Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2017

# Internal Review: Engineering & Maintenance

## Metrobus Revenue Collection Equipment Maintenance

December 15, 2017

Quality Assurance, Internal Compliance & Oversight (QICO)

*"Quality Trumps Quantity"*

# QICO INTERNAL REVIEW

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## 21. Metrobus Revenue Collection Equipment Maintenance

*Key Takeaway: Although BMNT - Revenue Equipment Technicians are equipped with the experience to perform their duties, controlled standards, procedures and training program are necessary to assure all requirements are consistently and effectively adhered to.*

### Wins and Areas for Improvement:

- ✓ Effective use of Electro-Static Discharge Protection (ESD) improves the reliability of repairs.
- Consistent and accurate capture of work order data in MAXIMO is essential to effective monitoring, tracking and analysis of the maintenance work performed.
- Effective revenue collection equipment training is needed for technicians to perform their duties effectively and efficiently.
- The development of engineering modification process is essential to the control and reliability of equipment modifications.
- While the Revenue Repair Shop strives to reduce costs and to help with parts availability, material requalification requires additional controls to promote reliability.
- Defining key performance indicators (KPI) for shop activities is needed to identify performance deficiencies and drive improvement.
- Utilization of a formal Quality Control Plan (QCP) is essential to promote the consistency and reliability of work being performed.

### Required Actions:

- QICO-FBO-17-01: Develop formal approved procedures for BMNT practices, including standards for MAXIMO data entry, engineering modification instructions, refurbished parts requalification, and develop a quality control plan to promote consistent application of corrective and preventative maintenance.
  *(Risk Rating: Moderate)*
- QICO-FBO-17-02: Develop a comprehensive training program specific to the revenue collection equipment technicians, covering both class room and on the job training.
  *(Risk Rating: Elevated)*
- QICO-FBO-17-03: Develop and consistently measure performance indicators that reflects the actual performance of BMNT shop activities and drives improvement.

  *(Risk Rating: Moderate)*

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

## INTERNAL REVIEW SUMMARY

### Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the current methods and practices associated with the maintenance of revenue collection equipment on buses throughout the authority. The review will promote the actions needed to address areas of concern.
- QICO is an internal management function authorized by the Metro General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

### QICO's Methodology:

- QICO developed relevant review activities through identifying and assessing risks to quality of work, compliance with standards, and records management.
- QICO observed Bus Maintenance (BMNT) – Revenue Collection Equipment Technicians while on duty, assessed their conformance to requirements, reviewed maintenance documentation and key records and interviewed key personnel.
- Review findings and required actions are rated based on risk, which ranges on a scale from "Insignificant" to "High.

## DEPARTMENT/FUNCTION OVERVIEW

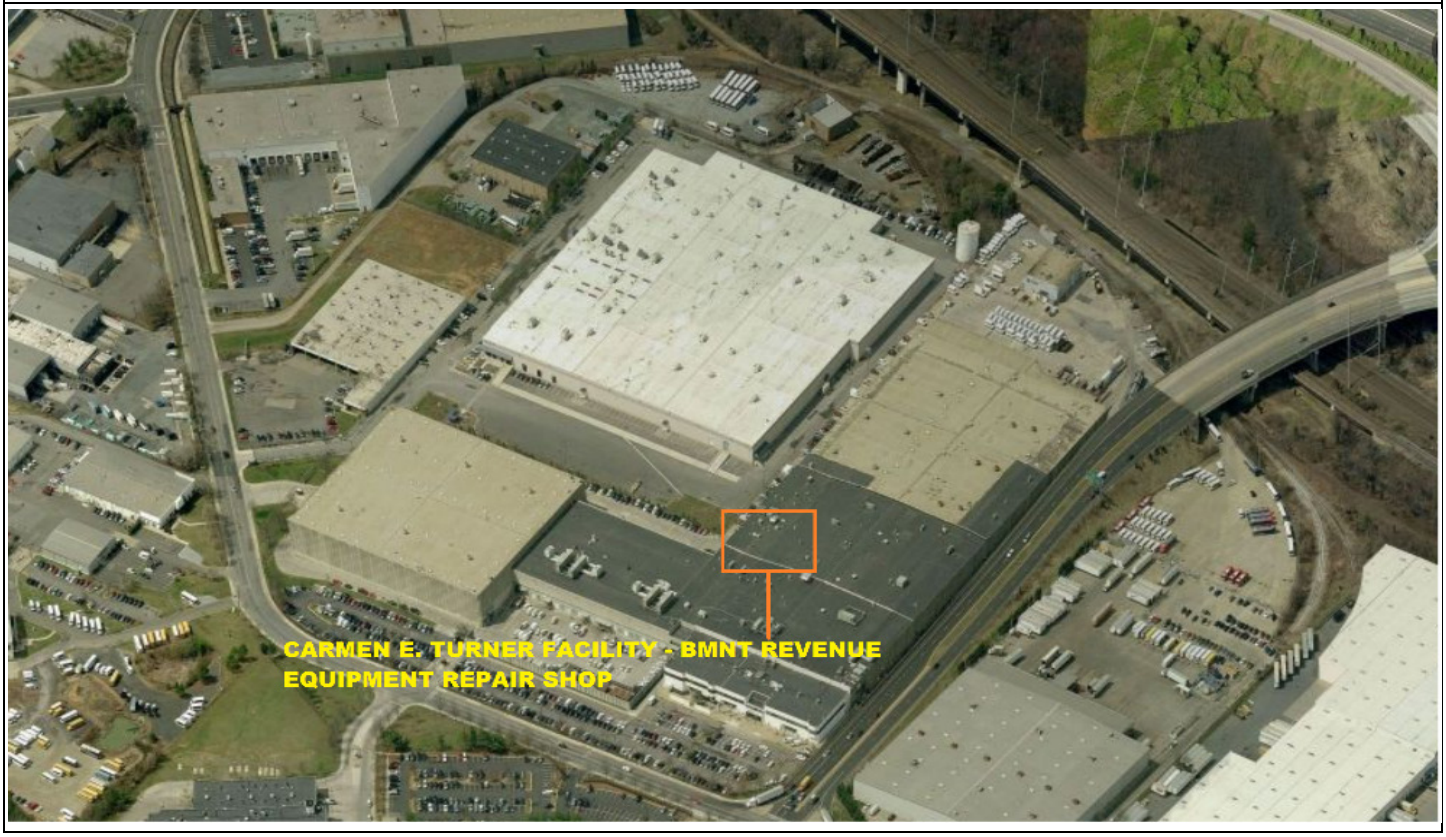
### Bus Maintenance (BMNT) – Revenue Collection Equipment Shop

