Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2017

Comprehensive Internal Review:

Capital Program Management and Execution

Metrorail Vehicle Capital Improvement Program **(17)**

Metrorail Power Systems Upgrade Program **(18)**

7000-Series Railcar Acquisition Program **(19)**

Metrorail Radio Infrastructure Replacement Program **(20)**

December 19, 2017

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

QICO INTERNAL REVIEW

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COMPREHENSIVE INTERNAL REVIEW SUMMARY

What is QICO?

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

Purpose of this Review:

- The comprehensive nature of this internal review encompasses four distinct projects underway at WMATA for both rail vehicles and infrastructure improvements; the Metrorail Vehicle Capital Improvement Program, 7000-Series Railcar Acquisition Program, Metrorail Power Systems Upgrade Program, and Metrorail Radio Infrastructure Replacement Program; accounting for the 11th – 14th installments of QICO's 20-part CY2017 internal review. Each of these reviews was conducted in the third and fourth quarters (Q3 & Q4) of calendar year (CY) 2017, and are intended to collectively provide an overall assessment of project management and execution to Metro's senior management to improve future capital program planning.

Methodology:

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

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

Capital Program Management

December 2017

17. Metrorail Vehicle Capital Improvement Program

Key Takeaway: Standardized project management processes that meets the requirements are essential towards successful delivery of projects.

Wins:

- ✓ Comprehensive Quality Management Plan for the 5000 Series HVAC Overhaul, including predefined inspection criteria.
- ✓ Comprehensive Master Program Schedule for the 5000 Series HVAC Overhaul.

Areas for Improvement:

- Effective Quality Management Plan is essential to the quality of project deliverables.
- Comprehensive activity based schedule is essential to timely project delivery.

Required Actions:

- One Project-Specific Required Action has been developed to address the areas for improvement noted above, resulting in one corrective action plan for this review.

18. Metrorail Power Systems Upgrade Program

Key Takeaway: New processes and controls need to be implemented to help improve the successful delivery of an upgraded traction power system.

Wins:

- ✓ Proactive planning of specific work areas has enabled effective resource allocation for the execution of project activities.
- ✓ Project roles and responsibilities are clearly defined and understood by the project team.

Areas for Improvement:

- Consistent inspection reporting standards are required to promote effective communication and accurate accounting of work within the project.

Required Actions:

- One Project-Specific Required Action has been developed to address the areas for improvement noted above, resulting in one corrective action plan for this review.

19. 7000-Series Railcar Acquisition Program

Key Takeaway: Better Coordination with Internal Stakeholders will Improve Long-Term Asset Management of the 7000-Series Railcar and Improve the Next Railcar Procurement.

Wins:

- ✓ Quality management has representation at all stages of manufacturing.
- ✓ The document management system is well organized.
- ✓ Periodic inspection activities are occurring in a timely manner.

Areas for Improvement:

- Establishing policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT) capabilities is essential.
- Timely and through troubleshooting training is required…
- Timely delivery of spare parts is required to address ongoing maintenance issues.

Required Actions:

- Three Project-Specific Required Actions have been developed to address the areas for improvement noted above, resulting in three corrective action plans for this review.

20. Metrorail Radio Infrastructure Replacement Program

Key Takeaway: New processes and controls need to be implemented, both authority-wide and at the project level, to help improve the successful delivery of an upgraded radio system.

Wins:

- ✓ Project adherence to safety briefing requirements prior to field assessments promotes a positive safety culture throughout the team.

Areas for Improvement:

- Identification of clear roles and responsibilities of project personnel is essential.
- Consistent enforcement of design package requirements is essential.
- Consistent acceptance procedures are necessary for effective project delivery.
- Consistent, documented inspections of equipment installation are essential.

Required Actions:

- Three Project-Specific Required Actions have been developed to address the areas for improvement noted above, resulting in three corrective action plans for this review.

Summary of System-Wide Results

Key Takeaway: A formalized framework for capital program management, with system-wide standard requirements and processes, will help improve consistency and effectiveness of Metro's capital program planning and execution.

Areas for Improvement:

- Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.
- Standard project controls for managing cost and schedule will support effective project execution and promote accountability.
- Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability.
- Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution.

Required Actions:

- QICO-CPM-17-01: Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.
- QICO-CPM-17-02: Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.
- QICO-CPM-17-03: Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.
- QICO-CPM-17-04: Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2017

Capital Program Management and Execution

Metrorail Vehicle Capital Improvement Program (17)

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

INTERNAL REVIEW SUMAMRY

November 2017

17. Metrorail Vehicle Capital Improvement Program

Key Takeaway: Standardized project management processes that meets the requirements are essential towards successful delivery of projects.

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the CENV Capital Improvement Program and promote the actions needed to address areas of concern.
- QICO is an internal management function authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- QICO developed relevant review activities by identifying and assessing risks to quality of work, compliance with standards, records management, and safety.
- QICO reviewed the project's governing documentation, observed field personnel performing daily work activities, assessed their conformance to requirements, reviewed records and key documents, and interviewed key personnel
- Review findings and required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale. Each is associated with either project-specific areas, or identified as a systemic issue across capital program management.

Wins and Areas for Improvement:

- ✓ Comprehensive Quality Management Plan for the 5000 Series HVAC Overhaul, including predefined inspection criteria.
- ✓ Comprehensive Master Program Schedule for the 5000 Series HVAC Overhaul.

Project-Specific:

- Effective Quality Management Plan is essential to the completion of project deliverables that meet the required levels of quality.
- Comprehensive activity based schedule is essential to the timely delivery of the project objectives.

Systemic:

- Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.
- Standard project controls for managing cost and schedule will support effective project execution and promote accountability.
- Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability.
- Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution.

Project-Specific Required Actions:

- QICO-CRP-17-01: Establish a requirement to develop a standardized comprehensive Quality Management Plan (QMP) and Project Master Schedule prior to project implementation to ensure the quality and timeliness of work being performed. *(Risk Rating: Elevated)*

System-Wide Required Actions:

- Four System-Wide Required Actions have been developed to address the systemic areas for improvement noted above, resulting in four comprehensive corrective action plans to address each.

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.

17.1. PROJECT OVERVIEW

CENV Capital Improvement Program – 2000, 3000 & 6000 Series Door Spindle | 5000 Series HVAC

The Capital Improvement Programs (CIP's) are a group of capitally funded programs intended to improve the reliability of our cars, enhance safety, and improve our customers riding experience. The CENV group, working closely with the CMNT, QICO and other groups identified specific areas where our vehicles can be improved, making them less expensive to operate and more reliable. Having reliable cars, improves our ability to meet the ridership demands of our customers.

2000, 3000 & 6000 Series Door Spindle Overhaul

The Washington Metropolitan Area Transit Authority (WMATA) required the services of IFE North America to supply Door Spindle Parts and accessories as spares in the inventory of the 2000, 3000 and 6000 series cars. After the required spares and inventory are all delivered and accepted, WMATA then requires the Services of IFE North America to provide the labor and materials to upgrade and modify the door spindles. This involves supplying, delivering and replacing 354 car sets of door spindles (4,248 spindles) of the 2000 and 3000 Cars and 184 car sets of door spindles (2,208 spindles) of the 6000 cars plus the supply of 200 spare spindles overhaul kits. The installation of the new three (3) flute aluminum spindle with maintenance free spindle nut will improve reliability, reduce overhaul cycles, and significantly reduce the amount of labor required for cleaning and greasing at regular Periodic Inspection (PI) intervals.

5000 Series HVAC Overhaul

Failure rates of 5000 series railcars HVAC system have increased dramatically, therefore, Merak proposed a HVAC system overhaul and upgrade to reduce the failure rate and increase the reliability of the HVAC system. Merak is the Original Equipment Manufacturer (OEM) of the 5000 series cars' HVAC Systems and owns the necessary design information and proprietary software to accomplish the requested improvements. The new condenser fan is more efficient compared to the original, 5- bladed, plastic fan. Merak used new condenser coils which contain more fins per inch and required a matched capacity compressor. The new 32.5° fan combined with the more efficient coil will maintain the system capacity at about the same as the original configuration.

The Washington Metropolitan Area Transit Authority (WMATA) required the services of Merak to provide all factors of production, including but not limited to management, safety, quality control, engineering, transportation, labor, equipment, materials and incidentals to refurbish the HVAC system on 80 married pairs of 5000 series railcars. Furthermore, the replacement of select components with upgraded or later generation units within the HVAC system shall be completed.

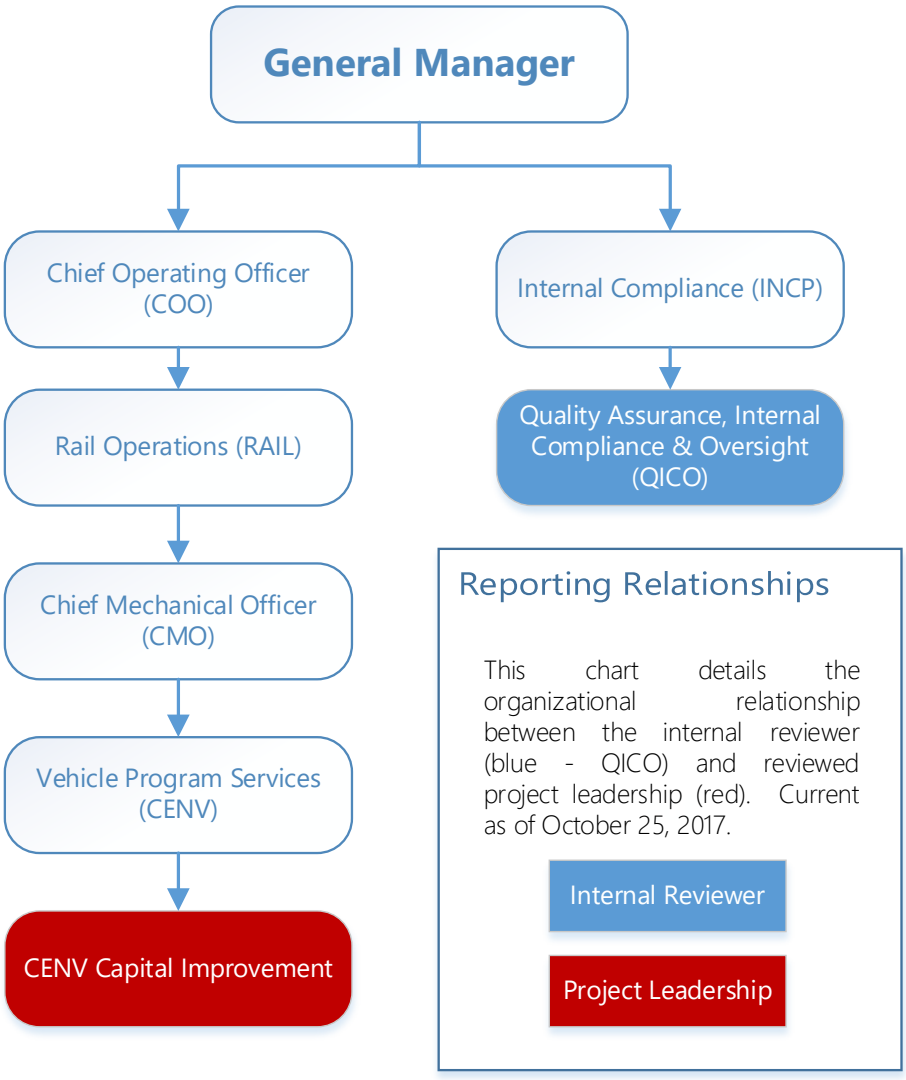
The project has been descoped due to concerns regarding the remaining service life of the 5K fleet, plans to decommission the 5K fleet have accelerated and will be decommissioned in the first quarter of 2018. Thus, it is not fiscally or operationally beneficial to upgrade HVAC equipment on railcars that will shortly be decommissioned.

17.2. REVIEW METHODOLOGY

Internal Review Stakeholders

The Office of Quality, Internal Compliance and Oversight (QICO) conducted an internal review of the CENV Capital Improvement Program, specifically the 2000, 3000 & 6000 Series Door Spindle Overhaul and the 5000 Series HVAC Overhaul. The CENV Capital Improvement Program resides within Office of Vehicle Engineering (CENV), within the Office of Chief Mechanical Officer (CMO), within Rail under the Chief Operating Officer (COO).

As shown below, QICO is separate from the function under review, reporting to the General Manager through Internal Compliance (INCP). QICO provides objective quality assurance and compliance services in order to improve the quality of Metrorail operations, processes, and compliance to regulatory requirements.



