign a MAXIMO report each month to document their audits. The result of the Superintendent's spot check audits shall be submitted to the respective Assistant General Superintendent.

CMNT Periodic Inspection (PI) Supervisors shall place all deferred work orders in progress (INPRG) state and assign a technician to address the deferral with the exception of any deferred work order where a part has been placed on-order and is not available to be installed per CMNT SOP 1.06. CMNT Superintendents or Assistant Superintendents shall conduct a weekly spot checks to verify these requirements are in compliance and document these audits on a spreadsheet. The result of the Superintendent's spot check audits shall be submitted to the respective Assistant General Superintendent.

CMNT Shift Supervisors shall ensure all parts removed from rail vehicles are properly tagged and signed per CMNT SOP 1.06. CMNT Superintendents or Assistant Superintendents shall conduct a weekly spot checks to verify these requirements are in compliance and document these audits on a spreadsheet. The result of the Superintendent's spot check audits shall be submitted to the respective Assistant General Superintendent.

To address open work orders, CENV will dispose of all open Maximo work orders for Engineering Test Plans (ETP) on revenue rail car assets where testing has concluded. In addition, CENV will dispose of all open Maximo work orders for Engineering Modification Instructions (EMI) on revenue rail car assets that have been superseded by a subsequent EMI. CENV will dispose of all open Maximo work orders for EMI campaigns that have been identified as ineligible for capital funding, or otherwise will not be implemented.

CENV will establish a new procedure governing the lifecycle of CENV-generated Maximo work orders, to include the following elements:

- Limiting the quantity of pending Maximo work orders for any given EMI campaign to rail car assets that will actually by modified over a standardized forecastable period.
- Designating ownership of Maximo work orders for ETP to the originating CENV staff member.
- Succession plan for pending ETP work orders to transfer responsibility in the event of CENV personnel changes.
- Periodic monitoring of CENV-generated Maximo work orders to assure adherence with these requirements.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Supervisor Review of Deferred Work Orders	Superintendents or Assistant Superintendents shall conduct a weekly check to verify Supervisors are reviewing deferred work orders for workability. CMNT will submit three months of completed audits.	Larry Skelton (CMNT)	05/01/18	08/12/18
2.	PI Supervisor Review of Deferred Work Orders for Conclusion	Superintendents or Assistant Superintendents shall conduct weekly spot checks to verify PI Supervisors are reviewing deferred work orders for workability. CMNT will submit three months of completed audits.	Larry Skelton (CMNT)	05/01/18	08/12/18
3.	Failure Data Tags	Superintendents or Assistant Superintendents shall conduct weekly spot checks to verify parts are properly tagged. CMNT will submit three months of completed audits.	Larry Skelton (CMNT)	05/01/18	08/12/18
4.	Work Order Disposition	CENV will dispose of Maximo work orders for ETPs that have concluded, and EMIs that will not be implemented. CENV will submit a Maximo report indicating the number of open EMI and ETPs work orders.	Anthony Johnson (CENV)	05/01/18	10/03/18
5.	Develop New SOP for Work Order Process	CENV will create and promulgate new procedure governing the lifecycle of Maximo work orders. CENV will periodically review all open ETP and EMI work orders for compliance with new procedure. CENV will submit new SOP.	Anthony Johnson (CENV)	04/17/18	05/30/18
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	10/03/18	10/31/18

Completion Documentation & Performance Measures

- 95 percent compliance as per actionable items 1-3 (CMNT).
- 95 percent compliance as per actionable item 5 (CENV).

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

CMNT	Larry Skelton	[redacted] 4-25-18 (Signature/Date)
CENV	Anthony Johnson	[redacted] 4/25/18 (Signature/Date)

Second-Level Responsibility

CMO	John Doherty	[redacted] 4-25-18 (Signature/Date)
RAIL	Andrew Off	[redacted] 25APR 18 (Signature/Date)

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding Metrorail Vehicle Maintenance & Engineering. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-RCM-18-04 and the associated finding(s).

Required Action

QICO-RCM-18-04 ***Office of Car Maintenance (CMNT)*** *Elevated*

Update and enforce established procedures to improve work quality and parts management.

Comply with the requirements established in CMNT Standard Operating Procedure (SOP) 2.10, including the proficiency and methodology reviews to be performed by the shop Superintendent and CMNT Assistant General Superintendent.

Applicable Finding(s)

- F-RCM-18-04: Implementation of a quality control plans is vital to ensure high quality work that conforms to the requirements.
    - *Measure: Quality Control. Risk: Service Delivery– Elevated (3.5).*

Action Plan Overview

Car Maintenance (CMNT) Supervisors shall use the Car Maintenance Audit Form(s) to perform audits as required by CMNT Standard Operating Procedure (SOP) 2.10.

CMNT Superintendents shall review 100 percent of direct reports audits per month to assess their proficiency in providing constructive feedback on unsatisfactory audits per CMNT SOP 2.10.

CMNT Assistant General Superintendents (AGSs) shall review 10 percent of direct reports audits per month to assess their proficiency in providing constructive feedback on unsatisfactory audits per CMNT SOP 2.10.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Maintenance Quality Audits	Supervisors shall perform and document audits per CMNT SOP 2.10. CMNT will submit two months of completed audits per Supervisor per shop.	Larry Skelton (CMNT)	05/01/18	07/18/18
2.	Maintenance Audit Supervisory Quality Control Checks	Superintendents or Assistant Superintendents shall review and document all direct reports' audits per month to assess their proficiency and document their audits on a spreadsheet. CMNT will submit the audit spreadsheet for two months.	Larry Skelton (CMNT)	05/01/18	07/18/18
3.	Maintenance Audit Superintendent Quality Control Checks	Assistant General Superintendent(s) shall perform reviews required per CMNT SOP 2.10 and document their results on a spreadsheet. CMNT will submit the spreadsheets for a three month period.	Larry Skelton (CMNT)	05/01/18	08/15/18
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)	08/15/18	9/12/18

Completion Documentation & Performance Measures

- 95 percent Compliance as per actionable items 1-3.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Party

CMNT	Larry Skelton	[redacted] 4-25-18 (Signature/Date)

Second-Level Responsibility

CMO	John Doherty	[redacted] 4-25-18 (Signature/Date)
RAIL	Andrew Off	[redacted] 25 APR 18 (Signature/Date)

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding Metrorail Vehicle Maintenance & Engineering. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-RCM-18-05 and the associated finding(s).