Currently the Washington Metro Area Transit Authority (WMATA) is made of nine (9) bus divisions; four (4) in Washington DC, three (3) in Maryland, and two (2) in Virginia. At each division garage, Bus Maintenance (BMNT) has a dedicated team of maintenance personnel to address preventative maintenance and corrective maintenance on the authority's bus fleet of 1,583 transit buses (as of 9/14/2017).

Currently the Metrobus fleet are equipped with the Odyssey Farebox system. Due to the sensitive nature of servicing fare collection systems, BMNT has a dedicated group assigned, servicing the Odyssey farebox. The Odyssey farebox system is now beyond its expected service life, and has been presenting a challenge to meet the required reliability.

At the time of this review, The Revenue Equipment Repair shop is made up of 17 technicians and one supervisor. These technicians operate on two shifts, morning and evening. The Revenue Equipment Repair shop is responsible for the following:

- Conducting both preventive and corrective maintenance on all fareboxes in the Metrobus fleet.
- The overhaul and rebuilding of components at Carmen E. Turner Facility.
- Responding daily to all Metrobus divisions to address farebox failures.
- Maintaining direct contact with each division for current list of farebox failures.
- Conducting regularly scheduled preventive maintenance work, in order to provide increased reliability.
- Handling of ridership data stored on the farebox's controller board during maintenance.
- Returning of parts replaced in the field to Carmen E. Turner Facility for refurbishment.
- Creation and completion of work orders related to the Revenue Equipment in MAXIMO.



# REVIEW METHODOLOGY

## Internal Review Stakeholders

The **Office of Quality Assurance, Internal Compliance and Oversight (QICO)** conducted an internal review of the Metrobus Revenue Equipment maintenance function, which resides within Bus Maintenance (BMNT), which resides under the Chief Operating Officer (COO). As shown, QICO is an internal management function, reporting to the General Manager through Internal Compliance (INCP). QICO provides objective quality assurance and compliance services in order to improve the quality of Metrorail operations, processes, and compliance to regulatory requirements.


QICO observed revenue collection equipment technicians performing their duties, interviewed key personnel, and reviewed records and governing procedures. This internal review notes both positive findings (What Worked Well) and negative findings (Areas for Improvement). The findings are rated based on severity of risk, which ranges from 'Insignificant' to 'High.' Recommendations are combined into several Required Actions, which summarize the steps actions owners must take to address deficiencies.

| REVIEW SCOPE | |
|---|---|
| **Category** | **Description** |
| Review of Existing Documentation | - Revenue equipment repair MAXIMO incidents and work orders.<br>- S-002, Rev.0; Farebox Inspection and Repair Manual.<br>- SOP # 22; Farebox Operation and Fare Collection.<br>- Procedure 1.6, revision 7; GFI Odyssey Farebox Preventive Maintenance Service.<br>- Procedure 2.24, revision 7; Bus Farebox Probing Procedure.<br>- Procedure 1.1, revision 14; Preventive/Corrective Maintenance Program.<br>- Fare Collection and Farebox Troubleshooting Guide.<br>- Internal Certification Matrix.<br>- Creating a farebox child work order process instructions (non-document controlled).<br>- Revenue Equipment Repairer job description.<br>- Farebox employees' time sheet. |
| Interviews of Key Personnel | - [redacted], Bus Maintenance.<br>- [redacted], Shop Support Services.<br>- [redacted] Heavy Overhaul Shop.<br>- [redacted] Electric Equipment Repairer AA.<br>- [redacted] Electric Equipment Repairer AA. |
| Field Observations | - Carmen Turner Facility, Farebox shop: Components overhaul and testing, manuals, Electronic Static Discharge (ESD) protection, controller boards' repair and parts management.<br>- Montgomery Bus Division: Observing the process of repairs and preventive maintenance while being performed. |