QICO observed project management personnel and field personnel performing their duties, interviewed the project manager, and reviewed records and governing procedures. This internal review notes both positive findings (What worked well) and negative findings (Areas of Improvement). The findings are rated based on severity of risk, which ranges from 'Insignificant' to 'High', and associated with project-specific areas and systemic issues. The resulting Required Actions summarize the steps actions owners must take to address deficiencies.

REVIEW SCOPE	
Category	Description
Review of Existing Documentation	- 2000, 3000 & 6000 Series Door Spindle: o Conformed Contract – FQ15170. o Project Management Plan – 2K3K6K Spindle Upgrade – 20160209 Rev. 01. o Knorr Brake Company Proposed Schedule – FQ15170. o CENV Approved Work Instruction – EMI 150145 Rev. 01. o CENV Approved Work Instruction – EMI 180453 Rev. 01. o CENV Approved Work Instruction – ETR-ETP 180324 Rev. 01. o CENV Approved Work Instruction – MSI 180266 Rev. 01. o Inspection Records – Sample of Spindle Removal Check Sheet. - 5000 Series HVAC Overhaul: o Conformed Contract – RFP FQ16064_LP. o Contract Modification – FQ16064 Modification 001. o Contract Modification – FQ16064 Modification 002. o Contract Modification – FQ16064 Modification 003. o Quality Management Plan – MN-WM-FQ16064-007. o Project Management Plan – TA37391-831-00 o Master Program Schedule - TA37391-800-00 o Merak QMP TA37391_830_01. o CENV Approved Work Instruction – EMI 160283 Rev. 00. o CENV Approved Work Instruction – ETR-ETP 160092 Rev. 02. o Request to Office of Procurement (PRMT) to cancel option 2 – FQ16064. o HVAC cancel Letter to Merak – June 30, 2017. o Reply to WMATA, Notice of Partial Termination - FQ16064.
Interviews of Key Personnel	- Project Manager – [redacted]

17.3. WHAT WORKED WELL

Measure	Finding	Description
Quality Management	Comprehensive Quality Management Plan for the 5000 Series HVAC Overhaul, including predefined inspection criteria.	- A comprehensive Quality Management Plan was developed by the contractor (Merak), reflecting the quality organization, assembly inspection and testing, on-site inspection, etc. - Comprehensive inspection and testing records against a pre-set inspection and testing criteria.
Time Management	Comprehensive Master Program Schedule for the 5000 Series HVAC Overhaul.	- Activities based detailed schedule were created by the contractor (Merak), reflecting the timing of each activity and the relationship between activities in a visual manner (Gantt Chart).

17.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Quality Management	F-CRP-17-01: Effective Quality Management Plan is essential to ensure project deliverables are met with the required levels of quality. Service Delivery Elevated (4,4)	- While detailed inspection records exist for the 2000, 3000 & 6000 Series Door Spindle Overhaul, it lacks a comprehensive Quality Management Plan. Recommendation: Establish a requirement for a standardized comprehensive Quality Management Plan prior to project implementation to ensure the quality of work being performed.
Time Management	F-CRP-17-02: Comprehensive activity based schedule is essential to ensure timely delivery of the project objectives. Service Delivery Elevated (4,4)	- While a project schedule exists for the 2000, 3000 & 6000 Series Door Spindle Overhaul, it's not detailed enough to allow sufficient review and control of the project activities to promote timely delivery. Recommendation: Establish a requirement for a standardized comprehensive Project Master Schedule prior to project implementation to ensure timely project deliverables.

17.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Scope Management	F-CPM-17-01: Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals. *Strategic* *Elevated (4,4)*	Plan Development - Capital program planning is not constrained to available funding due to the annual appropriation process, where funds are approved by jurisdictions each year without adequate consideration of ongoing long-term project needs. - QICO did not observe a regimented process for inclusion of scope or projects in WMATA's capital plan. - QICO did not observe a detailed, long-term overhaul capital program that reflects the overhauling requirements for the existing fleet, driven by reliability, CMNT and CENV inputs. Capital Program and Asset Condition Targets - Accounting for past performance of assets and equipment is fundamental to the effective planning of specifications and scope for future improvement projects. Recommendation: Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.

17.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Time and Cost Management	F-CPM-17-02: Standard project controls for managing cost and schedule will support effective project execution and promote accountability. *Strategic* *Elevated (4.3)*	**Cost Controls** - Project budgets are based on estimated expenditures and approved on an annual basis, regardless of the projected duration of each project. Without stable multi-year funding allocation for long-term projects, developing effective cost control and expenditure strategies is problematic. - Project personnel indicated that future funding for projects is not guaranteed, based on current appropriation processes Metro is subject to, presenting barriers to effective activity planning and execution from year-to-year. - While overall project costs were tracked by project managers, there was limited tracking of costs by type (i.e. hard vs. soft costs), limiting the ability to analyze cost trends over time for future activity planning. - Capital program staff indicated that the standard budget contingency was 5% for greenfield projects and 7.5% for rehabilitation projects, but that the contingency level remained the same throughout the life of the project. Industry standards call for increased contingency levels at earlier project development stages. - Project management indicated that cost control is tracked and controlled on a project-by-project basis, where each project implements their own strategies to manage project costs, without an overall standard of control. This has the potential to generate inconsistent results from project to project. **Schedule Controls** - QICO did not observe establishment of standard schedule milestones for tracking project schedules. - Project schedules observed by QICO were not signed by the project manager. - Regular review of project schedules (monthly/quarterly/etc.) was not observed, limiting the ability to account for changing priorities or unforeseen issues. - QICO did not observe any schedule contingency standards. **Performance Standards** - QICO did not observe performance standards in-place to track the effectiveness of projects, regarding adherence to schedule or cost projections; i.e. no observable measurement of planned versus actual. - Performance Management staff indicated that Capital Program performance measures were lacking relative to other departments at WMATA. **Recommendation:** Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.

17.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Communications Management	F-CPM-17-03: Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability. *Strategic* *Elevated (4.3)*	- QICO did not observe any standard reporting practices for WMATA capital projects. - Project Managers indicated that reports provided to their management were developed on their own, in the absence of standard processes. - Without consistent and standardized reporting mechanisms for progress, spending, and overall status, assessing the performance of projects from one to the next is not practicable. **Recommendation:** Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.
Integration Management	F-CPM-17-04: Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution. *Strategic* *Elevated (4.3)*	Ineffective Planning - Inadequate planning evident through the overhauling of the 5000 series cars that will be decommissioned starting from 2018. - According to the 2015 Rail Fleet Management Plan, the 5000 car series will start being decommissioned at 2018, leading to the project being de-scoped, rendering a loss of current parts inventory allocated for use in the overall program. This reflects inadequate project integration management and planning. - Multiple departments are responsible for the development of project plans, selection of projects, and various stages of approval (operational, business needs, financial, etc.), without standardized interfaces or protocols to govern the capital program planning process. - Although organizational controls are in-place to govern financial authorization and monitoring of projects, there are inconsistent methods applied to initiating and monitoring projects based on performance data or other indicators, varying from project-to-project and department-to-department. - Inconsistent grouping of projects and programs inhibits effective management and monitoring of departmental project portfolios, where some projects overlap departmental authorities or functional areas. - Consistent interdepartmental coordination in capital program planning will improve project selection and portfolio development, producing a more effective capital program. Projects vs Programs - QICO did not observe an enterprise-wide standard for distinguishing capital "projects" from ongoing capital "programs". **Recommendation**: Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

17.6. PROJECT-SPECIFIC REQUIRED ACTIONS

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

Refer to Appendix A: Risk Assessment for further details

Required Action	Finding		Owner
QICO-CRP-17-01: Establish a requirement to develop a standardized comprehensive Quality Management Plan (QMP) and Project Master Schedule prior to project implementation to ensure the quality and timeliness of work being performed. Elevated	F-CRP-17-01	Effective Quality Management Plan is essential to ensure project deliverables are met with the required levels of quality.	CENV
	F-CRP-17-02	Comprehensive activity based schedule is essential to ensure timely delivery of the project objectives.	CENV

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

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2017

Capital Program Management and Execution

Metrorail Power System Upgrade Program (18)

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

INTERNAL REVIEW SUMMARY

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the Power Systems Upgrade Program specifically the 100% 8-Car Train project's performance of assigned duties and promote the actions needed to address areas of concern.
- QICO is an internal management function authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- QICO developed relevant review activities by identifying and assessing risks to quality of work, compliance with standards, records management, and safety.
- QICO reviewed the project's governing documentation, observed field personnel performing daily work activities, assessed their conformance to requirements, reviewed records and key documents, and interviewed key personnel
- Review findings and required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale. Each is associated with either project-specific areas, or identified as a systemic issue across capital program management.

November 2017

18. Metrorail Power Systems Upgrade Program

Key Takeaway: New processes and controls need to be implemented to help improve the successful delivery of an upgraded traction power system.

Wins and Areas for Improvement:

- ✓ Proactive planning of specific work areas has enabled effective resource allocation for the execution of project activities.
- ✓ Project roles and responsibilities are clearly defined and understood by the project team.

Project-Specific:

- Consistent inspection reporting standards are required to promote effective communication and accurate accounting of work within the project.

Systemic:

- Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.
- Standard project controls for managing cost and schedule will support effective project execution and promote accountability.
- Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability.
- Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution.

Project-Specific Required Actions:

- QICO-PSUP-17-01: Standardize requirements for project inspection reports, including frequency and content, and define methods to measure project performance in accordance with these requirements. *(Risk Rating: Moderate)*

System-Wide Required Actions:

- Four System-Wide Required Actions have been developed to address the systemic areas for improvement noted above, resulting in four comprehensive corrective action plans to address each.

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.

18.1. PROJECT OVERVIEW

100% 8-Car Train Project

The 100% 8-Car Train Project involves major upgrades to Metrorail's traction power system to allow Metrorail to operate every train as an eight-car (maximum) consist; the system currently operates as a mixture of six-car and eight-car consists during peak periods. The project involves replacing approximately half of Metrorail's Traction Power Substations (TPSS), Tie Breaker Stations (TBS), and high-current Automatic Train Control (ATC) bonds with higher capacity components. The initial planning began in 2001. Construction is ongoing, and upgrades to power systems on the Orange and Blue Lines are scheduled to be complete by 2021. Funding remains to be secured for upgrades to the rest of the system.

For each location, WMATA engineers designed and specified the requirements for replacing existing equipment and adding new capacity. WMATA has engaged multiple contractors to manufacture, supply, and install new equipment at different locations through open and competitive procurement processes.

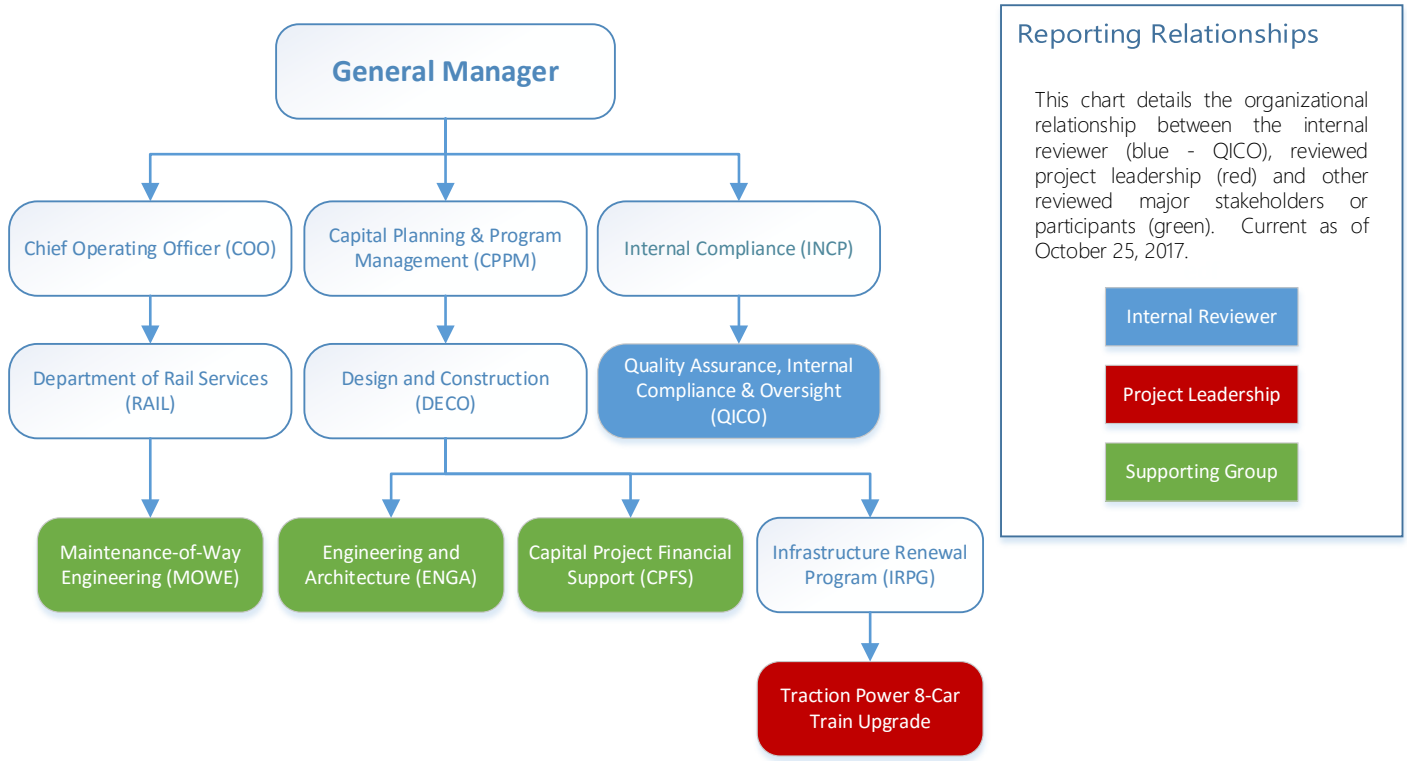
During this internal review, the project was focused on the execution of a contract to upgrade six TBS stations along the Orange and Blue Lines. At the time of this report, three of the substations have been accepted as substantially complete, two are actively under construction, and the last one was scheduled to start outside of the period of this review. QICO observed two of the three completed installations of the TBS.