Required Action

QICO-RCM-18-05 ***Office of Car Maintenance (CMNT)*** *Low*

Update and enforce established procedures to improve work quality and parts management.

Comply with the requirements prescribed in CMNT Standard Operating Procedure (SOP) 1.08, Shelf Life Management. Establish procedures to identify, tag, and organize parts stored on the shop floor as well as housekeeping and workplace organization including implementation and periodic reviews.

Applicable Finding(s)

- F-RCM-18-05: Establishing concise parts management and workplace organization requirements are vital for safe and reliable operations.
    - *Measure: Work Standards Risk: Safety– Low (2,4).*

Action Plan Overview

Car Maintenance (CMNT) Superintendents shall implement a Shelf Life Management Program and verify the Shelf Life Inspection Checklist is used to perform, at a minimum, quarterly shelf life audits per CMNT SOP 1.08.

CMNT Superintendents or Assistant Superintendents shall ensure all components of rail vehicles stored at the shop floor level are properly identified (tagged) as either serviceable, unserviceable or warranty parts.

CMNT Superintendents or Assistant Superintendents shall conduct a weekly spot checks to verify these requirements are in compliance and document these audits on a spreadsheet.

The result of the Superintendent's spot check audits shall be submitted to the respective Assistant General Superintendent.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Shelf Life Management Quality Control	Superintendents or Assistant Superintendents shall perform quarterly shelf life checks of products. CMNT will submit two quarterly management audits per shop.	Larry Skelton (CMNT)	05/01/18	01/02/18
2.	Rail Vehicle Parts on Shop Floor	Superintendents or Assistant Superintendents shall conduct weekly spot checks to verify parts on the shop floor are properly tagged. CMNT will provide three months of completed audits.	Larry Skelton (CMNT)	05/01/18	09/05/18
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	01/03/19	02/06/19

Completion Documentation & Performance Measures

- 95 percent compliance as per actionable items 1 and 2.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

CMNT	Larry Skelton	[redacted] 4-25-18 (Signature/Date)

Second-Level Responsibility

CMO	John Doherty	[redacted] 4-25-18 (Signature/Date)
RAIL	Andrew Off	[redacted] 25 APR 18 (Signature/Date)

Purpose and Scope

On March 9, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding Metrorail Vehicle Maintenance & Engineering. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-RCM-18-06 and the associated finding(s).

Required Action

QICO-RCM-18-06 ***Office of Car Maintenance (CMNT)*** *Low*

Establish shop specific metrics to improve maintenance performance and Maximo data collection.

Establish shop specific metrics and indicators that reflects the actual work being done within the shops and utilize them within sound management routines to drive improvement.

Applicable Finding(s)

- F-RCM-18-06: Developing methods to assess reliability of work performed at the shop floor level will help drive performance improvements and establish fleet comparison metrics.
    - *Measure: Work Measurement. Risk: Service Delivery– Low (2,4)*

Action Plan Overview

Car Maintenance (CMNT) General Superintendent shall establish a working relationship with Reliability Engineering and Performance Analysis (REPA) office to develop rail vehicle shop specific metrics. Currently, these metrics are not being produced to identify rail vehicle series assigned to the shop level.

Reliability metrics for rail vehicle fleets are being discussed during the bi-weekly CMNT staff meetings. Once these shop specific metrics become available, the CMNT General Superintendent will task each CMNT Superintendent to share this information with the shop workforce and documented a daily safety briefing sign-in sheets.

Business Impact - Budget/Cost Estimate

Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Key Performance Indicator (KPI) Development and Distribution	CMNT GS shall establish a working relationship with REPA to establish KPIs for each shop. Superintendents or Assistant Superintendents shall brief these KPIs at the safety meetings. CMNT will provide three sign-in sheets, per shift, indicating KPIs were discussed at safety meetings.	Larry Skelton (CMNT)	05/01/18	11/07/18
2.	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	11/07/18	12/05/18

Completion Documentation & Performance Measures

- CMNT will provide three months of KPI Reports.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Party

CMNT	Larry Skelton	[redacted] 4-25-18 (Signature/Date)

Second-Level Responsibility

CMO	John Doherty	[redacted] 4-25-18 (Signature/Date)
RAIL	Andrew Off	[redacted] 25APR18 (Signature/Date)

METRORAIL VERTICAL TRANSPORTATION: ELEVATOR MAINTENANCE AND INSPECTIONS iCAPAs

Return to Summary of Required Actions

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-ELES-18-01

Purpose and Scope

On April 5, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review of the Office of Elevators and Escalators: Elevators. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-ELES-18-01 and the associated finding.

Required Action

QICO-ELES-18-01 *Office of Elevator and Escalator Services (ELES)* *Overall Risk – Moderate (3,3)*

Required Action: Identify opportunities to update the methodology for managing certification of all assets; include methods to ensure documentation is readily available on the System Asset Map.

Applicable Finding

- F-ELES-18-01: Readily available elevator certificates of inspection are vital for the safe and reliable delivery of elevator services to customers.
    - *Measure: Regulations & Oversight. Risk: Legal & Compliance – Moderate (3,3)*

Action Plan Overview

PLAN OVERVIEW

ELES will improve scheduling and implement a robust process to address past due inspections. ELES will modify monthly maintenance checklists to confirm valid inspection certificates are available on the system asset map.