## REVIEW CRITERIA

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

## RISK ASSESSMENT SUMMARY

**Note:** Required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale. Refer to Appendix A Risk Assessment for details.

### Definitions

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

| WHAT WORKED WELL | | |
|---|---|---|
| **Measure** | **Finding** | **Description** |
| Compliance with Standards | Effective use of Electro-Static Discharge Protection (ESD) improves the reliability of repairs. | - During the field observation at the Revenue Repair Shop, QICO observed technicians performing repairs with all the necessary ESD protection at their work stations |

| AREAS FOR IMPROVEMENT | | Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.<br>Refer to Appendix A: Risk Assessment for further details |
|---|---|---|
| **Measure** | **Finding** | **Description** |
| Records Management | F-FBO-17-01:<br>Consistent and accurate capture of work order data in MAXIMO is essential to effective monitoring, tracking and analysis of the maintenance work performed.<br>*Service Delivery*<br>*Moderate (3,4)* | - A random sample of 36 bus farebox work orders have been reviewed covering the following reporting dates; [redacted] (14), [redacted] (11) and [redacted] (11).<br>- 22% of work orders assessed had the component field entered as farebox, which is generic and doesn't indicate where the problem is. Examples: Work orders [redacted].<br>- 17% of the work orders assessed had incorrect Asset/Parent Asset entered. Examples: Work orders [redacted].<br>- 25% of the work orders assessed had insufficient memo entered. Examples: [redacted].<br>- While MAXIMO work order process instructions exist, it is not controlled, posing a risk of using outdated/modified versions.<br>**Recommendation:** Develop standard processes for MAXIMO data entry, conduct training and perform quality control checks to have effective work order data entry. |
| Quality of Work | F-FBO-17-02:<br>Effective revenue collection equipment training is needed for technicians to perform their duties effectively and efficiently.<br>*Service Delivery*<br>*Elevated (4,4)* | - During interviews, revenue equipment specific curriculum, class room training records and on the job training records were requested, only a training matrix and the Enterprise Learning Management (ELM) records were provided, no revenue collection equipment specific training is provided to maintenance personnel.<br>- Parts testing and requalification training records were also requested, but were not available.<br>- The only Original Equipment Manufacturer (OEM) training occurred when the fareboxes were first introduced to the fleet.<br>- According to a training matrix and the Enterprise Learning Management (ELM) records provided, no revenue collection equipment specific training is provided to the maintenance personnel.<br>**Recommendation:** Develop a comprehensive training program specific to the revenue collection equipment technicians, covering both class room and on the job training. |

| AREAS FOR IMPROVEMENT | | Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.<br>Refer to Appendix A: Risk Assessment for further details |
|---|---|---|
| Measure | Finding | Description |
| Compliance with Standards | F-FBO-17-03:<br>The development of engineering modification process is essential to the control and reliability of equipment modifications.<br>*Legal & Compliance Risk Moderate (3,3)* | - QICO observed and was informed by a revenue equipment repairer that farebox machine motherboards were being coated in-house by the revenue equipment shop without submitting Engineering Requests (ER) or the use of a WMATA approved Engineering Modification Instruction (EMI).<br>- It was also observed that technicians were utilizing unapproved screws in the absence of a factory dowel/guide pin which is used to hold the coin validator in place.<br>**Recommendation:** Develop formal requirements to govern the modification process for consistent and reliable future modifications of bus revenue equipment. |
| Quality of Work | F-FBO-17-04:<br>While the Revenue Repair Shop strives to reduce costs and to help with part availability, material requalification requires additional controls to promote reliability.<br>*Service Delivery Moderate (3,3)* | - The current bus farebox and related support systems are now outdated and have been used beyond their expected life. The current effort is to extend the life of the current system until a new one can be procured.<br>- As an example, the original farebox controller board (Kontron PCB) is no longer being manufactured by the OEM. BMNT – Revenue Repair Shop over time has acquired the skill to repair the board and has a sufficient stock of refurbished controller boards.<br>- The reuse and refurbishment of parts without appropriate identification and serialization will impact parts traceability especially for repeater failed parts.<br>- This process needs to be controlled through a detailed requalification (certification process for refurbished materials) work instructions and mandated training.<br>**Recommendation:** Develop a parts requalification procedure to govern the condition and traceability of the parts reused. |