This project is part of a larger program to upgrade and maintain Metrorail power assets. The larger program includes the Traction Power State of Good Repair, AC [Alternating Current] State of Good Repair, and DC [Direct Current] State of Good Repair programs.

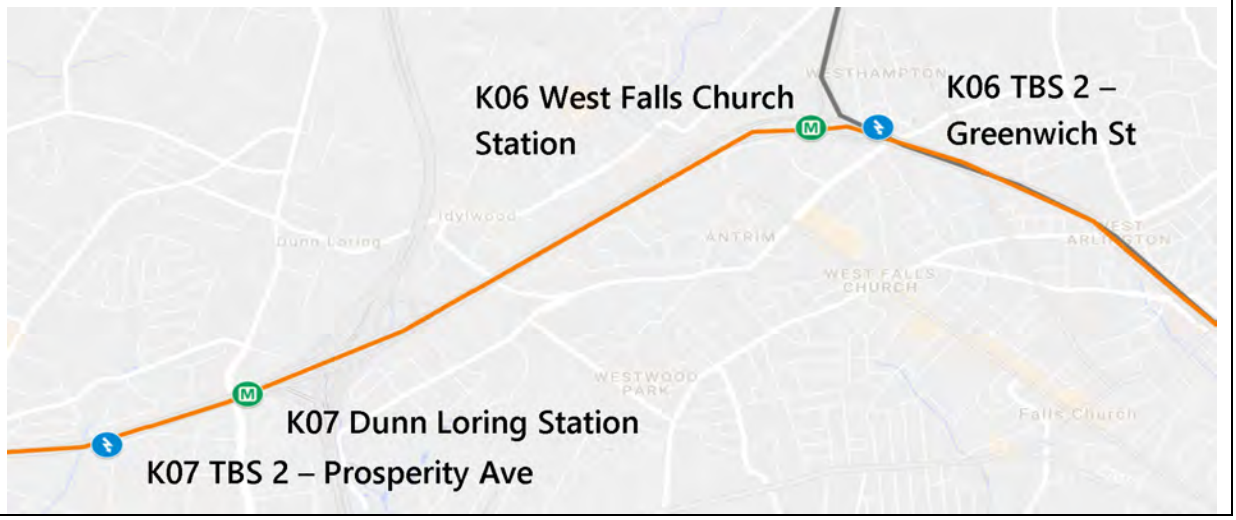
18.2. REVIEW METHODOLOGY

Internal Review Stakeholders

The Office of **Quality, Internal Compliance and Oversight (QICO)** conducted an internal review of the **100% 8-Car Train Project.** This resides within WMATA's Department of Capital Planning & Program Management Delivery (CPPM). As shown below, QICO is separate from operations and capital functions, reporting directly to the General Manager.



QICO observed project management personnel 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', and associated with project-specific areas and systemic issues. The resulting Required Actions summarize the steps actions owners must take to address deficiencies.

REVIEW SCOPE	
Category	**Description**
Review of Existing Documentation	- CIP0076 Project Work Plan - CIP0076 Project Forecasts, April 2017 – August 2017 - FQ15237R/GG Six (6) Tie Breaker Station Upgrades Orange and Blue Lines VA, MD, and DC Conformed Contract - FQ17165/WJG Blue Line Rail Power Systems Upgrades Invitation for Bid documents - FQ15237R Project Specific Quality Management Plan - FQ17165 Project Specific Quality Management Plan - Clark Construction Group Quality Control Plan - FQ15327R Contractor Daily Reports, Dec 2016 – October 2017 - FQ15237R WMATA Inspector Reports, June 2017 – October 2017 - MSRPH Temporary Orders T-17-08 and T-17-10 - 11-FQ10061-ENSS-01 Service Evaluation Study Load Flow Report, Vol 1 & 2 (Systra Report)
Interviews of Key Personnel	Senior Management Level - Acting CPFS Manger [redacted] - IRPG Systems [redacted] - CPMO [redacted] - OMBS [redacted] - OMBS Senior Financial Officer [redacted] - ENGA [redacted]) - PLAN [redacted] - PRMT [redacted] - CPO [redacted] Project Level Staff - Program Manager ([redacted] - Assistant Project Manager [redacted] - Construction Engineers ([redacted]) - Construction Inspection Facilitator ([redacted]) - Power Engineering Director ([redacted]) - Traction Power Maintenance [redacted]
Field Assessments	- K06 Tie Breaker Station – Greenwich St - K07 Tie Breaker Station – Prosperity Ave
	

18.3. WHAT WORKED WELL

Measure	Finding	Description
Risk Management	Proactive planning of specific work areas has enabled effective resource allocation for the execution of project activities.	- The Project Management team pursued the establishment of temporary orders to document the coordination and understanding of contractor access to work site by RAIL and SAFE.
Human Resources Management	Project roles and responsibilities are clearly defined and understood by the project team.	- The project provided an organization chart and responsibilities for the project team. Members of the project team were aware of the each person's responsibilities.

18.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Quality Management	F-PSUP-17-01: Consistent inspection reporting standards are required to ensure effective communication and accurate accounting of work within the project. *Service Delivery* *Moderate (3,3)*	- Each WMATA inspector prepares a slightly different inspection report as an email. - The content of the emails vary, at times indicating attachments but attachments are not always present, for example Sign-in sheets. - WMATA has an inspection manual and checklist, but it does not cover all of the construction disciplines. - This project has a construction manager, but he does not report to an entity outside the project manager's chain of command. **Recommendation:** Standardize requirements for project inspection reports, including frequency and content, and define methods to measure project performance in accordance with these requirements.

18.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Scope Management	F-CPM-17-01: Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals. *Strategic Elevate (4.4)*	Plan Development - The project scope was identified through an engineering study of the traction power system to determine the incremental system-wide changes needed to provide 100% 8-Car train operation with two minute headways, provided to WMATA in September 2012. This report identified the replacement of contact rail as the second highest priority. - QICO reviewed the engineering report in comparison with the project scope and observed the contact rail was not included. - QICO observed that some of the scope items from FQ15237R had been installed by the Office of Traction Power Maintenance (TRPM) prior to advertising the contract. - Capital program planning is not constrained to available funding due to the annual appropriation process, where funds are approved by jurisdictions each year without adequate consideration of ongoing long-term project needs. - QICO did not observe a regimented process for inclusion of scope or projects in WMATA's capital plan. Capital Program and Asset Condition Targets - QICO observed that project scope was not based on a condition rating of traction power system. The project team indicated that all the information about scope was derived from the September 2012 engineering study, which did not take into account average age of system components at the end of the project. - QICO confirmed with project management staff that performance and asset management measures such as condition of power system or average age of track, have not been developed. - Accounting for past performance of assets and equipment is fundamental to the effective planning of specifications and scope for future improvement projects **Recommendation:** Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.

18.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Time and Cost Management	F-CPM-17-02: Standard project controls for managing cost and schedule will support effective project execution and promote accountability. *Strategic* *Elevated (4.3)*	Cost Controls - Project budgets are based on estimated expenditures and approved on an annual basis, regardless of the projected duration of each project. Without stable multi-year funding allocation for long-term projects, developing effective cost control and expenditure strategies is problematic. - Project personnel indicated that future funding for projects is not guaranteed, based on current appropriation processes Metro is subject to, presenting barriers to effective activity planning and execution from year-to-year. - While overall project costs were tracked by project managers, there was limited tracking of costs by type (i.e. hard vs. soft costs), limiting the ability to analyze cost trends over time for future activity planning. - Capital program staff indicated that the standard budget contingency was 5% for greenfield projects and 7.5% for rehabilitation projects, but that the contingency level remained the same throughout the life of the project. Industry standards call for increased contingency levels at earlier project development stages. - Project management indicated that cost control is tracked and controlled on a project-by-project basis, where each project implements their own strategies to manage project costs, without an overall standard of control. This has the potential to generate inconsistent results from project to project. Schedule Controls - QICO observed a project schedule that did not include the following: schedule contingency; closeout and other standard milestones; and a signature from the project manager. - Standardized schedule milestones variance tracking for project schedules was not observed. - Regular review of project schedules (monthly/quarterly/etc.) was not observed, limiting the ability to account for changing priorities or unforeseen issues. - QICO did not observe any schedule contingency standards. - Performance Standards QICO did not observe performance standards in-place to track the effectiveness of projects, regarding adherence to schedule or cost projections; i.e. no observable measurement of planned versus actual. - Performance Management staff indicated that Capital Program performance measures were lacking relative to other departments at WMATA. **Recommendation:** Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.

18.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Communications Management	F-CPM-17-03: Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability. *Strategic* *Elevated (4.3)*	- The project team prepares a monthly project report for review by their management team. o The reports provide details on contract deliverables and note if the project is on schedule without reference to a baseline. - QICO did not observe any standard reporting practices for capital projects. - Project Managers indicated that reports provided to their management were developed on their own, in the absence of standard processes. - Without consistent and standardized reporting mechanisms for progress, spending, and overall status, assessing the performance of projects from one to the next is not practicable. **Recommendation:** Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.
Integration Management	F-CPM-17-04: Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution. *Strategic* *Elevated (4.3)*	Ineffective Planning - Multiple departments are responsible for the development of project plans, selection of projects, and various stages of approval (operational, business needs, financial, etc.), without standardized interfaces or protocols to govern the capital program planning process. - Although organizational controls are in-place to govern financial authorization and monitoring of projects, there are inconsistent methods applied to initiating and monitoring projects based on performance data or other indicators, varying from project-to-project and department-to-department. - Inconsistent grouping of projects and programs inhibits effective management and monitoring of departmental project portfolios, where some projects overlap departmental authorities or functional areas. - Consistent interdepartmental coordination in capital program planning will improve project selection and portfolio development, producing a more effective capital program. Projects vs Programs - QICO did not observe an enterprise-wide standard for distinguishing capital "projects" from ongoing capital "programs". **Recommendation:** Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

18.6. PROJECT-SPECIFIC REQUIRED ACTIONS

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

Refer to Appendix A: Risk Assessment for further details

Required Action	Finding		Owner
QICO-PSUP-17-01 Standardize requirements for project inspection reports, including frequency and content, and define methods to measure project performance in accordance with these requirements. Moderate	F-PSUP-17-01	Consistent inspection reporting standards are required to ensure effective communication and accurate accounting of work within the project.	IRPG

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

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2017

Capital Program Management and Execution

7000-Series Railcar Acquisition Program (19)

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

INTERNAL REVIEW SUMMARY

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the 7000-Series Railcar Project's performance of assigned duties and promote the actions needed to address areas of concern.
- QICO is an internal management function authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- QICO developed relevant review activities by identifying and assessing risks to quality of work, compliance with standards, and records management.
- QICO reviewed the project's governing documentation, observed field personnel performing daily work activities, assessed their conformance to requirements, reviewed records and key documents, and interviewed key personnel.
- Review findings and required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale. Each is associated with either project-specific areas, or identified as a systemic issue across capital program management.

19. 7000-Series Railcar Acquisition Program

Key Takeaway: Better coordination with internal stakeholders will improve long-term asset management of the 7000-series railcar and improve the next railcar procurement.