Business Impact - Budget/Cost Estimate

- **Process Improvement** – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	ELES Annual Inspection Scheduling	Revise 212-SOP-30 to include annual inspection scheduling of assets in Maximo before certificate expiration dates and to allow ample time for potential repairs and jurisdictional delays. Submit revised SOP.	Madhavan Kozhipurath (ELES)	05/01/18	06/06/18
2.	Certificate of Inspection Availability	Revise monthly preventative maintenance (PM) checklist to add item for elevator certificate availability on system asset map. ELES Engineering to upload most-current, valid certificates to system asset map. Submit revised monthly PM checklist and matrix of certificate uploads.	Rolando Grimaldi (ELES) Madhavan Kozhipurath (ELES)	05/01/18	10/03/18
3.	Safety Work Order (SWO) Completion	ELES inspections group in conjunction with maintenance will craft and implement a plan to address the back log of SWOs and inspection compliance with 212-SOP-30. Submit inspections tracking matrix.	Madhavan Kozhipurath (ELES) Rolando Grimaldi (ELES)	05/01/18	05/01/19
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	05/06/19	05/17/19

Completion Documentation & Performance Measures

- 100 percent of valid certificates uploaded to system asset map confirmed by QICO follow-up activities in relation to actionable item 2.
- 100 percent of re-inspections completed 30 days from the creation of SWOs in relation to actionable item 3.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

ELES	Madhavan Kozhipurath	[redacted]	4/26/18 (Signature/Date)
ELES	Rolando Grimaldi	[redacted]	4/26/18 (Signature/Date)
ELES	Mitchell Nici	[redacted]	4/26/18 (Signature/Date)

Second-Level Responsibility

SSRV	Randall Grooman	[redacted]	4/28/18 (Signature/Date)

Purpose and Scope

On April 5, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review of the Office of Elevators and Escalators: Elevators. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-ELES-18-02 and the associated findings.

Required Action

QICO-ELES-18-02 ***Office of Elevator and Escalator Services (ELES)*** *Overall Risk – Elevated (4,4)*

Required Action: Identify opportunities to implement established safety procedures that mitigate job hazards.

Applicable Findings

- F-ELES-18-02: Compliance with Lock Out / Tag Out (LOTO) procedures minimizes job hazards and assures safe working conditions.
    - *Measure: Job Safety Risk: Safety – Moderate (3,4)*
- F-ELES-18-07: Maintaining work areas free of trash and debris encourages a positive work environment and reduces job hazards.
    - *Measure: Application & Fulfillment Risk: Safety – Elevated (4,4)*

Action Plan Overview

PLAN OVERVIEW

ELES will revise safety procedures, create checklists and install equipment to improve compliance with current departmental standards.

Business Impact - Budget/Cost Estimate

- Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Update LOTO Standard Operating Procedure (SOP)	Update SOP 212-23-6.14(d) to change "locations" to "station." Train active field personnel on revised policy. Submit updated SOP and signed acknowledgments from active field personnel.	Rolando Grimaldi (ELES)	05/09/18	07/09/18
2.	Install LOTO Stations	Install at least one LOTO station at every rail station as per the revised SOP 212-23-6.14(d). Submit spreadsheet of install locations.	Rolando Grimaldi (ELES)	05/01/18	08/01/18
3.	ELES Materials Storage Policy Reinforcement	Reinforce policy 212-SOP-35 2.2.02-5.6 through toolbox meetings. Submit signed acknowledgments from active field personnel.	Rolando Grimaldi (ELES)	05/09/18	07/09/18
4.	Housekeeping Checklist	Create housekeeping checklist to be posted at all non-public locations containing ELES materials. Submit checklist and list of locations where checklist is posted.	Rolando Grimaldi (ELES)	05/01/18	08/01/18
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	08/06/18	08/17/18

Completion Documentation & Performance Measures

- 95 percent of active personnel acknowledge updated LOTO procedures.
- 95 percent of active personnel acknowledge ELES materials storage policy.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

ELES	Rolando Grimaldi	[redacted]	4/26/18 (Signature/Date)
ELES	Mitchell Nici	[redacted]	4/26/18 (Signature/Date)

Second-Level Responsibility

SSRV	Randall Grooman	[redacted]	4/28/18 (Signature/Date)

INTERNAL CORRECTIVE AND PREVENTIVE ACTION (iCAPA) QICO-ELES-18-03

Purpose and Scope

On April 5, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review of the Office of Elevators and Escalators: Elevators. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-ELES-18-03 and the associated findings.

Required Action

QICO-ELES-18-03 ***Office of Elevator and Escalator Services (ELES)*** *Overall Risk – Moderate (3,4)*

Required Action: Review and update the MCP to reinforce established SOPs, assure accurate management and availability of records.

Applicable Findings

- F-ELES-18-03: Availability of maintenance records in accordance with the ELES Maintenance Control Policy (MCP) is essential for consistency and traceability of maintenance activities.
  - *Measure: Document Control Risk: Service Delivery – Moderate (3,4)*
- F-ELES-18-04: Accuracy of the MCP assures consistency of maintenance processes and increases asset reliability.
  - *Measure: Document Control Risk: Service Delivery – Moderate (3,4)*
- F-ELES-18-05: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of completed maintenance.
  - *Measure: Data Assurance Risk: Service Delivery – Moderate (3,4)*
- F-ELES-18-06: Logbook recordkeeping in accordance with regulatory code A17.1 assures onsite availability of and access to maintenance history.
  - *Measure: Data Assurance Risk: Service Delivery – Elevated (4,3)*

Action Plan Overview

PLAN OVERVIEW

ELES will correct typographical errors in the hydraulic elevator maintenance control policy and distribute replacement pages to field employees. ELES will update procedures to address limited maintenance work orders remaining open after repairs have been completed. Reinforce the policy requiring logbook completion.

Business Impact - Budget/Cost Estimate

- Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Revise Hydraulic Elevator Maintenance Control Policy (MCP)	Correct typographical errors and remove unrelated content from work instructions in the hydraulic elevator MCP. Submit revised document.	Rolando Grimaldi (ELES)	05/09/18	07/11/18
2.	ELES Repair Records Management	Update the elevator operations control (EOC) SOP to include work order quality records check to account for proper handling of limited maintenance (LM) work orders. Train active EOC staff on the updated procedures. Submit the revised SOP and signed acknowledgments of EOC staff members.	Rolando Grimaldi (ELES)	05/01/18	08/01/18
3.	Assure Logbook Completion	Have technicians complete kiosk logbooks with maintenance and repair information in accordance with SOP 212-19 6.1. Submit a supervisor quality audit from each region.	Rolando Grimaldi (ELES)	05/09/18	10/10/18
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	1/25/19	02/06/19

Completion Documentation & Performance Measures

- 95 percent of active EOC staff acknowledge updated procedures included as part of actionable item 2.
- 95 percent compliance of logbook record completion as part of actionable item 3.