| AREAS FOR IMPROVEMENT | | Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.<br>Refer to Appendix A: Risk Assessment for further details |
|---|---|---|
| Measure | Finding | Description |
| Quality of Work | **F-FBO-17-05:**<br>Defining key performance indicators (KPI) for shop activities is needed to identify performance deficiencies and drive improvement.<br>*Service Delivery*<br>*Moderate (3,3)* | - While BMNT – Revenue Repair Shop uses PM compliance, percentage (%) availability of buses and Mean Distance between Failures (MDBF) of buses as key performance indicators, they do not reflect the actual specific work performance of the shop. This is clearly notable through comparing the number of farebox MAXIMO incidents and work orders with the key performance indicators they are currently utilizing.<br>- Example, for the month of August 2017:<br>o Bus Availability: 91%<br>o Farebox Preventive maintenance Inspection (PMI) Compliance: 97%<br>o Number of MAXIMO Incidents: 132<br>o Number of corrective MAXIMO work orders (excluding preventive maintenance and overhauls): 912<br>- Current KPI structure focuses on fleet performance, rather than work completed at BMNT shops.<br>**Recommendation:** Develop and consistently measure performance indicators that reflect the actual performance of BMNT shop activities and drives improvement. |
| Quality of Work | **F-FBO-17-06**<br>Utilization of a formal Quality Control Plan (QCP) is essential to promote the consistency and reliability of work being performed.<br>*Service Delivery*<br>*Moderate (3,3)* | - During the interviews and through document request, QICO requested evidence of supervisor quality control checks, but none were provided through the course of this review.<br>- After reviewing BMNT Standard Operating Procedures through the BMNT intranet, QICO was unable to locate a Quality Control Plan requirement.<br>**Recommendation:** Develop a quality control plan for BMNT corrective and preventative maintenance to promote consistent application of work. |

| SUMMARY OF REQUIRED ACTIONS | | | | Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding.<br>Refer to Appendix A: Risk Assessment for further details |
|---|---|---|---|---|
| Required Action | Finding | | | Owner |
| QICO-FBO-17-01:<br>Develop formal approved procedures for BMNT practices, including standards for MAXIMO data entry, engineering modification instructions, refurbished parts requalification, and develop a quality control plan to promote consistent application of corrective and preventative maintenance.<br>Moderate | F-FBO-17-01 | Consistent and accurate capture of work order data in MAXIMO is essential to effective monitoring, tracking and analysis of the maintenance work performed. | | BMNT |
| | F-FBO -17-03 | The development of engineering modification process is essential to the control and reliability of equipment modifications. | | BENG<br>BMNT |
| | F-FBO -17-04 | While the Revenue Repair Shop strives to reduce costs and to help with part availability, material requalification requires additional controls to promote reliability. | | BMNT |
| | F-FBO-17-06 | Utilization of a formal Quality Control Plan (QCP) is essential to promote the consistency and reliability of work being performed. | | BMNT |
| QICO-FBO-17-02:<br>Develop a comprehensive training program specific to the revenue collection equipment technicians, covering both class room and on the job training.<br>Elevated | F-FBO-17-02 | Effective revenue collection equipment training is needed for technicians to perform their duties effectively and efficiently. | | BMTR |
| QICO-FBO-17-03:<br>Develop and consistently measure performance indicators that reflects the actual performance of BMNT shop activities and drives improvement.<br>Moderate | F-FBO-17-05 | Defining key performance indicators (KPI) for shop activities is needed to identify performance deficiencies and drive improvement. | | BMNT |

# CORRECTIVE ACTION PLANS (CAPs)

## INTERNAL REVIEW

### Capital Program Management and Execution

In response to the internal review of Metrobus Revenue Collection Equipment Maintenance, the office of Quality Assurance, Internal Compliance & Oversight (QICO) has coordinated the development of three (3) CAPs. Each CAP outlines the findings, recommendations and requirements to be addressed, and a detailed action plan outlining responsible parties and specific actionable items.

## EXECUTIVE LEADERSHIP OF RESPONSIBLE PARTIES

### Corrective Action Plan Commitment

[redacted] 12/05/17

Joseph Leader — Date

*Chief Operating Officer (COO)*

## WMATA INTERNAL OVERSIGHT

### Corrective Action Plan Acknowledgement

[redacted] 12/15/17

Angel Peña — Date

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

[redacted] 12/15/17

Eric Christensen — Date

*Chief, Internal Compliance (INCP)*

[redacted] 12/15/17

Paul J. Wiedefeld — Date

*General Manager & Chief Executive Officer (GM/CEO)*

## CORRECTIVE ACTION PLAN

### Purpose and Scope

On November 17, 2017, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding Metrobus Revenue Collection Equipment Maintenance. This Corrective Action Plan (CAP) has been developed to address required action QICO-FBO-17-01 and the associated findings.