Wins and Areas for Improvement:

- ✓ Project personnel demonstrated effective contractor management.
- ✓ Railcar commissioning rate is meeting or exceeding goals.
- ✓ Quality management has representation at all stages of manufacturing.
- ✓ The document management system is well organized.
- ✓ Periodic inspection activities are occurring in a timely manner.

Project-Specific:

- Establishing policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT) capabilities is essential to fully take advantage of the 7000-series maintenance architecture.
- Timely and thorough training is required for proper maintenance of railcars.
- Timely delivery of spare parts is required to address ongoing maintenance issues.

Systemic:

- Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.
- Standard project controls for managing cost and schedule will support effective project execution and promote accountability.
- Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability.
- Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution.

Project-Specific Required Actions:

- QICO-7K-17-01: Establish policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT).
- QICO-7K-17-02: Establish a comprehensive strategy for training for maintenance techs and engineers – one that includes training on the use of on-board vehicle diagnostics and on-the-job training (OJT) from Kawasaki.
- QICO-7K-17-03: Establish a process to ensure spare parts are available in sufficient quantities for the 7000-series railcar fleet, for everything that is under warranty or not covered by warranty. In addition, in future railcar acquisitions, include spare parts in each of the contract options.

System-Wide Required Actions:

- Four System-Wide Required Actions have been developed to address the systemic areas for improvement noted above, resulting in four comprehensive corrective action plans to address each.

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.

19.1. PROJECT OVERVIEW

Introduction

WMATA's 7000-Series Railcar Acquisition Project is an effort to procure 748 new revenue railcars for the Metrorail system. When completed, the 7000-series railcar will make up more than half of Metro's rolling stock; the Authority is removing from service and decommissioning 400 of the oldest, least reliable, and poorest performing railcars in the system (1000 and 4000-series), with plans to decommission the 5000-series (an additional 192 in-service vehicles).

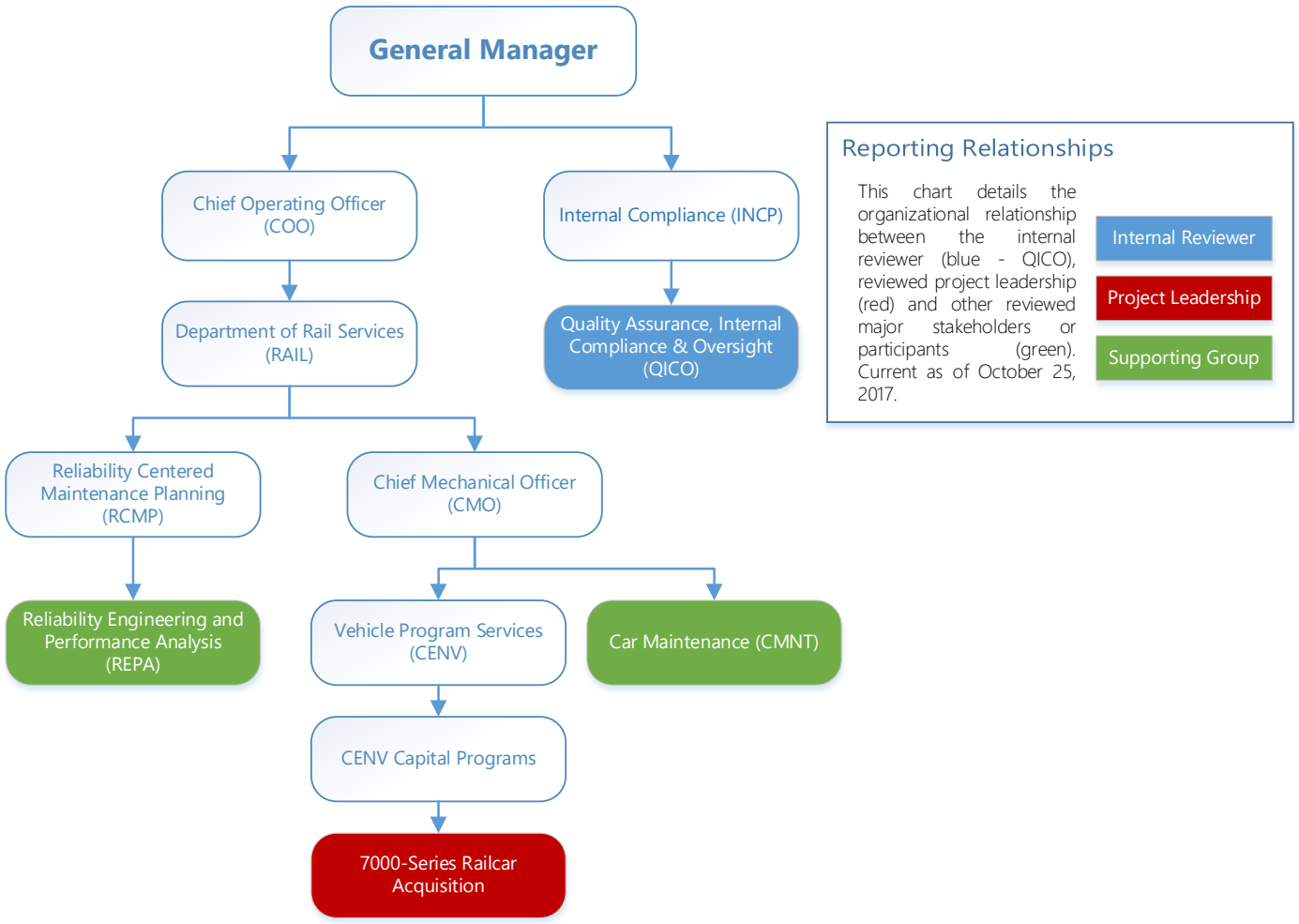
The 7000-Series Railcar Project has been in progress since 2007, proceeding through conceptual, bidding, design, and pilot testing phases. At the time of this internal review, the 7000-Series Railcar Project is in the manufacturing, delivery and commissioning phase, with upwards of 20 railcars per month being delivered to WMATA's Greenbelt Yard and conditionally accepted for revenue use; the older 7000-series railcars are exiting the warranty period on key components. Key project management personnel, including the project manager and quality manager, have changed within the past three years. For more introductory information on the project, see 7000-Series Railcar Project Overview.

The intention of this internal review is to provide an objective evaluation of the 7000-Series Railcar Project, comparing the project management to best practices recommended by the FTA, and identifying potential risks to the Authority with regards to project management, quality, engineering, and other externalities that will affect the long-term performance of the newly acquired railcars. The report identifies positive project outcomes and areas of improvement (requiring corrective action), with the intention of improving current management of the project as well as providing lessons learned for future acquisitions of rolling stock at WMATA (e.g. 8000-series).

19.2. REVIEW METHODOLOGY

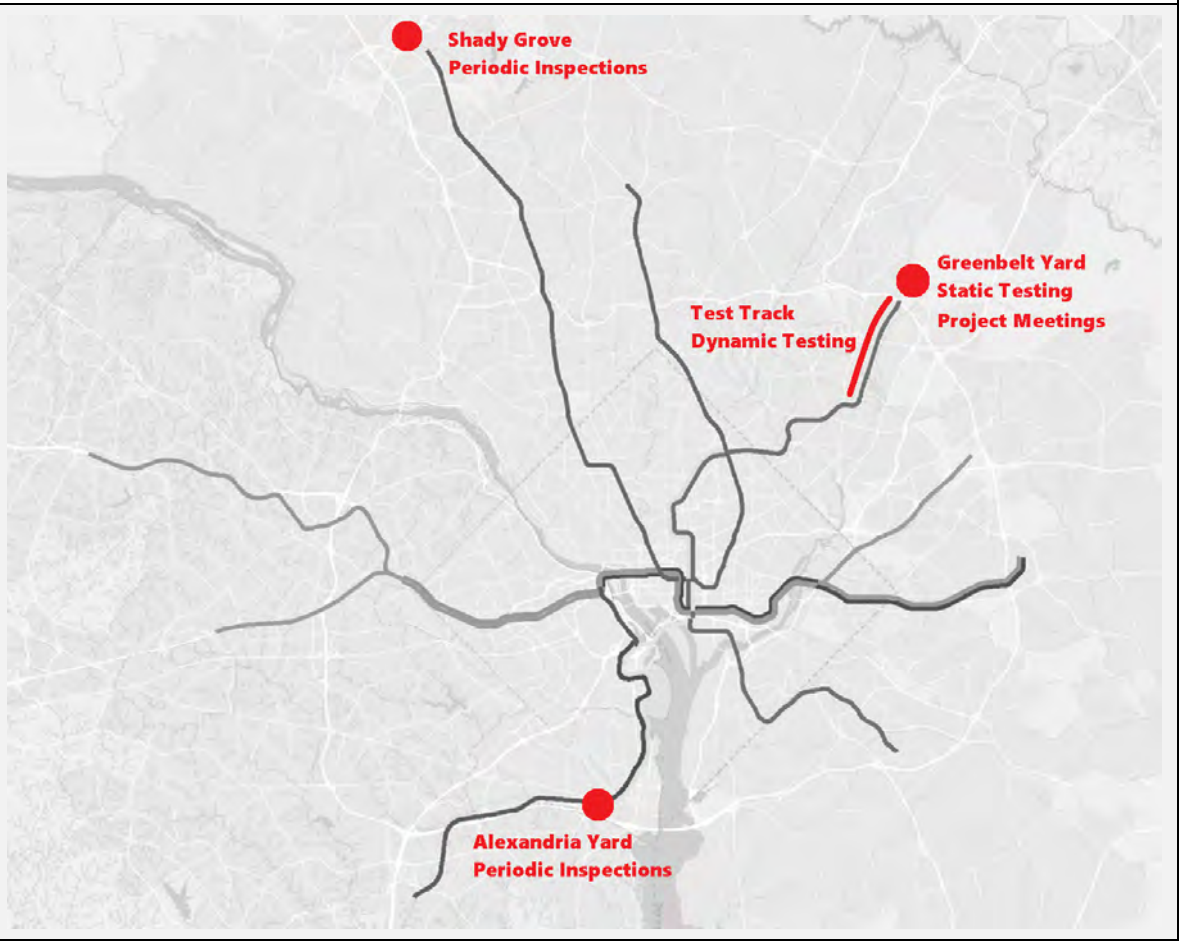
Internal Review Stakeholders

The 7000-Series Railcar Project is managed through a group within WMATA's vehicle program services office (CENV), which has a reporting chain through the Chief Operating Officer (COO) to the General Manager. Quality Assurance, Internal Compliance and Oversight (QICO) is separate from this chain of command. For more information, see 7000-Series Railcar Project Overview. The review period was from September 15 – October 18, 2017.



QICO observed project personnel performing their duties, interviewed key stakeholders, 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', and associated with project-specific areas and systemic issues (see Appendix A: Risk Assessment). The resulting Required Actions summarize the steps actions owners must take to address deficiencies.

REVIEW SCOPE	
Category	Description
Review of Existing Documentation	7000-Series Railcar Project Management Plan (PMP) 7000-Series Railcar Quality Assurance Program Plan (QAPP) 7000-Series Railcar Technical Specification and Special Provisions to the Contract
Interviews of Key Personnel	[redacted] Senior Program Manager, [redacted] Project Manager, [redacted] Quality Assurance Manager, [redacted] Project and Vehicle Engineers (CENV and LTK) Reliability Engineers (REPA) [redacted], Car Maintenance (CMNT) [redacted] Servicing & Inspection (S&I), Shady Grove Yard (CMNT)
Field Observations	Field Observations Conducted in October 2017 Routine Acceptance Testing (RAT) for one 7000-series quad (7424-7427) Periodic Inspections at Shady Grove Service and Inspection (S&I) and Alexandria Yard S&I Warranty, Commissioning, and Reliability Meetings



19.3. WHAT WORKED WELL

Measure	Finding	Description
Human Resource Management	During the review period, project personnel provided effective contractor management.	- The internal review team shadowed several weekly project meetings for failure reporting, commissioning, and warranty. WMATA representation from engineering (CENV), reliability (REPA), and quality (QICO rolling stock) were observed diligently reviewing contractor claims with regards to open items, warranty claims and 7000-series failures during mainline operation. Personnel were in general well versed in contract requirements.
Time Management	Rail vehicles are being delivered and commissioned at or above the goal of 16 per month.	- Since May 2016, WMATA has met commissioning goals of 16 railcars per month, accepting up to 20 railcars (May 2017 was an exception). As of October 2017, more than 400 of the 748 railcars have been delivered, and the project is on track to commission all railcars in the order by 2019. - The number of days required to commission each married pair has remained relatively stable (between 20 – 28 days) since June 2016. Before that time, commissioning was volatile and took 40-80 days. The introduction of a dedicated commissioning facility and test track has made the process easier, as dynamic testing can be conducted with minimal disruption during the day. - Railcar availability during the internal review period (spot checked through Maximo) has been above 85%.
Quality Management	In contrast to previous WMATA railcar acquisitions, quality and warranty management have a larger role.	- QICO shadowed static and dynamic testing of a 7000-series quad ([redacted]), attended quality and warranty meetings, and interviewed members of the quality team. - In contrast to WMATA's previous railcar procurements (1000 through 6000), members of the quality team are present at all major stages of railcar production (Kobe Japan, Lincoln Nebraska, and Greenbelt Maryland). The quality team manages a list of open items for each car, and reserves the right to delay conditional acceptance of cars. - Warranty as outlined in the contract is sufficient. As detailed within the special provisions to the 7000-series contract, the warranty period (starting on a per-car basis after conditional acceptance) is 10 years for the carbody/truck, five years for axles/bearings, six years for traction motors, three years for the propulsion system, and two years on remaining elements. A one-year extension is provided consecutive to the two year warranty, with 24/7 on-site technical assistance and troubleshooting support. In the event of a fleet failure (5%), the warranty period is two years from the completion on the work on the last railcar. - Warranty items are identified and tracked daily. Trends are identified and discussed weekly, and containment actions are implemented while engineering solutions/corrective actions are developed.