Responsible Parties

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

ELES	Rolando Grimaldi	[redacted]	4/26/18 (Signature/Date)
ELES	Mitchell Nici	[redacted]	4/26/18 (Signature/Date)

Second-Level Responsibility

SSRV	Randall Grooman	[redacted]	4/28/18 (Signature/Date)

Purpose and Scope

On April 5, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review of the Office of Elevators and Escalators: Elevators. This internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-ELES-18-04 and the associated finding.

Required Action

QICO-ELES-18-04 ***Office of Elevator and Escalator Services (ELES)*** *Overall Risk – Moderate (3,3)*

Required Action: Verify Franconia-Springfield garage elevators J03X04, J03X05 and J03X06 programmable logic controllers (PLCs) meet capital improvement project (CIP) acceptance measures and confirming all WMATA requirements are met.

Applicable Finding

- **F-ELES-18-08** Enforcing established measures for approving rehabilitated equipment is vital to improved asset performance and integration with WMATA systems.
    - *Measure: Quality Control Risk: Service Delivery – Moderate (3,3)*

Action Plan Overview

PLAN OVERVIEW

ELES is working with the elevator installation contractor to resolve reliability issues and conform to WMATA standards.

Business Impact - Budget/Cost Estimate

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

PLAN STRUCTURE

	Actionable Items	Description	Responsible Party[1]	Est Start[2]	Est End[3]
1.	Establish Proper Programmable Logic Controller (PLC) Reporting Functions	Have contractor repair PLC per design specification. ELES inspector will confirm PLC properly reports faults with a date and timestamp. Contractor inspector to provide report to ELES. Submit both ELES and contractor reports.	Cedric Watson (ELES)	05/01/18	09/05/18
2.	QICO QA of PLC Function	QICO will confirm PLC properly reports faults with a date and timestamp. Submit verification report.	QICO	09/05/18	10/05/18
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	10/08/18	10/22/18

Completion Documentation & Performance Measures

- Conformation that all three PLCs were repaired and operate within the design specifications.

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Responsible Parties

ELES	Cedric Watson	[redacted]	4/26/18 (Signature/Date)
ELES	Mitchell Nici	[redacted]	4/26/18 (Signature/Date)

Second-Level Responsibility

SSRV	Randall Grooman	[redacted]	4/26/18 (Signature/Date)

METRORAIL AFCS INSPECTION AND MAINTENANCE iCAPAs

Return to Summary of Required Actions

Purpose and Scope

On April 5, 2018, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued an internal review report regarding the Automatic Fare Collection Section (AFCS). This Internal Corrective and Preventive Action (iCAPA) has been developed to address required action QICO-AFCS-18-01 and the associated finding(s).

Required Action

QICO-AFCS-18-01 ***Systems Maintenance (SMNT)*** *Moderate*

Review and update MCP in accordance with current business practices: reflecting improved quality control standards, consistent maintenance practices, and accurate asset reliability reporting.

Applicable Finding(s)

- F-AFCS-18-01: Development of preventative maintenance Standard Operating Procedures (SOPs) and related work instructions will promote consistency of maintenance and inspection performance resulting in improved asset reliability.
  - *Measure: Work Standards. Risk: Service Delivery – Moderate (3,3)*
- F-AFCS-18-02: An up-to-date Maintenance Control Policy (MCP) that includes guiding information (e.g. definitions, job aids, & flow charts) for current processes establishes clearly defined roles and responsibilities for AFCS personnel.
  - *Measure: Work Standards. Risk: Service Delivery – Low (2,4)*
- F-AFCS-18-03: Consistent and accurate capture of work order data in Maximo is essential to effective monitoring, tracking, and analysis of maintenance tasks performed.
  - *Measure: Data Assurance. Risk: Service Delivery – Moderate (3,3)*
- F-AFCS-18-04: Utilization of a formal Quality Control Plan (QCP) is essential to assure the consistency and reliability of work being performed.
  - *Measure: Work Standards. Risk: Service Delivery – Moderate (3,3)*

Action Plan Overview

AFCS will create Preventive Maintenance Procedures to replace the current PMI Checklists and update Maintenance Control Policy.

AFCS personnel will review and update WO problem/cause/remedy codes and other data inconsistencies and will eliminate the use 'Out of Service' or 'Won't Go/Stay in Service' as WO Problem Codes.

AFCS will conduct tool box meeting to communicate updated WO problem codes to maintenance personnel.

All technicians will complete PMI checklists for recordkeeping purposes.

AFCS will revise Weekly Activity Report checklist and shift supervisors will note in their Weekly Activity Reports their Maximo QC checks/inspections. All documents will be saved for recordkeeping purposes.

Business Impact - Budget/Cost Estimate

- Process Improvement – A current process/procedure needs to be optimized to address the 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[1]	Est Start[2]	Est End[3]
1.	Preventative Maintenance Standard Operating Procedures (SOP)	AFCS will develop preventative maintenance procedures for all AFCS assets and distribute a staff notice on the implementation of the new SOPs into maintenance practices resulting in improved asset reliability. AFCS will provide new preventive maintenance procedures for PM activities and staff notice.	Gairy Johnson SMNT	05/02/18	08/01/18
2.	Revise Maintenance Control Policy (MCP)	AFCS will review and revise Maintenance Control Policy to define the roles and responsibilities of AFCS personnel as well as include process guidelines and the appropriate problem codes to be used in Maximo. AFCS will provide the revised MCP.	Gairy Johnson SMNT	05/02/18	12/05/18
3.	Maximo Work Order Problem Codes	AFCS will eliminate the use of "Out of Service" and "Won't Go/Stay in Service" as work order problem codes so that AFCS personnel accurately and consistently enter the correct problem/cause/remedy codes in Maximo. AFCS will submit Maximo corrective maintenance work order reports for the three months following implementation of new Maximo problem/cause/remedy codes.	Gairy Johnson SMNT	05/02/18	08/01/18
4.	Quality Control Plan (QCP)	AFCS will develop a QCP to include a revision of the current Weekly Activity Report checklist and review of completed PMI checklists ensuring consistent maintenance performance. All documents will be saved for recordkeeping purposes. AFCS will submit QCP.	Gairy Johnson SMNT	05/02/18	08/01/18
5.	Toolbox Meeting	AFC will conduct Maximo toolbox meeting with maintenance personnel to communicate the requirements for Maximo work order problem code entries. AFCS will submit toolbox meeting notes and sign-in sheets.	Gairy Johnson SMNT	08/01/18	09/05/18
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	12/05/18	01/02/19

[1] In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
[2] Est Start – Estimated Start Date.
[3] Est End – Estimated Completion Date.