| QICO Finding | QICO Recommendation |
|---|---|
| F-FBO-17-01: Consistent and accurate capture of work order data in MAXIMO is essential to effective monitoring, tracking and analysis of the maintenance work performed. | - Develop standard processes for MAXIMO data entry, conduct training, and perform quality control checks to have effective work order data entry. |
| F-FBO-17-03: The development of engineering modification process is essential to the control and reliability of equipment modifications. | - Develop formal requirements to govern the modification process for consistent and reliable future modifications of bus revenue equipment. |
| F-FBO-17-04: While the Revenue Repair Shop strives to reduce costs and to help with part availability, material requalification requires additional controls to promote reliability. | - Develop a parts requalification procedure to govern the condition and traceability of the parts reused. |
| F-FBO-17-06: Utilization of a formal Quality Control Plan (QCP) is essential to promote the consistency and reliability of work being performed. | - Develop a quality control plan for BMNT corrective and preventative maintenance to promote consistent application of work |

Required Action

QICO-FBO-17-01: Develop formal approved procedures for BMNT practices, including standards for MAXIMO data entry, engineering modification instructions, refurbished parts requalification, and develop a quality control plan to promote consistent application of corrective and preventative maintenance.

(Risk Rating: Moderate)

## ACTION PLAN

### Description

BMNT will work with the Information and Technology department while updating the revision of MAXIMO software and develop a standard operating procedure (SOP) to outline BMNT processes, including accurate capturing of work order data, tracking and analysis. The SOP will also include identification of roles and responsibilities for quality control checks to have effective correct work order data entry. BMNT will train all personnel on the new SOP for the updated MAXIMO system.

BMNT will develop a quality control procedure for corrective and preventative maintenance to promote consistency of the work being performed.

Business Impact – Budget/Cost Estimate

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

## PLAN STRUCTURE

| | Actionable items | Description | Responsible Party | Estimated Start | Estimated Completion |
|---|---|---|---|---|---|
| 1) | Develop Standard Operating Procedure for BMNT work order processing in MAXIMO | Develop a SOP to accurately track, capture and analyze work order data in the updated revision of MAXIMO software and outline roles and responsibilities for quality control checks to have effective work order data entry. | Raphael Alfred (BMNT) | 01/01/18 | 12/31/18 |
| 2) | Training for MAXIMO | Develop training to support the utilization of the MAXIMO system by BMNT staff in accordance with MAXIMO Standard Operating Procedure | Raphael Alfred (BMNT) | 01/01/18 | 12/31/18 |
| 3) | Initiate a Quality Control process | Develop a quality control (QC) process to promote consistency of work being performed during corrective and preventative maintenance activities. | Joseph Bailey / Michael Clark (BMNT) | 01/01/18 | 07/02/18 |
| 4) | Review current established modifications processes | Automatic Fare Collection (AFC) Engineering & BMNT Staff to review current established modification processes. This team will determine which process (BMNT or AFC Engineering) is most suitable for Bus Farebox Depot Level Maintenance Modifications. | Gregory Freeman Sr (COMS) Joseph Bailey (BMNT) | 01/01/18 | 03/01/18 |
| 5) | Implementation of the approved Farebox modification process | Implement the approved Farebox modification process on any modifications related to WMATA GFI Odyssey Bus Farebox. | Gregory Freeman Sr (COMS) Joseph Bailey (BMNT) | 03/01/18 | 12/31/18 |

| | | | | | |
|---|---|---|---|---|---|
| 6) | Develop Qualification Checklists & Documentation Procedures | Automatic Fare Collection (AFC) Engineering & BMNT staff to develop checklists and documentation processes/procedures to ensure all equipment or components are acceptable before return to service upon the review of all current depot level maintenance on the GFI Odyssey Farebox equipment. | Gregory Freeman Sr (COMS) Joseph Bailey (BMNT) | 01/02/18 | 11/16/18 |
| 7) | QICO CAP Verification Report | QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures. | QICO | 12/31/18 | 01/31/18 |

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

## COMPLETION DOCUMENTATION

### Performance Measures

- 80% of active BMNT personnel have received Maximo training as developed under actionable item #2.
- Evidence of compliance with approved EMI process developed under actionable item #4.
- Evidence of developed checklists and documented procedures.

## RESPONSIBLE PARTIES

| | | |
|---|---|---|
| BMNT | Raphael Alfred | [redacted] |
| BMNT | Joseph Bailey | [redacted] |
| COMS | Gregory Freeman Sr | [redacted] |

## SECOND LEVEL RESPONSIBILITY

| | | |
|---|---|---|
| Managing Director BMNT | Dave Michels | [redacted] |
| Assistant Chief Engineer | David O'Toole | [redacted] |
| AGM BUSV | Robert Potts | [redacted] |
| Chief Engineer | John Thomas | [redacted] 12·11·17 |

## CORRECTIVE ACTION PLAN

### Purpose and Scope

On November 17, 2017, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding Metrobus Revenue Collection Equipment Maintenance. This Corrective Action Plan (CAP) has been developed to address required action QICO-FBO-17-02 and the associated finding.

| QICO Finding | QICO Recommendation |
|---|---|
| F-FBO-17-02: Effective revenue collection equipment training is needed for technicians to perform their duties effectively and efficiently. | - Develop a comprehensive training program specific to the revenue collection equipment technicians, covering both class room and on the job training. |

Required Action

QICO-FBO-17-02: Develop a comprehensive training program specific to the revenue collection equipment technicians, covering both class room and on-the-job training (OJT).