19.3. WHAT WORKED WELL

Measure	Finding	Description
Records Management	Project documents are well arranged in the Document Management System (Windchill).	- The 7000 series Project Management Plan (PMP) dictates, "*an integrated and tracked Document Control System (DCS) will be used to improve the efficiency and reduce the costs and complication associated with managing the large quality of documents in the project office.*" - QICO accessed 7000-series documentation in Windchill. Documents were well organized, including the Engineering Open Item List, EMI/FMIs, manuals, car history books, and drawings. The Contract Data Requirements List (CDRL) has been updated consistently, with a revision stored for each month. - There were detailed process flow charts for handling correspondence from contractors.
Stakeholder Management	Periodic inspections on the active 7000-series fleet are occurring in a timely manner.	- QICO shadowed periodic inspections of 7000-series railcars at Shady Grove and Alexandria Yard Service & Inspection (S&I) Shops. Mechanics in WMATA's Car Maintenance (CMNT) group conducted the periodic inspections, with help provided by Kawasaki representatives (now present at all S&I shops). - Car Maintenance (CMNT) keeps hard copies and electronic copies of the A, B, C and Y inspection manuals available at the shop for all technicians. Rev. 1, dated 6/9/2017 was the release currently being followed at the Shady Grove facility. The manuals define the tasks associated with each type of inspection. - The process for generating and closing work orders for the 7000-series railcars appears to be effective and efficient. If the results indicate a warranty item, a work order is generated and the discrepancy is emailed to the car builder (KRC). - Maximo documentation of the preventative maintenance inspection included issues encountered during inspection, warranty items, and measurements of key variables (e.g. wheel diameter) stored as variables (not just free text).
Human Resource Management	Project managers interviewed generally embrace modern principles of project management.	- QICO interviewed a number of project managers at WMATA as well as a number of WMATA capital oversight staff. - QICO observed a genuine desire on the part of project managers and many of their support staff to embrace the principles of project management. Several were trained or certified as project managers. - With the principles of project management being relatively new to government agencies, the level of interest in and education in project management at WMATA is strong.

19.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Integration Management	F-7K-17-01: Establishing policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT) capabilities is essential to fully taking advantage of the 7000-series maintenance architecture. *Strategic* *Moderate (3,3)*	- Train-to-Wayside-Data Transfer (TWDT) is a framework for transferring data wirelessly from the 7000-series railcars (through a rooftop antenna) to Authority systems. The data transfer would take place at WMATA rail yards and passenger stations. - TWDT presents major opportunities to improve predictive maintenance and general asset management capabilities through reducing manpower to fetch data off cars and updating mileage, car status, and emergency information seamlessly into Maximo. It would also streamline the process of pushing certain software updates to the cars. - While wireless internet has been set up at all rail yards and some passenger stations, the system is not ready to be utilized. Software is to be updated across the entire fleet in November 2017; however, QICO has seen no evidence that the policies and procedures for what data is to be uploaded, who owns the data and where the data is to be stored. **Recommendation:** Establish policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT).
Stakeholder Management	F-7K-17-02: Timely and thorough training is required in order to ensure railcars are properly maintained. *Strategic* *Moderate (3,3)*	- 7000-series railcar periodic inspections typically take longer than other rail vehicles. This is primarily due to married-pair power isolation concerns, which require tests to be conducted one at a time. Problems or faults in one step can delay the subsequent steps; troubleshooting requires analyzing data from the on-board vehicle diagnostics system. During the warranty period, Kawasaki mechanics and engineers are available at all service and inspection locations to perform any troubleshooting requiring analysis of the VMDS data. - The Authority provides training in the form of 7000-series familiarization courses and operator training, but advanced diagnostics are not covered. Thus, mechanics have mostly learned from on-the-job training (OJT). - Some of the mechanics interviewed during QICO's shadowing of periodic maintenance inspections had not completed 7000-series familiarization training. - Major manuals are still in draft status, which is preventing WMATA's training department from advancing curriculums. - Some of the training that was provided on the railcar was given prior to major revenue operations of the 7000-series, limiting the effectiveness of the training. **Recommendation:** Establish a comprehensive strategy for training for maintenance techs and engineers – one that includes training on the use of on-board vehicle diagnostics and on-the-job training (OJT) from Kawasaki.

19.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Stakeholder Management	F-7K-17-03: Timely delivery of spare parts is required to address ongoing maintenance issues. *Service Delivery Moderate (3,3)*	- The Authority required the contractor to deliver a spare parts provisioning plan to provide that sufficient spare parts are on-hand for preventative maintenance and warranty requirements. In addition, the contractor was responsible for providing a Recommended Spare Parts List in a format that can be directly imported into Maximo, from which the project's contracting officer can order as he determines is necessary. - Spare parts for 7000-series maintenance activities (after entering revenue service) have not been arriving in a timely manner to the property, and spare part lists were not delivered until recently in a format that could be incorporated into the Authority's maintenance management system (Maximo). - For example, 7000-series railcar [redacted] incurred foreign object damage to the truck several months prior to the internal review. As of October 25, 2017, the railcar has not been reintroduced into service, partially because of the unavailability of a spare truck. - As stated in the special provisions, spare parts (consumable, replacement, repairable, and overhaul parts) quantities are based on the parts necessary to maintain 16 quad-units (64 railcars). Capital spare parts were not included as part of the contract options, which account for the vast majority of the railcars produced. It is more advantageous to the Authority in the long term to procure the spare parts up-front while manufacturing, than determining the spare parts purchases as future maintenance expenses under separate contracts. Recommendation: Establish a process to ensure spare parts are available in sufficient quantities for the 7000-series railcar fleet, for everything that is under warranty or not covered by warranty. In addition, in future railcar acquisitions, include spare parts for each of the options.

19.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Scope Management	F-CPM-17-01: Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.	Plan Development - Capital program planning is not constrained to available funding due to the annual appropriation process, where funds are approved by jurisdictions each year without consideration of ongoing long-term project needs. **Recommendation:** Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.

19.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Time Management	F-CPM-17-02: Standard project controls for managing cost and schedule will support effective project execution and promote accountability. *Strategic* *Elevated (4.4)*	Cost Controls - Project budgets are based on estimated expenditures and approved on an annual basis, regardless of the projected duration of each project. Without stable multi-year funding allocation for long-term projects, developing effective cost control and expenditure strategies is problematic. - Project personnel indicated that future funding for projects is not guaranteed, based on current appropriation processes Metro is subject to, presenting barriers to effective activity planning and execution from year-to-year. - While overall project costs were tracked by project managers, there was limited tracking of costs by type (i.e. hard vs. soft costs), limiting the ability to analyze cost trends over time for future activity planning. - Project management indicated that cost control is tracked and controlled on a project-by-project basis, where each project implements their own strategies to manage project costs, without an overall standard of control. This has the potential to generate inconsistent results from project to project. Schedule Controls - The project manager for the 7000-Series Railcar Project tracks contractor schedules, but does not maintain a project schedule. Standardized milestone variance tracking was not observed, nor was comprehensive tracking of milestones prior to contract award. Performance Standards - QICO did not observe performance standards in-place to track the effectiveness of projects, regarding adherence to schedule or cost projections; i.e. no observable measurement of planned versus actual. **Recommendation:** Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.
Communication Management	F-CPM-17-03: Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability. *Strategic* *Elevated (4.4)*	- QICO did not observe any standard reporting practices for capital projects. - Project Managers indicated that reports provided to their management were developed on their own, in the absence of standard processes. - Without consistent and standardized reporting mechanisms for progress, spending, and overall status, assessing the performance of projects from one to the next is not practicable. **Recommendation:** Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.

19.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Integration Management	F-CPM-17-04: Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution. *Strategic* *Elevated (4.4)*	Ineffective Planning - Multiple departments are responsible for the development of project plans, selection of projects, and various stages of approval (operational, business needs, financial, etc.), without standardized interfaces or protocols to govern the capital program planning process. - Although organizational controls are in-place to govern financial authorization and monitoring of projects, there are inconsistent methods applied to initiating and monitoring projects based on performance data or other indicators, varying from project-to-project and department-to-department. - Inconsistent grouping of projects and programs inhibits effective management and monitoring of departmental project portfolios, where some projects overlap departmental authorities or functional areas. - Consistent interdepartmental coordination in capital program planning will improve project selection and portfolio development, producing a more effective capital program. Projects vs Programs - QICO did not observe an enterprise-wide standard for distinguishing capital "projects" from ongoing capital "programs". Recommendation: Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

19.6. PROJECT-SPECIFIC REQUIRED ACTIONS

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

Refer to Appendix A: Risk Assessment for further details

Required Action	Finding		Owner
QICO-7K-17-01: Establish policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT). Moderate	F-7K-17-01	Establishing policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT) capabilities is essential to fully taking advantage of the 7000-series maintenance architecture.	CENV
QICO-7K-17-02: Establish a comprehensive strategy for training for maintenance techs and engineers – one that includes training on the use of on-board vehicle diagnostics and on-the-job training (OJT) from Kawasaki. Moderate	F-7K-17-02	Timely and thorough training is required in order to ensure railcars are properly maintained.	CMO
QICO-7K-17-03: Establish a process to ensure spare parts are available in sufficient quantities for the 7000-series railcar fleet, for everything that is under warranty or not covered by warranty. In addition, in future railcar acquisitions, include spare parts in each of the options. Moderate	F-7K-17-03	Timely delivery of spare parts is required to address ongoing maintenance issues.	CENV
Approved Corrective Action Plans (CAPs) are provided following the Internal Review reports, with each developed to address the findings and required actions listed above.			

Washington Metropolitan Area Transit Authority

INTERNAL REVIEW 2017

Capital Program Management and Execution

Metrorail Radio Infrastructure Replacement Program (20)

Quality Assurance, Internal Compliance & Oversight (QICO)

"Quality Trumps Quantity"

INTERNAL REVIEW SUMMARY

Why QICO Performed This Review:

- This internal review is intended to provide Metro senior management with an assessment of the Radio Infrastructure Replacement Program specifically the Neutral Host & Tunnel DAS installation portions' performance of assigned duties and promote the actions needed to address areas of concern.
- QICO is an internal management function authorized by the General Manager to conduct objective reviews with unrestricted access to all functions, records, assets and employees under its purview.

QICO's Methodology:

- QICO developed relevant review activities by identifying and assessing risks to quality of work, compliance with standards, records management, and safety.
- QICO reviewed the project's governing documentation, observed field personnel performing daily work activities, assessed their conformance to requirements, reviewed records and key documents, and interviewed key personnel
- Review findings and required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale. Each is associated with either project-specific areas, or identified as a systemic issue across capital program management.

November 2017

20. Metrorail Radio Infrastructure Replacement Program

Key Takeaway: New processes and controls need to be implemented, both authority-wide and at the project level, to help improve the successful delivery of an upgraded radio system.

Wins and Areas for Improvement:

✓ Project adherence to safety briefing requirements prior to field assessments promotes a positive safety culture throughout the team.

Project-Specific:

- Effective control of project documentation is required.
- Identification of clear roles and responsibilities essential.
- Consistent enforcement of design package requirements is essential.
- Consistent acceptance procedures are necessary.