Completion Documentation & Performance Measures

- Evidence of developed SOPs and MCP as prescribed under actionable item numbers 1, 2, & 4.
- Toolbox meeting notes and sign in sheets demonstrating evidence of discussion regarding Maximo problem code entries as prescribed under actionable item #5.

Responsible Parties

SMNT Gairy Johnson [redacted] 4/26/18
(Signature/Date)

Second-Level Responsibility

SSRV Randall Grooman [redacted] 4/26/18
(Signature/Date)

SUPPLEMENTAL MATERIALS

APPENDIX A: QUALITY MEASURES

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Policies, Procedures & Standards

- **Work Standards:** The existence and effectiveness of department policies, procedures, manuals, work instructions, quality control measures, and other requirements that define department activities.
- **Work Measurement:** The existence and effectiveness of operational goals (indicators) and sound management routines to achieve these goals.
- **Change Management:** The existence and effectiveness of processes, tools and techniques to manage changes to a system to achieve intended outcomes.
- **Skills Management:** The existence and effectiveness of a training strategy to ensure personnel are adequately qualified to perform work.

Quality & Compliance

- **Application & Fulfillment:** Adherence to existing/adopted policies, procedures, and standards; including applicable engineering or other technical requirements that specify material and/or workmanship standards.
- **Job Safety:** Adherence to safety requirements, including enterprise-wide standards (e.g. MSRPH) or those specific to a particular type of work (e.g. PPE).
- **Quality Control:** The performance of quality control functions to ensure the consistency and reliability of work performed; including the usage of properly calibrated equipment and compliant materials/parts.
- **Regulations & Oversight:** Adherence to requirements, guidelines, and recommendations from external/regulatory authorities and internal oversight functions, including items issued for corrective and preventive actions.

Traceability

- **Data Assurance:** Assessment of the validity, accuracy, consistency, relevance, and completeness of data used to schedule, document, and track work activities.
- **Assets and Activities:** Assessment of the ability to verify the history, location, or application of an item by means of documented recorded identification; including the quality and validity of data capturing this information.
- **Document Control:** Assessment of version control, ownership and approval, dissemination, storage and accessibility of business-critical documents.

APPENDIX B: RISK ASSESSMENT

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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 bad are the consequences? – The Impact
- How often does/will it happen? – The Probability of Occurrence
- 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.
- **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.
- **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.

Risk Assessment Process

The following risk matrix is 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 significance of their impact (see horizontal axis in Figure 1) and the probability of occurrence (see vertical 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 Matrix

Probability of Occurrence	Potential Impact of Risk				
	Negligible (1)	**Minor (2)**	**Moderate (3)**	**Significant (4)**	**Major (5)**
Almost Certain (5)	Low	Moderate	Elevated	High	High
Likely (4)	Low	Low	Moderate	Elevated	High
Possible (3)	Low	Low	Moderate	Elevated	Elevated
Unlikely (2)	Insignificant	Low	Low	Moderate	Moderate
Rare (1)	Insignificant	Insignificant	Low	Moderate	Moderate
Probability / **Impact**					

Risk Scale Definitions

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

Potential Impact

(1) Negligible – Unlikely to cause the activity to fail to meet part of its objectives.
(2) Minor – 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.
(3) Moderate – 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.
(4) Significant – 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.
(5) Major – 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.

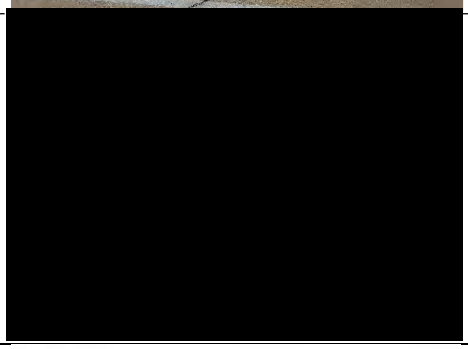
Probability of Occurrence

(1) Rare – Reasonable assumption that this risk will not occur
(2) Unlikely – Reasonable assumption that this risk will likely not occur
(3) Possible – Reasonable assumption that this risk may occur
(4) Likely – Reasonable assumption that this risk will likely occur
(5) Almost Certain – Reasonable assumption that this will occur

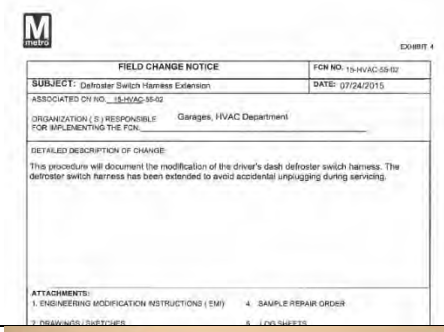
Technical Terminology – WMATA-Wide

Corrective Maintenance:
Corrective maintenance is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations.

Emergency Evacuation Plan:
Emergency evacuation plan is the urgent immediate egress or escape of people away from an area that contains an imminent threat, an on-going threat or a hazard to lives or property. Building Evacuation plans should clearly display evacuation routes to exits as well as a muster location away from the building to verify personnel evacuation.



Engineering Modification Instruction (EMI):
An EMI is a document authorizing and recording design changes throughout the prototyping and life-cycle phases of a part/component. EMI documents are developed by engineering departments (e.g. Bus Engineering (BENG) and Engineering and Architecture (ENGA)).