(Risk Rating: Elevated)

## ACTION PLAN

| Description |
|---|
| BMNT will provide training specific to revenue collection equipment technicians utilizing accessible resources to develop curriculum consistent with covering class room and on the job training. |
| Business Impact – Budget/Cost Estimate |
| Process Improvement – A current process/procedure needs to be optimized to address the QICO Required Action. This type of initiative does not need additional resources because current manpower will be used to improve the process. |

## PLAN STRUCTURE

| | Actionable items | Description | Responsible Party | Estimated Start | Estimated Completion |
|---|---|---|---|---|---|
| 1) | Provide training specific to revenue collection equipment technicians | Develop training specific to revenue collection equipment technicians covering both class room and on-the-job training. | Raphael Alfred (BMNT) | 01/01/18 | 06/30/18 |
| 2) | Schedule and enroll technicians for training | Schedule revenue collection equipment technicians for on-the-job and class room training. | Michael Clark (BMNT) | 07/31/18 | 12/31/18 |
| 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 | 12/31/18 | 01/31/18 |

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

## COMPLETION DOCUMENTATION

| Performance Measures |
|---|
| - 80% of active revenue collection equipment technicians have received training developed under actionable item #1. |

## RESPONSIBLE PARTIES

| | | |
|---|---|---|
| BMNT | Raphael Alfred | [redacted] |
| BMNT | Michael Clark | [redacted] |

## SECOND LEVEL RESPONSIBILITY

| | | |
|---|---|---|
| Managing Director BMNT | Dave Michels | [redacted] |
| AGM BUSV | Robert Potts | [redacted] |

## CORRECTIVE ACTION PLAN

### Purpose and Scope

On November 17, 2017, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding Metrobus Revenue Collection Equipment Maintenance. This Corrective Action Plan (CAP) has been developed to address required action QICO-FBO-17-03 and the associated finding.

| QICO Finding | QICO Recommendation |
|---|---|
| F-FBO-17-05: Defining key performance indicators (KPI) for shop activities is needed to identify performance deficiencies and drive improvement. | - Develop and consistently measure performance indicators that reflect the actual performance of BMNT shop activities and drives improvement. |

Required Action

QICO-FBO-17-03: Develop and consistently measure performance indicators that reflects the actual performance of BMNT shop activities and drives improvement.

(Risk Rating: Moderate)

## ACTION PLAN

| Description |
|---|
| BMNT will provide and maintain reports which consistently measure actual performance of shop activities by identifying and outlining performance drivers specific to improving process, products and people. |
| Business Impact – Budget/Cost Estimate |
| Process Execution – A current process/procedure exists that meets the QICO Required Action, but needs to be executed. This type of initiative does not need additional resources. |

## PLAN STRUCTURE

| | Actionable items | Description | Responsible Party | Estimated Start | Estimated Completion |
|---|---|---|---|---|---|
| 1) | Develop KPI reports | Generate reports which measure key performance indicators to improve efficiency. | Michael Clark (BMNT) | 01/01/18 | 07/02/18 |
| 2) | Provide weekly and monthly reports | Share performance indicators with stakeholders to improve efficiency and drive performance | Michael Clark (BMNT) | 03/01/18 | 07/02/18 |
| 3) | Maintain reports | Catalog reports to consistently measure for constant improvements | Joseph Bailey (BMNT) | 01/01/18 | 12/31/18 |
| 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 | 12/31/18 | 01/31/18 |

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

## COMPLETION DOCUMENTATION

| Performance Measures |
|---|
| - KPI reporting developed under actionable item #1 includes all applicable KPIs defined for BMNT specific functions and activities. |

## RESPONSIBLE PARTIES

| | | |
|---|---|---|
| BMNT | Joseph Bailey | [redacted] |
| BMNT | Michael Clark | [redacted] |

## SECOND LEVEL RESPONSIBILITY

| | | |
|---|---|---|
| Managing Director BMNT | Dave Michels | [redacted] |
| AGM BUSV | Robert Potts | [redacted] |