Systemic:

- Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.
- Standard project controls for managing cost and schedule will support effective project execution and promote accountability.
- Consistent methods for reporting project progress and status of will improve coordination of project activities and promote accountability.
- Clearly defining the roles and responsibilities for capital planning and monitoring is will promote effective interdepartmental coordination and project execution.

Project-Specific Required Actions:

- QICO-RIRP-17-01: Develop Project Management Plan (PMP) that clearly defines personnel roles, includes an updated Quality Management Plan (QMP) consistent with WMATA's new QMSP and includes document control measures. *(Risk Rating: Elevated)*
- QICO-RIRP-17-02: Establish requirements to secure design-build contractor's approval of 100% plan and have plans certified prior to installation of equipment on the railroad. *(Risk Rating: Elevated)*
- QICO-RIRP-17-03: Define uniform inspection and acceptance requirements for radio and cellular system assets and develop methods to measure asset condition in accordance with these requirements. *(Risk Rating: High)*

System-Wide Required Actions:

- Four System-Wide Required Actions have been developed to address the systemic areas for improvement noted above, resulting in four comprehensive corrective action plans to address each.

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.

20.1. PROJECT OVERVIEW

Radio Infrastructure Replacement Program

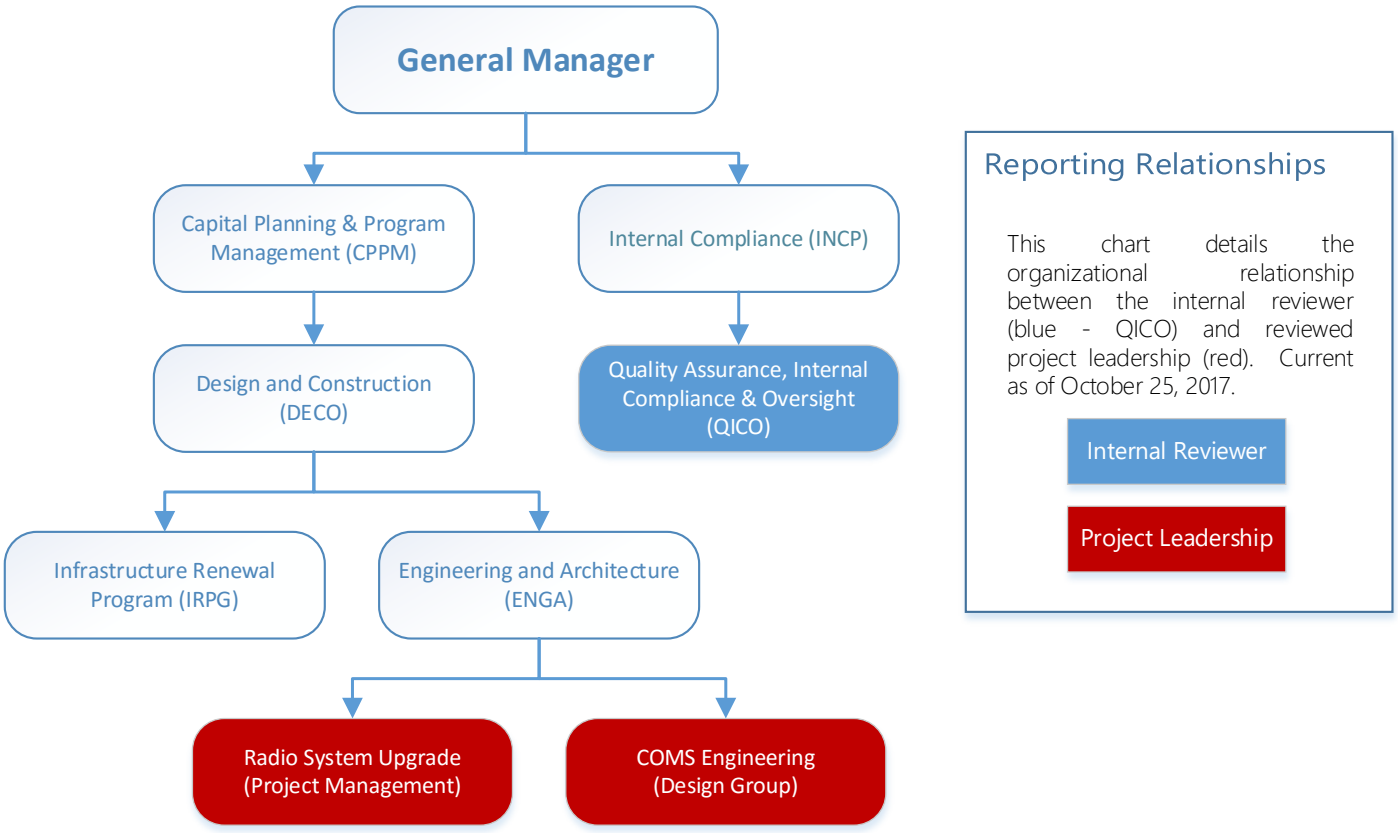
The Washington Metropolitan Area Transit Authority's (WMATA) 700 MHz Radio Replacement Project addresses two major pieces of legislation by Congress: the Middle Class Tax Relief and Job Creation Act (47 U.S. Code § 1413, February 2012) requires WMATA to vacate T-band frequencies (470-512 MHz) by December 2021, and the Passenger Rail Investment and Improvement Act (PRIIA 2008, P. L. 110–432) requires WMATA to provide cellular service to Metrorail stations and tunnels. To accomplish these objectives, the project is replacing all above-ground and below-ground radio infrastructure and equipment, including the design and construction of 28 above-ground antenna sites, over two million feet of radiating coaxial, fiber, and power cabling within the underground system, and all radio subscriber units (bus, rail, police and individual handheld radios). The new radio system along with cellular service in the tunnels is expected to be completed and in use by December 2021.

The current focus of the radio project is a systematic replacement/upgrade of the Authority's underground radio system. Underground tunnels, which comprise approximately 40% of the Metrorail system, are typically not penetrable to above-ground radio signals. Tunnels are lined with radiating coaxial cable (slotted electrical cable) that transmits and receives radio frequency signals from radios in passing trains and handheld radios from personnel working on underground track. This is known as the Distributed Antenna System (DAS). At strategic points, radiating cable connects to a fiber optic cable backbone, which leads to the master radio controller in WMATA's operations control center (Carmen Turner Facility). The radio project is systematically installing these components to accommodate 700 MHz WMATA communication and 800 MHz communication for jurisdictional emergency response crews. A separate cable along the tunnel walls is being installed to provide service for the major cell carriers through the underground portion of the Metrorail system

20.2. REVIEW METHODOLOGY

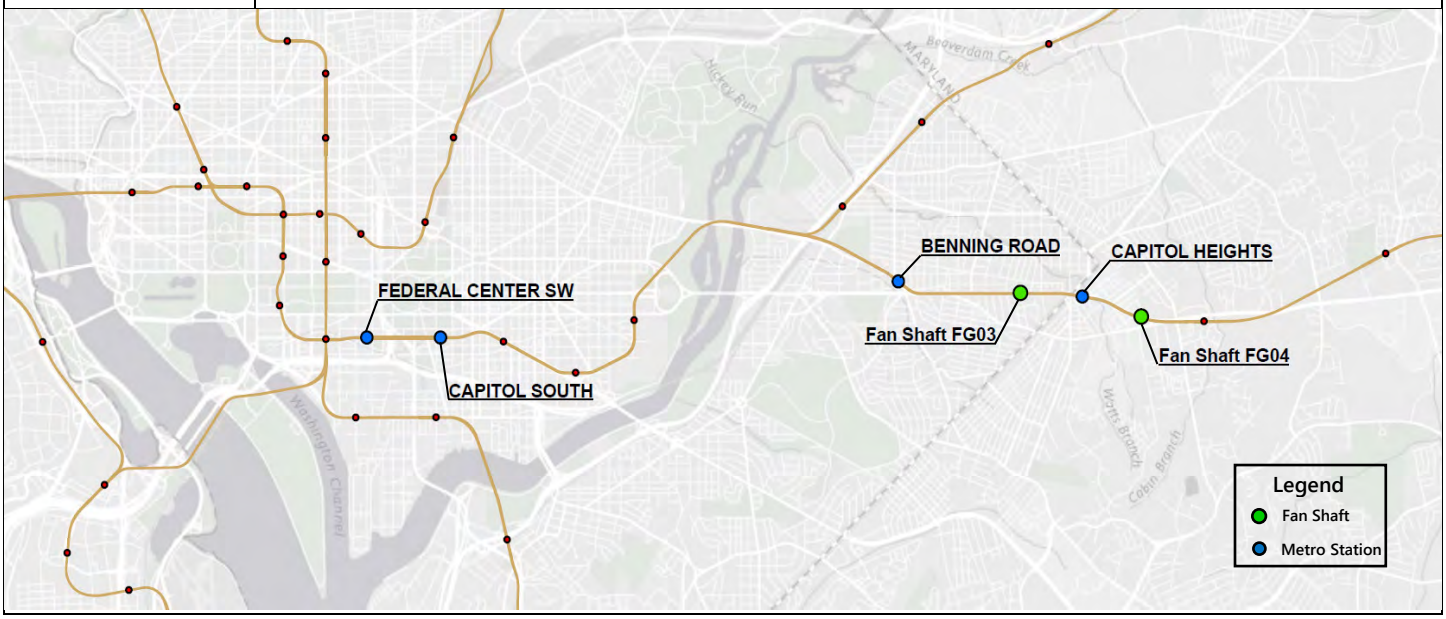
Internal Review Stakeholders

The Office of Quality, Internal Compliance and Oversight (QICO) conducted an internal review of the Radio Infrastructure Replacement Program, specifically the Neutral Host & Tunnel DAS Installation effort which resides in the WMATA Office of Capital Planning & Program Management (CPPM) with the Office of Engineering and Architecture (ENGA) supporting. As shown below, QICO is separate from operations and engineering functions, reporting directly to the General Manager.



QICO observed project management personnel and field personnel 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 of Improvement). The findings are rated based on severity of risk, which ranges from 'Insignificant' to 'High', and associated with project-specific areas and systemic issues. The resulting Required Actions summarize the steps actions owners must take to address deficiencies.

REVIEW SCOPE	
Category	**Description**
Review of Existing Documentation	- FQ15000 – WMATA 700 MHz Radio System Conformed Contract - Project Work Plan - Project Specific Quality Management Plan - WMATA 4th Amendment to Master License Agreement
Interviews of Key Personnel	Senior Management Level - Acting CPFS Manger [redacted] - IRPG [redacted] - CPMO [redacted] - OMBS Capital Budgets [redacted] - OMBS [redacted] - ENGA [redacted] - PLAN [redacted] - PRMT [redacted] - CPO [redacted] Project Level - Project Manager ([redacted]) - Assistant Project Manager ([redacted]) - FACP [redacted] - Engineering Manager ([redacted]) - Material Control Supervisor ([redacted]) - Acting Construction Manager ([redacted]) - QA/QC Manager ([redacted]) - Construction Inspectors ([redacted])
Field Observations	- Jumper Cable Installation at Capitol Heights Metro Station (G02), 7/18. - Jumper Cable Installation at Benning Road Metro Station (G01) and Fan Shaft FG03, 7/19. - Jumper Cable Installation at Fan Shaft FG04, 7/20. - Antenna Installation at Federal Center SW Metro Station (D04), 8/03. - Cable Testing at Capitol South Metro Station (D05), 8/04.



20.3. WHAT WORKED WELL

Measure	Finding	Description
Risk Management	Project adherence to safety briefing requirements prior to all observed field assessments promotes a positive safety culture throughout the project team.	- Safety briefings were conducted before work was performed on all field assessments. - Performed in accordance with RWP requirements *(Source: QICO Field Assessments)*

20.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Human Resource Management	F-RIRP-17-01: Identification of clear roles and responsibilities of project management personnel is essential to effective project implementation. *Strategic* *Elevated (3,5)*	- The Project Specific Quality Management Plan (PSQMP) requires a figure illustrating the functional responsibilities of the Project Team. - The Project Management Body of Knowledge (PMBOK) Chapter 9 - Organization Planning states that identifying, documenting, and assigning project roles, responsibilities, and reporting relationships is required to effectively utilize project personnel. - The organization chart provided by the project management team illustrates roles but does not provide specific responsibilities associated with project personnel. - Assigning specific responsibilities to project team members boosts efficiency, enhances productivity, provides clarity, and produces clear lines of communication which are critical elements to a successful project delivery. **Recommendation**: Establish specific responsibilities for project management personnel as required in the PSQMP.