FIELD CHANGE NOTICE

FCN NO. 15-HVAC-55-02

SUBJECT: Defroster Switch Harness Extension

DATE: 07/24/2015

ASSOCIATED CN NO.: 15-HVAC-55-02

ORGANIZATION (S) RESPONSIBLE FOR IMPLEMENTING THE FCN: Garages, HVAC Department

DETAILED DESCRIPTION OF CHANGE:

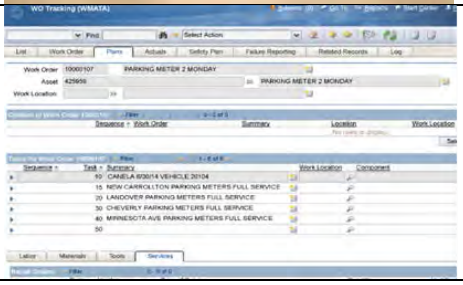
This procedure will document the modification of the driver's dash defroster switch harness. The defroster switch harness has been extended to avoid accidental unplugging during servicing.

ATTACHMENTS:

1. ENGINEERING MODIFICATION INSTRUCTIONS (EMI)
4. SAMPLE REPAIR ORDER

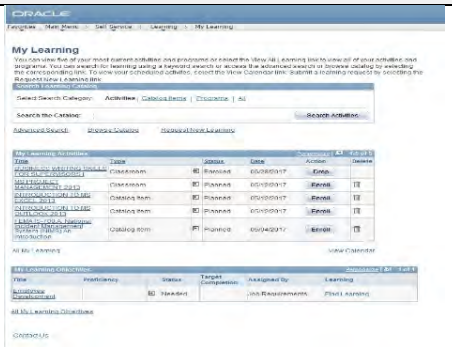
Eye wash station: Emergency eye wash stations are provided so that personnel may physically flush their eyes in the event they become contaminated by foreign materials or substances.

Maximo:
Maximo is WMATA's Enterprise Asset Management (EAM) system used for work order, incident and defect tracking.



PeopleSoft ELM:

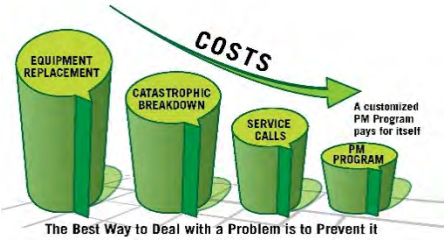
A computer based program that documents all the pertinent training data for WMATA employees and serves as their training record repository.



Personal Protective Equipment (PPE): Protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

Preventative Maintenance

The maintenance of equipment to ensure satisfactory operating condition by applying systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. Maintenance, including tests, measurements, adjustments, and parts replacement, performed specifically to prevent faults from occurring. The primary goal of maintenance is to avoid or mitigate the consequences of failure of equipment.

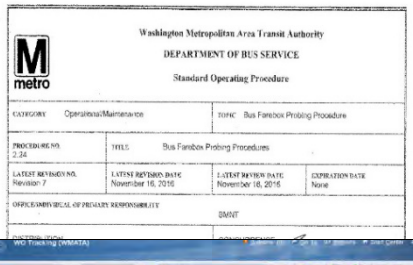


Quality Control Plan (QCP):

Quality Control Plan (QCP) ensures that an organization, product or service is consistent. It has four main components: quality planning, quality assurance, quality control and quality improvement. Quality control is focused not only on product and service quality, but also on the means to achieve it.

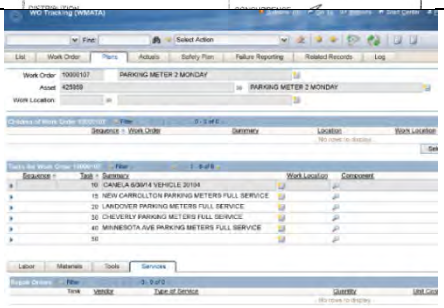
Standard Operating Procedure (SOP):

Standard Operating Procedures (SOPs) delineate responsibilities and procedures for performing certain department functions.



Work Order (WO):

A Work Order (WO) specifies a particular task and the labor, materials, services and tools required to complete the task. Work Orders are tracked primarily through Maximo.



Additional Terms – WMATA-Wide

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- **Limited Maintenance (LM):** Maintenance that is performed to bring an asset in-service for use, although some functionality may not be present in the equipment (Limited Service).
- **Quality Assurance:** Quality Assurance is a set of activities for ensuring quality in the process or construction (e.g. reviewing specifications or developing work instructions).
- **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.
- **Subject Matter Expert (SME):** A person who has special skills or in-depth knowledge on a particular job or topic.
- **Windchill:** Product Lifecycle Management (PLM) software used across the Authority for Parts Action Forms (PAF), and used for document control when applicable.

Technical Terminology - BME

Allison DOC® Premium (H 40/50 EPTM) (Software):
A diagnostic program designed for use with Allison's H 40/50 EV System™. This PC-based diagnostic program is capable of reading from H 40/50 EV System™ controllers using the J1939 communication protocol.

Bench Testing Equipment (BTE):
The equipment used to evaluate new or repaired components, devices, apparatus, etc., prior to installation to ensure that it is in perfect condition.

Compressed Gas Cylinder (e.g.: Oxygen/Acetylene):
A gas cylinder or tank is a pressure vessel used to store gases at above atmospheric pressure. High-pressure gas cylinders are also called *bottles*, but a bottled gas may instead be in a liquid or dissolved state in the cylinder.

Diagnostic Laptop:

Tough or rugged designed laptop, loaded with various diagnostic software to troubleshoot equipment failures, capture stored data and update systems on board that may require software for improvements to performance.

Fall Protection:

Fall protection is the use of controls designed to protect personnel from falling or in the event they do fall, to stop them without causing severe injury. Typically, fall protection is implemented when working at height, but may be relevant when working near any edge, such as the rooftop of a bus.

Fall Protection Harness:

A fall protection harness is a form of protective equipment designed to protect a person, animal, or object from injury or damage. The harness is an attachment between a stationary and non-stationary object and is usually fabricated from rope, cable or webbing and locking hardware.