# SUPPLEMENTAL MATERIALS

# APPENDIX A: RISK ASSESSMENT

# RISK ASSESSMENT

## Risk Assessment Methodology

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

- What can go wrong? – The Risk
- How 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.
- *Reputation* – The risk to the achievement of the Authority's mission arising from negative internal or external stakeholder opinion. Reputation risk affects the Authority's ability to establish new and /or sustain existing relationships.
- *Safety* - The risk of achievement of the Authority's mission arising from failures to prevent hazards that may cause harm to human, equipment, or the environment. This would also include risk arising from the Authority's inability to comply with safety-related legal or regulatory standards.
- *Strategic* – Risks arising from failure to achieve strategic or tactical objectives, an adverse business decision, or a lack of strategic direction and leadership. This would also include the ineffective implementation of the strategic plans, a lack of business strategies developed to achieve goals, and inadequate resources deployed against the achievement of those goals. Strategic risks can be affected by changes in the political environment such as changes in administration and resulting changes in strategic priorities. Strategic risks can also be triggered by actions of key stakeholders such as the Tri-Jurisdictional law makers or the Federal Transit Authority (FTA).
- *Technology* – The risk of unexpected losses from inadequate systems, breaches in information technology security, and inadequate business continuity planning. This would also include risks to the achievement of the Authority's mission arising from the inability of networks, security, and technologies to meet Metro's evolving needs.

### Risk Assessment

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

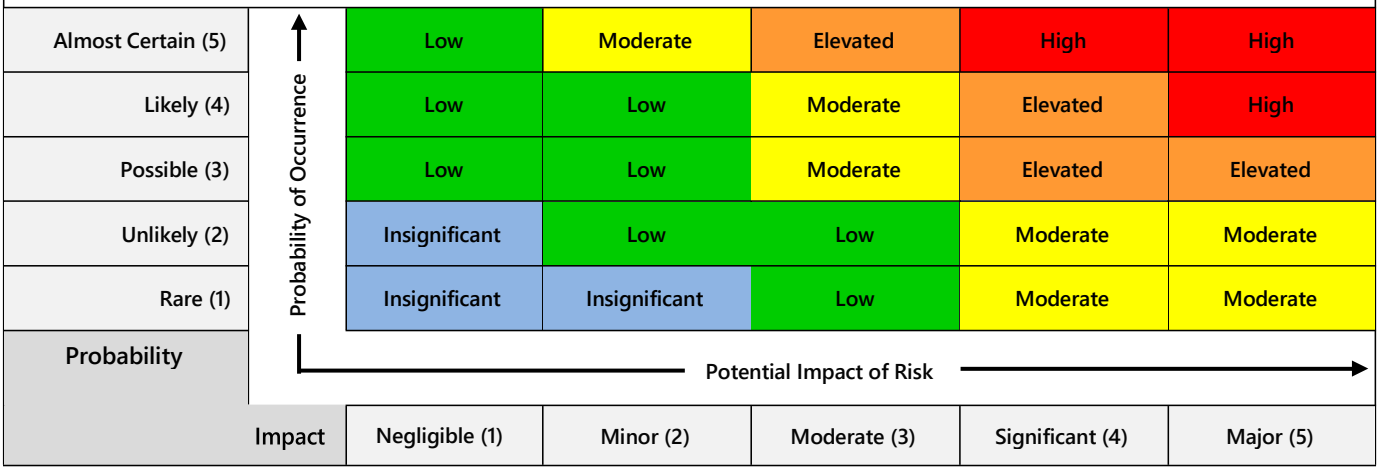
Risks are assessed based on the probability of occurrence (see vertical axis in Figure 1) and the significance of their impact (see horizontal axis in Figure 1). The impacts ratings are rated on a scale of 1 (minimum) to 5 (maximum) and are driven by the category of risks, which are then aligned on the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

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

# RISK ASSESSMENT

## Risk Assessment Methodology

Figure 1: Risk Assessment Matrix




### Potential Impact of Risk Events Defined

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

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

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

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

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

### Probability of Occurrence of Risk Events Defined

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

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

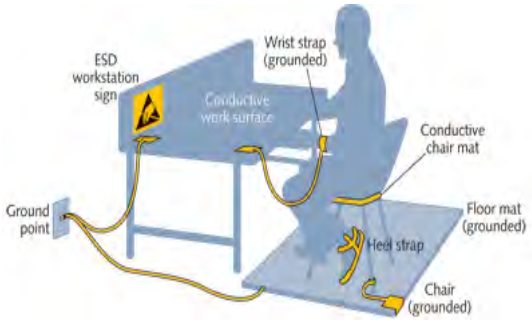
Possible | 3 – Reasonable assumption that this risk may occur

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

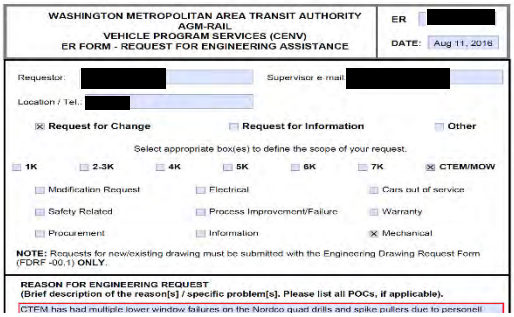
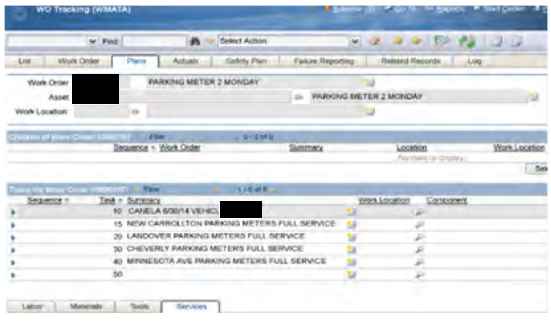
Certain | 5 – Reasonable assumption that this will occur