20.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Records Management	F-RIRP-17-02 Effective control of project documentation is required to validate and provide traceability of work performed. *Service Delivery* *Low (2,4)*	- Per PSQMP all project documents (including but not limited to: records, meeting minutes, photographs, drawings, specifications, submittals, revisions, comment logs, packing slips, invoices along with documentation of inspections, measurements or testing of received material, testing results, inspection reports, parts, systems and components) shall be maintained, preserved, and stored in the WMATA project management software system (Procore) within 24 hours of completion. - Per requirements of PSQMP, the WMATA issued test equipment calibration log is incomplete. - Bi-monthly Tunnel DAS coordination and Tunnel DAS installation meetings started in late 2015. The only documentation present in Procore for both bi-monthly meetings are meeting agendas and sign-in sheets, there are no meeting minutes. Tunnel DAS installation meeting documentation is only available for the month of June 2017 and Tunnel DAS coordination meeting has documentation available from June to October 2017. - Receiving inspection records which are supporting testing documentation of received material are not stored on Procore. - Supervisor and contractor daily reports are not available for every month in Procore. - Inspector and Contractor daily reports were uploaded into Procore months after completion, which is not in compliance with the 24-hour window allotted. **Recommendation:** Establish document controls to comply with requirements set forth in the PSQMP.

20.4. PROJECT-SPECIFIC AREAS FOR IMPROVEMENT

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

Measure	Finding	Description
Quality Management	F-RIRP-17-03: Consistent enforcement of design package requirements is essential to ensure program reliability. *Service Delivery* *Elevated (5,3)*	- Per Engineering Quality Control Plan, Issued for Construction (IFC) packages shall be released for 11 tunnel segments. - According to the Tunnel DAS baseline schedule and DAS design package tracker, design packages for four tunnel segments are to be completed as of 10/23/2017. - Field personnel are utilizing work instructions from the 90%-95% design packages to perform work. - 90%-95% design packages have discrete construction activities that have already been approved (e.g. snake tray mounting), but it is not documented nor is it clearly communicated to field personnel prior to start of construction. - Complete IFC drawing packages have not been approved for tunnel segments where components of the Tunnel DAS system have been installed. **Recommendation:** Establish processes and controls to ensure IFC packages are completed and approved prior to the start of distinct construction activities.
Quality Management	F-RIRP-17-04: Consistent acceptance procedures are necessary to ensure effective project delivery. *Service Delivery* *High (5,4)*	- The PSQMP defines the process for verifying and validating the completion of a tunnel line segment by an independent inspection team walk through and resolution of all Substantial Completion Inspection (SCI) punch list items. - An SCI draft for the D-line was provided by the project management team but it was not signed or approved. Additionally, the documentation supporting an independent inspection team walk through was not provided. **Recommendation:** Establish and implement controls that comply with the requirements set forth in the PSQMP for final acceptance inspection of completed tunnel line segments.
Quality Management	F-RIRP-17-05: Consistent, documented inspections of equipment installation are essential to ensure safe and reliable operations. *Service Delivery* *Moderate (3,3)*	- Inspector Daily Reports (IDRs) and Supervisor Daily Reports submitted daily details shift start/end time, location, and work performed. - Submitted reports lack detail to confirm that work was performed in accordance with key design parameters and cabling system design for proper radio frequency performance of DAS system. - QICO did not observe documentation of clearance checks performed post installation of equipment and materials. **Recommendation:** Establish inspection and reporting standards to ensure that reporting consistently provides a detailed condition assessment of radio and cellular systems.

20.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Scope Management	F-CPM-17-01: Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals. *Strategic* *Elevated (4.4)*	Plan Development - Capital program planning is not constrained to available funding due to the annual appropriation process, where funds are approved by jurisdictions each year without adequate consideration of ongoing long-term project needs. - QICO did not observe a regimented process for inclusion of scope or projects in WMATA's capital plan. Capital Program and Asset Condition Targets - Accounting for past performance of assets and equipment is fundamental to the effective planning of specifications and scope for future improvement projects. **Recommendation**: Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.
Time and Cost Management	F-CPM-17-02: Standard project controls for managing cost and schedule will support effective project execution and promote accountability. *Strategic* *Elevated (4.3)*	Cost Controls - Project budgets are based on estimated expenditures and approved on an annual basis, regardless of the projected duration of each project. Without stable multi-year funding allocation for long-term projects, developing effective cost control and expenditure strategies is problematic. - Project personnel indicated that future funding for projects is not guaranteed, based on current appropriation processes Metro is subject to, presenting barriers to effective activity planning and execution from year-to-year. - While overall project costs were tracked by project managers, there was limited tracking of costs by type (i.e. hard vs. soft costs), limiting the ability to analyze cost trends over time for future activity planning. - Capital program staff indicated that the standard budget contingency was 5% for greenfield projects and 7.5% for rehabilitation projects, but that the contingency level remained the same throughout the life of the project. Industry standards call for increased contingency levels at earlier project development stages. - Project management indicated that cost control is tracked and controlled on a project-by-project basis, where each project implements their own strategies to manage project costs, without an overall standard of control. This has the potential to generate inconsistent results from project to project. Schedule Controls - Standard schedule milestones variance tracking for project schedules was not observed.

20.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
		- QICO observed a project schedule that did not include the following: schedule contingency, closeout and other standard milestones and a signature from the project manager. - Regular review of project schedules (monthly/quarterly/etc.) was not observed, limiting the ability to account for changing priorities or unforeseen issues. - QICO did not observe any schedule contingency standards. Performance Standards - QICO did not observe performance standards in-place to track the effectiveness of projects, regarding adherence to schedule or cost projections; i.e. no observable measurement of planned versus actual. **Recommendation:** Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.
Communications Management	F-CPM-17-03: Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability. *Strategic* *Elevated (4,3)*	- QICO did not observe any standard reporting practices for capital projects. - Project Managers indicated that reports provided to their management were developed on their own, in the absence of standard processes. - Without consistent and standardized reporting mechanisms for progress, spending, and overall status, assessing the performance of projects from one to the next is not practicable. **Recommendation:** Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.

20.5. SYSTEM-WIDE AREAS FOR IMPROVEMENT

Note: System-Wide findings were identified across different projects, this section outlines how each applied to this specific project and are coordinated into a set of four System-Wide Required Actions.

Measure	Finding	Description
Integration Management	F-CPM-17-04: Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution. *Strategic* *Elevated (4.3)*	Ineffective Planning - Multiple departments are responsible for the development of project plans, selection of projects, and various stages of approval (operational, business needs, financial, etc.), without standardized interfaces or protocols to govern the capital program planning process. - Although organizational controls are in-place to govern financial authorization and monitoring of projects, there are inconsistent methods applied to initiating and monitoring projects based on performance data or other indicators, varying from project-to-project and department-to-department. - Inconsistent grouping of projects and programs inhibits effective management and monitoring of departmental project portfolios, where some projects overlap departmental authorities or functional areas. - Consistent interdepartmental coordination in capital program planning will improve project selection and portfolio development, producing a more effective capital program. Projects vs Programs - QICO did not observe an enterprise-wide standard for distinguishing capital "projects" from ongoing capital "programs". Recommendation: Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

20.6. PROJECT-SPECIFIC REQUIRED ACTIONS

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

Refer to Appendix A: Risk Assessment for further details

Required Action	Finding		Owner
QICO-RIRP-17-01: Establish consistency between the Project Specific Quality Management Plan (PSQMP) and WMATA's new Quality Management System Plan (QMSP) and ensure clearly defined personnel responsibilities and document control measures are included. Elevated	F-RIRP-17-01	Identification of clear roles and responsibilities of project management personnel is essential to effective project implementation.	IRPG
	F-RIRP-17-02	Effective control of project documentation is required to provide verification and traceability of activities.	IRPG
QICO-RIRP-17-02: Establish requirements to secure approval of Issue for Construction (IFC) plan and have plans certified prior to installation of equipment on the railroad. Elevated	F-RIRP-17-03	Consistent enforcement of design package requirements is essential to ensure program reliability.	DECO
QICO-RIRP-17-03: Define uniform inspection and acceptance requirements for radio and cellular system assets and develop methods to measure asset condition in accordance with these requirements. High	F-RIRP-17-04	Consistent acceptance procedures are necessary to ensure an effective project outcome.	IRPG
	F-RIRP-17-05	Consistent, documented inspections of equipment installation are essential to ensure safe and reliable operations.	IRPG

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

SUMMARY OF SYSTEM-WIDE REQUIRED ACTIONS

SUMMARY OF SYSTEM-WIDE REQUIRED ACTIONS			Note: Findings are rated based on the associated risk to organization's objectives, provided as Type of Risk followed by Risk Severity (Impact rating, Probability rating) Color Coding. Refer to Appendix A: Risk Assessment for further details
Required Action	Finding		Owner
QICO-CPM-17-01: Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives. Elevated	F-CPM-17-01	Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.	CPPM
QICO-CPM-17-02: Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements. Elevated	F-CPM-17-02	Standard project controls for managing cost and schedule will support effective project execution and promote accountability.	CPPM
QICO-CPM-17-03: Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements. Elevated	F-CPM-17-03	Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability.	CPPM
QICO-CPM-17-04: Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation. Elevated	F-CPM-17-04	Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution.	CPPM
Approved Corrective Action Plans (CAPs) are provided following the Internal Review reports, with each developed to address the findings and required actions listed above.			

CORRECTIVE ACTION PLANS (CAPs)

INTERNAL REVIEW

Capital Program Management and Execution

In response to the internal review of Metro's Capital Program Management, including review of Metrorail Vehicle Capital Improvement Program, Metrorail Power Systems Upgrade, 7000-Series Railcar Acquisition Program, and Metrorail Radio Infrastructure Replacement Program, the office of Quality Assurance, Internal Compliance & Oversight (QICO) has coordinated the development of twelve (12) CAPs, eight (8) are specific to individual projects and four (4) apply to system-wide areas for improvement. 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

FOR: [redacted] 19 DEC 17

Joseph Leader — *Date*

Chief Operating Officer (COO)

[redacted] 12/18/17

Craig Stewart — *Date*

Chief, Capital Planning and Program Management (CPPM)

WMATA INTERNAL OVERSIGHT

Corrective Action Plan Acknowledgement

[redacted] 12/19/17

Angel Peña — *Date*

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

[redacted] 12/19/17

Eric Christensen — *Date*

Chief, Internal Compliance (INCP)

[redacted] 12/19/17

Paul J. Wiedefeld — *Date*

General Manager & Chief Executive Officer (GM/CEO)

METRORAIL VEHICLE CAPITAL IMPROVEMENT PROGRAM CAPS

Return to Summary of Required Actions

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Metrorail Vehicle Engineering Capital Improvement Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-CRP-17-01.

QICO Finding	QICO Recommendation
F-CRP-17-01: Effective Quality Management Plan is essential to ensure project deliverables are met with the required levels of quality.	- Establish a requirement for a standardized comprehensive Quality Management Plan prior to project implementation to ensure the quality of work being performed.
F-CRP-17-02: Comprehensive activity based schedule is essential to ensure timely delivery of the project objectives.	- Establish a requirement for a standardized comprehensive Project Master Schedule prior to project implementation to ensure timely project deliverables.

Required Action

QICO-CRP-17-01: Establish a requirement to develop a standardized comprehensive Quality Management Plan (QMP) and Project Master Schedule prior to project implementation to ensure the quality and timeliness of work being performed.

(Risk Rating: Elevated)

ACTION PLAN

Description

The majority of Capital Improvement Projects require the use of outside contractors to complete the intended work, e.g. Rail Car Improvement of Equipment, etc.... Some project are completed internally. In either case, a Statement of Work (SOW) is typically completed for each CIP project and provides the technical requirements for the project along with any necessary contract deliverables. Depending upon the complexity, risks, and cost of the project; the Project Manager my elect to add additional requirements for the contractor to provide a PMP, QMP, and Schedule – these would be listed in the "Deliverables" section of the SOW. As a result some projects will contain a longer list of deliverables than others – this is a normal process. However, to improve the existing process and consistency between Project Managers; CENV proposes that we develop a CIP Project Specific Statement of Work SOW template. This template would be used by the Project Managers and Engineers that would include the appropriate deliverables needed based on project "Class" or complexity. A decision matrix (table) would be provided to guide the Project Managers and Engineers to include the necessary contract deliverables based on the "project class" – the project class would be defined based on complexity, risks, and cost of the project. For example, the Door Spindle modification did not require a compressive project schedule, while a project with major equipment overhauls or Rail Car improvement (e.g. 5K HVAC project) required a more detailed project schedule.