High Voltage Electrical Insulated Gloves:

Rubber insulating gloves protect against electrical shock and should be tested every six (6) months after being put into use in accordance with ASTM F496, "Standard Specification for In Service Care of Insulating Gloves and Sleeves" at an authorized safety equipment testing facility and meet ASTM D120, IEC EN60903, and NFPA 70E standards.

In-ground Lift (Floor Jacks):

Hydraulic lift machinery used to lift buses and create clearance to allow for under body maintenance and repairs.

Technical Terminology - BME

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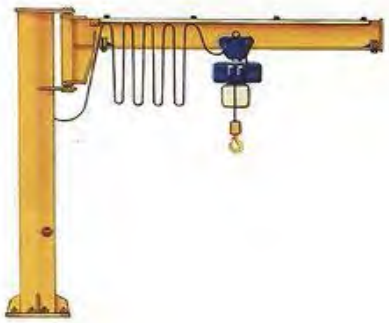
Jib Crane:
A jib crane is a type of crane where a horizontal member (*jib* or *boom*), supporting a moveable hoist, is fixed to the floor and mounted on a pillar.



Torque Indicating Tool:
An example of a torque indicating tool is a torque wrench as seen in the photo. A torque wrench is used where the tightness of securing hardware is crucial. It allows the operator to measure the torque applied to the fastener so it can be matched to the specifications for a particular application. This permits proper tension and loading of all parts.

Vansco I/O System:
A software application used to retrieve and clear all logs. This application also allows real time viewing of system logic operations and the overall electrical system on select bus models.

Technical Terminology - BMI

- **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.
- **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. Demands 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.
- **Economic Order Quantity (EOQ):** Calculated inventory measure to establish the quantity which will be reordered when a reorder point threshold is met.
- **Material Discrepancy Report (MDR):** Form used to inform Supplier/Customer of non-compliant material.
- **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.
- **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.

Technical Terminology - BMI

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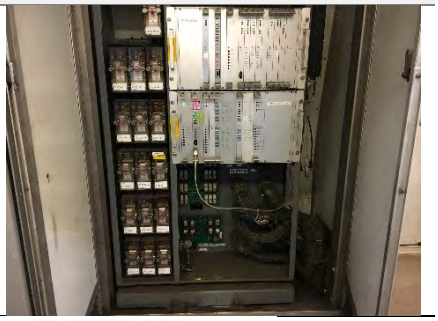
- **Parts Action Form (PAF):** The electronic form used to create, delete, or update an inventory item.
- **Procurement Lead Time:** The time between the dates a Purchasing Agent receives receives a customer order (either non-stock requisition or a PR) and when the order is awarded. It is used as a measure 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.
- **Purchase Request (PR):** PRs are automatically produced by Maximo when an inventory item has reached its reorder point (ROP) at the main storeroom. PRs are reviewed by an inventory planner and are then routed to a buyer to purchase the item.
- **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,
- **Safety Stock:** A quantity of an item planned to be in inventory to protect against fluctuations in demand and/or supply.
- **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.
- **Shelf Life:** The amount of time an item may be held in inventory before it becomes unusable for its intended purpose.
- **Stock Out:** When on hand inventory balance falls below zero.
- **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).

Technical Terminology - RCM

Automatic Train Protection (ATP): The ATP system is a subsystem of the Automatic Train Control system designed to enforce train separation by issuing limiting speed commands to the rail car. These commands are generated by the local wayside equipment.



High voltage gloves: An element of personal protective equipment (PPE), high voltage gloves are electrically insulated gloves designed to protect a worker from the hazards of exposure to electrically energized components.

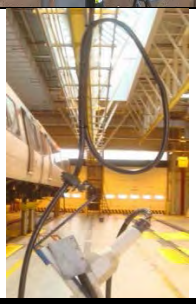
Lifting device: A device that employs a scissors mechanism, hydraulic or pneumatic cylinder, or other type of drive system to raise or lower heavy loads or equipment relatively short distances.

Lifting accessory: Cable, chain, rope, webbing, and/or rings used in conjunction with a lift or crane in order to facilitate lifting and balance a load.

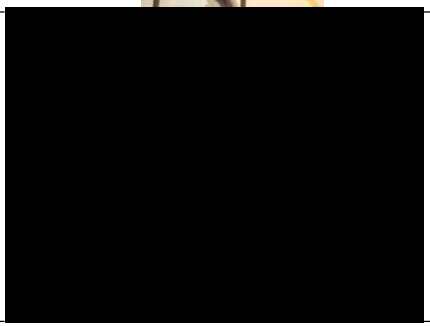
Precision Measuring Device (PMD): Equipment or tools used to effect precise measurements or adjustments, which are periodically calibrated or validated. Examples include torque wrenches, dial calipers, and pressure gauges.

Shop power system: All elements of the 750 volts direct current system used to supply auxiliary power to rail cars when they are berthed in a maintenance facility. This includes the control station, power cable, and associated fittings.

Stinger system: Used to supply 750 volts direct current exclusively used for powering the propulsion system on rail cars when they are moving in to, out of, or within a maintenance facility. This includes an oversized alligator clip, the control pendant, and associated cabling.



Vital relay: A vital relay is designed so that the probability of its failing to return to a prescribed state when it is de-energized is so low that for all practical purposes it is considered to be nonexistent. Vital relays are employed in critical safety applications such as Automatic Train Protection (ATP) systems.



Technical Terminology – MVT

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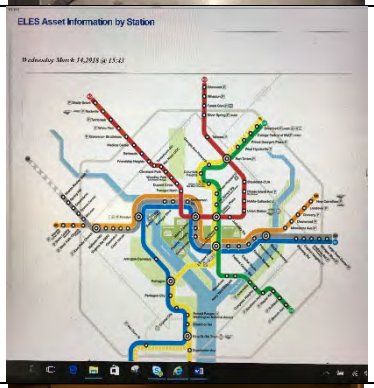
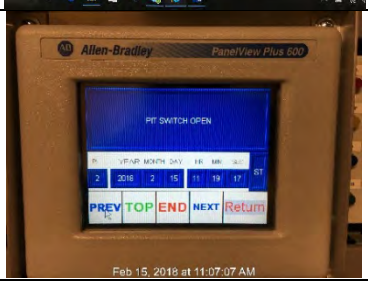
Elevator Certificate: A certificate issued by local jurisdictions verifying that an elevator has been inspected. Elevator units are not permitted to operate without a valid certificate of inspection.