# APPENDIX B: DEFINITIONS

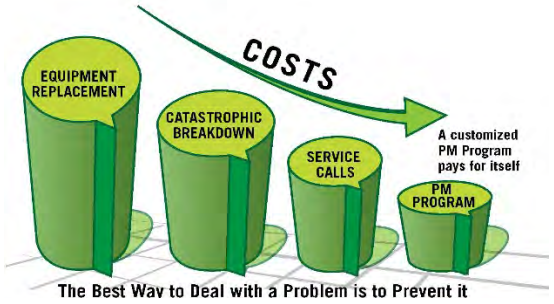
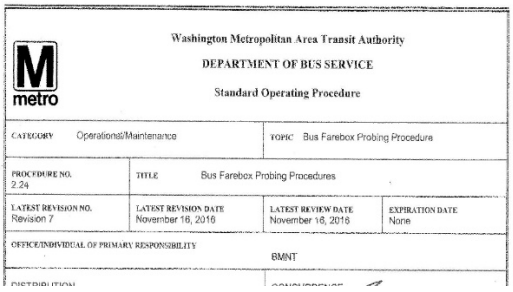
## APPENDIX B: DEFINITIONS

| Definitions | Photos |
|---|---|
| **Coin Validator**<br>A coin validator is a device that determines whether coins are genuine or counterfeit. |  |
| **Corrective Maintenance**<br>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. |  |
| **Electrostatic Discharge (ESD) Protection**<br>Used to prevent the sudden flow of electricity between two electrically charged objects caused by contact, an electrical short, or dielectric breakdown. |  |
| **Engineering Modification Instruction (EMI)**<br>An EMI is a document authorizing and recording design changes throughout the prototyping and life-cycle phases of a part/component. EMI documents a developed by Vehicle Engineering group (CENV). |  |

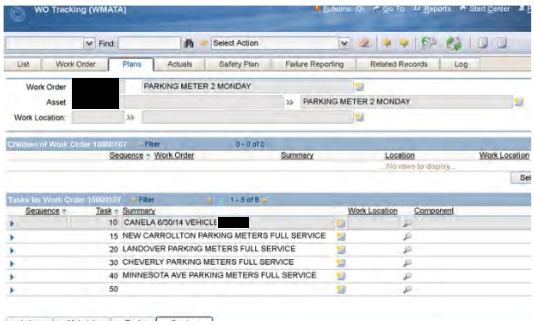
## APPENDIX B: DEFINITIONS

| Definitions | Photos |
|---|---|
| **Engineering Request (ER)**<br>An engineering request (ER) is used to describe a suggested enhancement or problem with a product. An ER initiates the change process, it promotes discussions within the organization to help determine the impact of a change and the best possible solution. |  |
| **Farebox**<br>A farebox is a device used to collect fares and tickets on streetcars, trains and buses upon entry, replacing the need for a separate conductor. Nearly all major metropolitan transit agencies in the United States use a farebox to collect or validate fare payment. |  |
| **Controller Board (Kontron PCB)**<br>The controller board is the computer which controls the functionality of the farebox machine. It includes a microprocessor, disk on chip (a hard drive that stores the operating software for the farebox, as well has additional memory which stores all transaction data). |  |
| **Maximo**<br>Maximo is WMATA's Enterprise Asset Management (EAM) system used for work order, incident, and track defect tracking.<br>Maximo Work Orders (WO) specifies a particular task and the labor, materials, services, and tools required to complete the task. |  |

## APPENDIX B: DEFINITIONS

| Definitions | Photos |
|---|---|
| **Motherboard or Backplane**<br>A Motherboard or backplane is a group of electrical connectors in parallel with each other, so that each pin of each connector is linked to the same relative pin of all the other connectors, forming a computer bus. It is used as a backbone to connect several printed circuit boards together to make up a complete computer system. The logic board and other farebox components gets its power through this backplane. |  |
| **Preventative Maintenance**<br>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. |  |
| **Probing**<br>In order to retrieve the data from the farebox, a service lane technician must use an infrared probe to commence download and upload of information. |  |
| **Standard Operating Procedure (SOP)**<br>Standard Operating Procedures (SOP) delineate responsibilities and procedures for performing certain Metrobus functions. |  |

## APPENDIX B: DEFINITIONS

| Definitions | Photos |
| --- | --- |
| Work Order (WO)<br><br>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. |  |