Elevator Machine Room (EMR):
An enclosed machinery space outside the hoistway, intended for full bodily entry, that contains the electric driving machine or the hydraulic machine. The room could also contain electrical and/or mechanical equipment used directly in connection with the elevator.

ELES Asset Information System Map:
A page accessible form the ELES homepage on the Metroweb. This allows a user to select a station and access information (e.g. certificates, O&M manuals and wiring diagrams) of the ELES assets at that location.



Programmable Logic Controller (PLC):
An electronic controller that uses a programmable memory for its internal stored procedures, implementation of logical, sequential control, timing, user-oriented counting and arithmetic operations such as instruction, and monitoring through digital or analog input / output it that controls various types of machinery or production processes.



Additional Terms - MVT

- **Capital Improvement Projects (CIP):** The group responsible for the overall administration of the modernization and/or replacement process as well as the quality assurance (testing and inspections) of vertical transportation equipment.
- **Corrective Maintenance (CM):** 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).
- **Elevator/Escalator Operations Center (EOC):** The Elevator and Escalator dispatch group tasked with taking and processing equipment outage calls, dispatch of technicians, recordation of accidents and incidents, and the processing of work orders for all ELES assets.
- **Safety Work Order (SWO):** An inspection document that identifies code deficiencies which must be abated before a unit can return to service.
- **Virtual EOC:** the system that the ELES maintenance technicians log into and out of throughout the work day to identify their locations and enter work order information.

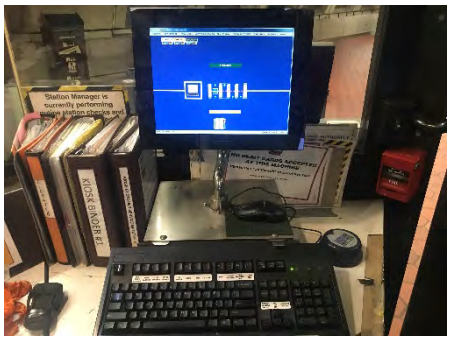
Faregate: Passengers are allowed to enter or exit Metrorail station mezzanines or train platforms through faregates, which have two barriers that slide upwards upon SmarTrip (a contactless, closed-loop prepaid card) verification. WMATA does not use turnstiles characteristic of other transit systems. Customers are required to tap-in to access the platform and tap-out upon arrival to their destination. Standard faregates are typically configured for one direction (entry or exit), but ADA faregates (e.g. wider faregates for wheelchair access) operation in both directions.

Fare Vendor: WMATA has over 230 fare vending machines, which are used to purchase and refill SmarTrip contactless cards; paper farecards were phased out in December 2015. The fare vending machines accept cash or credit.

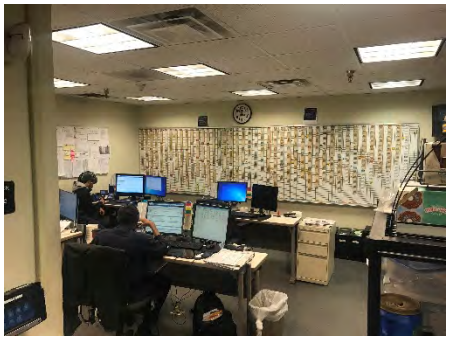
Exitfare Machine: Because WMATA requires customers to tap their smartcards at both the beginning and end of their trip, exitfare machines allow customers to add additional funds to their SmarTrip cards in order to keep the balance positive before exiting through the faregate. As of February 2018, SmarTrip balances are not allowed to be negative before exiting the system.

SmarTrip Card: A contactless, closed-loop prepaid card used to access both WMATA's Metrobus and Metrorail system. The card uses near-field RFID to communicate with readers on each faregate or bus farebox machine.

Station Operator Console (SOC): The SOC is a computer within the Kiosk of Metro stations which provides monitoring and control functions for all AFCS devices associated with a single station. It allow Station Managers and other authorized personnel to place fare vendors and faregates in or out of service, configure faregates for entry or exit operation (control direction), and read patron's smartcards on the SOC's attached card reader.



AFCS Maintenance Field Office Dispatch Center (Helpdesk): Where all failures relating to Rail AFCS equipment are reported (L'Enfant Plaza). It is manned by dispatchers and at least one AFCS supervisor during the hours of revenue operation. Station Managers and possibly other WMATA personnel call the center to report problems with AFCS devices. Work orders are then generated, and technicians are dispatched to investigate. The dispatch center provides a secure "Keywatcher" system for managing the keys to fare vendors, which each technician must pick up at the beginning of their shift and return at the end of their shift.



AFCS Maintenance Status Board: Located within the AFCS Maintenance field office, the status board provides a visual representation of all Metrorail AFCS devices, including their maintenance status and availability. Each device is grouped by Rail mezzanine and listed by machine number.

A "Pin" system has been developed to show the status of devices. The "Pins" are actually small magnets that are placed on the board beside the device machine number by the AFCS dispatchers or supervisors. The color of the pin indicates the device's status:

- Red indicates a newly reported issue to which a technician must be dispatched.
- White indicates that a technician has looked at the problem and has ordered a part (awaiting part).
- Blue means that a part has been delivered to the location and now a tech must be dispatched to install the part.
- Green indicates that a part has been ordered, but is not immediately available (back-ordered part).
- Yellow indicates an issue that requires assistance from the Revenue Collection department.
- The absence of a pin indicates that the device is in-service with no issues.

Additional Terms – AFC

- **Mean Time Between Failures (MTBF):** Average time required to bring system from a failed state to an operational state. MTTR is calculated considering diagnostic, repair (or replacement), and retest times only.
- **Mean Time To Repair (MTTR):** Average time required to bring system from a failed state to an operational state. MTTR is calculated considering diagnostic, repair (or replacement), and retest times only.