With the implementation of the Project Class Decision Matrix and the CENV CIP SOW Template, CENV will provide better instructions for Project Managers and Engineers to develop the SOWs for their projects (reduce the guess work in what requirements are really needed and what: "must haves" should be included). We consider this a Process Improvement.

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 Project Class Matrix	A simple table that provides a method of selection to include contract deliverables for projects based on complexity, risk, and cost. The project class would be provided for three basic types: Class A – Large Project with Highest Complexity and Cost; Class B – Medium project with lower complexity and cost and Class C – Small project with little complexity and lower costs. And finally, Class D projects are the lowest cost, complexity and risk.	CENV Baldassano	11/06/17	12/31/17
2)	CIP Project Specific Statement of Work SOW template – issue an SOP.	A CIP Project Specific Statement of Work SOW *template* (in outline format) for use by the Project Managers and Engineers that would include the appropriate language for the deliverables considered "minimum must haves" based on Project Class. An SOP would be issued with the SOW Template.	CENV Baldassano	01/08/18	02/28/18
3)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	02/28/18	04/25/18

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

COMPLETION DOCUMENTATION

Performance Measures

- Statement of Work (SOW) template developed under actionable item #2 conforms to Project Class Matrix established under actionable item #1.
- Examples of completed SOWs demonstrating conformance with Standard Operating Procedure (SOP) requirements developed under actionable item #2.

RESPONSIBLE PARTIES[1]

CENV	Stephen Baldassano	[redacted] 11/3/2017
CENV	Tara Soesbee	[redacted] 11/3/17

SECOND LEVEL RESPONSIBILITY

Chief Engineer, Rail Vehicles	Sachit Kakkar	[redacted] 11/8/17
Chief Mechanical Officer	John Doherty	[redacted]
AGM Rail Services	Andrew Off	[redacted] 8 NOV 17

METRORAIL POWER SYSTEMS UPGRADE PROGRAM CAPS

Return to Summary of Required Actions

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 26, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Metrorail Power Systems Upgrade Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-PSUP-17-01.

QICO Finding	QICO Recommendation
F-PSUP-17-01: Consistent inspection reporting standards are required to ensure effective communication and accurate accounting of work within the project.	- Standardize requirements for project inspection reports, including frequency and content, and define methods to measure project performance in accordance with these requirements.

Required Action

QICO-PSUP-17-01: Standardize requirements for project inspection reports, including frequency and content, and define methods to measure project performance in accordance with these requirements.

(Risk Rating: Moderate)

ACTION PLAN

Description

The Infrastructure Renewal Program Group (IRPG) 100% 8-Car Train Upgrades project team will create a report template for WMATA Inspector Daily Records (IDRs) to ensure consistent and uniform content is recorded each work shift. The required content will be specified on the IDR form.

Individual separate IDRs will be prepared by each Inspector for each location worked each day. After completing the IDR Form, the Inspector will email the completed form along with photo attachments illustrating work completed to the Project Team: Assistant Project Manager(s), Construction Engineers (CE), other Inspectors, and Office engineer (OE) by 10 AM each day.

Contractors will continue to upload Daily Progress Reports (DPRs) on the Documents tab on Procore using pre-specified DPR form.

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)	Establish requirement for a WMATA IDR Form	Provide the IRPG-Power team with a written directive that a report form has been created for WMATA Inspector Daily Records (IDRs) and all sections are required to be completed. Identify the new procedure for review and provide a time for when the report template is required to be in use.	Alex Zimar	11/06/17	11/30/17
2)	Create a flow chart to illustrate QC process for review of daily reports	Establish roles and responsibilities for reviewing WMATA Inspector IDRs to ensure reports are complete and stored appropriately.	Alex Zimar	10/31/17	11/30/17
3)	Train Inspectors to use report form	Provide Inspectors with training on the requirements of the new form and expectations of the new process.	Pedro Luina	11/13/17	11/30/17
4)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	12/01/17	1/30/18

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

COMPLETION DOCUMENTATION

Performance Measures

- 100% of active inspection personnel assigned to the project are trained on requirements and process developed under actionable items 1 and 2.

RESPONSIBLE PARTIES

IRPG-POWER	Alexandria Zimar	[redacted] 11/6/17
IRPG-POWER	Kelly Reahl	[redacted] 11/6/2017

SECOND LEVEL RESPONSIBILITY

IRPG	Kenneth Spain	[redacted] 11/7/17

7000-SERIES RAILCAR ACQUISITION PROJECT CAPS

Return to Summary of Required Actions

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's 7000-Series Railcar Acquisition Project. This Corrective Action Plan (CAP) has been developed to address the finding and required action per **QICO-7K-17-01**.

QICO Finding	QICO Recommendation
F-7K-17-01: Establishing policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT) capabilities is essential to fully taking advantage of the 7000-series maintenance architecture.	- Establish policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT).

Required Action

QICO-7K-17-01: Establish policies and procedures regarding Train-to-Wayside-Data-Transfer (TWDT).

(Risk Rating: Moderate)

ACTION PLAN

Description

Base functionality for Train-to-Wayside-Data-Transfer (TWDT) needs to be established in the near-term, and detailed policies and procedures should be in place before the end of the commissioning phase of the project. This is a multi-stakeholder effort, with dependencies on other WMATA business functions. Therefore, parts which are achievable by the 7000-series project team in railcar engineering (CENV) are detailed here.

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)	Functional TWDT System	Establish a 7000-series railcar Train-to-Wayside-Data-Transfer (TWDT) system with base functionality. This includes automatic wireless downloading of mileage and faults at WMATA rail yards.	CENV IT-APPS	12/1/2017	6/1/2018 (6 months)
2)	Establish Policies and Processes for TWDT	Establish detailed 7000-series railcar policies and procedures for Train-to-Wayside-Data-Transfer (TWDT).	CENV	12/1/2017	12/1/2018 (12 months)
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	6/1/2018	1/1/2019

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

COMPLETION DOCUMENTATION

Performance Measures

- Evidence of basic functionality of TWDT in Metrorail yards.
- Evidence of approved TWDT Standard Operating Procedures (SOPs) / Operating Administration Procedures (OAPs).

RESPONSIBLE PARTIES

7000-Series Railcar Project Manager (CENV)	Timothy Bach	[redacted] 11/7/17
IT Project Manager	Marc Laforture	for Marc Laforture [redacted]
Senior Program Manager (CENV)	Tara Soesbee	[redacted] 11/7/17

SECOND LEVEL RESPONSIBILITY

Chief Engineer, Rail Vehicles (CENV)	Sachit Kakkar	[redacted] 18/17
Chief Mechanical Officer (CMO)	John Doherty	[redacted]
AGM RAIL	Andrew Off	[redacted] 8 NOV 17

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's 7000-Series Railcar Project. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-7K-17-02.

QICO Finding	QICO Recommendation
F-7K-17-02: Timely and through troubleshooting training is required in order to ensure railcars are properly maintained.	- Establish a comprehensive strategy for troubleshooting training for maintenance techs and engineers – one that includes training on the use of on-board vehicle diagnostics and on-the-job training (OJT) from Kawasaki.

Required Action

QICO-7K-17-02: Establish a comprehensive strategy for training of maintenance techs and engineers – one that includes training on the use of on-board vehicle diagnostics and on-the-job training (OJT) from Kawasaki.

(Risk Rating: Moderate)

ACTION PLAN
Description
Re-training is to be conducted for relevant project personnel and maintenance technicians. In addition, because the 7000-series railcar represents a technological leap forward in comparison to previous railcar series, an investigation into the need for specialized technicians for troubleshooting data off VMDS is needed.
Business Impact – Budget/Cost Estimate
- Process Execution – A current process/procedure exists that meets the QICO Required Action, but needs to be executed.

PLAN STRUCTURE

Actionable items		Description	Responsible Party	Estimated Start	Estimated Completion
1)	Establish new training program	Execute contract modification for new training to be provided for WMATA vehicle engineers and maintenance personnel.	CENV	12/1/2017	12/1/2018 (12 months)
2)	Investigate needs for 7000-series railcar network technicians	Investigate the need for specialized technicians for 7000-series onboard train networks.	CMO	12/1/2017	12/1/2018 (12 months)
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	6/1/2018	12/1/2018

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

COMPLETION DOCUMENTATION
Performance Measures
- Execution of the contract modification, and committed schedule for training delivery.

RESPONSIBLE PARTIES		
7000-Series Railcar Project Manager (CENV)	Timothy Bach	[redacted] 11/3/17
Senior Program Manager, CENV Capital Programs	Tara Soesbee	[redacted] 11/3/17

SECOND LEVEL RESPONSIBILITY		
Chief Engineer, Rail Vehicles (CENV)	Sachit Kakkar	[redacted] 11/8/17
Chief Mechanical Officer (CMO)	John Doherty	[redacted]
AGM RAIL	Andrew Off	[redacted] 8 NOV 17

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017, the Office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's 7000-Series Railcar Project. This Corrective Action Plan (CAP) has been developed to address the finding and required action per **QICO-7K-17-03**.

QICO Finding	QICO Recommendation
F-7K-17-03: Timely delivery of spare parts is required to address ongoing maintenance issues.	- Establish a process to ensure spare parts are available in sufficient quantities for the 7000-series railcar fleet, for everything that is in warranty or not covered by warranty. In addition, in future railcar acquisitions, consider including capital spares for each of the options.

Required Action

QICO-7K-17-03: Establish a process to ensure spare parts are available in sufficient quantities for the 7000-series railcar fleet, for everything that is in warranty or not covered by warranty. In addition, in future railcar acquisitions, consider including capital spares for each of the options.

(Risk Rating: Moderate)

ACTION PLAN

Description

Spare parts management for the 7000-Series is of increasing concern as more cars exit the warranty stage. The first step towards improving this process is securing an updated Recommended Spare Parts List from the contractor and transferring this information into the Authority's systems. Doing so will help increase supplier registration with WMATA's supplier portal.

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)	Finalize the Spare Parts List / Illustrated Parts Catalogue	Finalize the Illustrated Parts Catalogue (IPC) / Spare Parts List.	CENV	12/1/2017	6/1/2018 (6 months)
2)	Transfer lessons learned to 8000-series railcar project	Track and present lessons learned with regards to deficiencies in spare parts contract and spare parts management to the 8000-series project before it goes out to bid in spring 2018.	CENV	12/1/2017	3/1/2018 (3 months)
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	3/1/2018	6/1/2018

*In the event of personnel or departmental changes, responsibilities for actionable items shall transfer to the new leadership.
**Additional Note: QICO has a set of required actions from an internal review on Parts & Materials Management (QICO-PMIM-17-01 through QICO-PMIM-17-04) which are addressing systematic issues in parts/inventory management.

COMPLETION DOCUMENTATION

Performance Measures

- Evidence that the IPCS / Spare Parts List is completed and approved (actionable item #1).
- Evidence that lessons learned (actionable item #2) are included in 8000-series project bid.

RESPONSIBLE PARTIES

7000-Series Railcar Project Manager (CENV)	Timothy Bach	[redacted] 11/3/17
Senior Program Manager, CENV Capital Programs	Tara Soesbee	[redacted] 11/3/17

SECOND LEVEL RESPONSIBILITY

Chief Engineer, Rail Vehicles (CENV)	Sachit Kakkar	[redacted] 11/8/17
Chief Mechanical Officer (CMO)	John Doherty	[redacted]
AGM RAIL	Andrew Off	[redacted] 9 NOV 17

METRORAIL RADIO INFRASTRUCTURE REPLACEMENT PROGRAM CAPS

Return to Summary of Required Actions

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Metrorail Radio Infrastructure Replacement Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-RIRP-17-03.

QICO Finding	QICO Recommendation
F-RIRP-17-04: Consistent acceptance procedures are necessary to ensure an effective project outcome.	- Establish and implement controls that comply with the requirements set forth in the PSQMP for final acceptance inspection of completed tunnel line segments.
F-RIRP-17-05: Consistent, documented inspections of equipment installation are essential to ensure safe and reliable operations.	- Establish inspection and reporting standards to ensure that reporting consistently provides a detailed condition assessment of radio and cellular systems.

Required Action

QICO-RIRP-17-03: Define uniform inspection and acceptance requirements for radio and cellular system assets and develop methods to measure asset condition in accordance with these requirements.

(Risk Rating: Elevated)

ACTION PLAN

Description

F-RIRP-17-04: The radio project management team will establish controls to ensure compliance with defined work acceptance requirements and update Project Specific Quality Management Plan (PSQMP) accordingly.

F-RIRP-17-05: The radio project management team will modify inspection daily report (IDR) template and define inspection requirements to ensure a consistent detailed condition assessment of radio and cellular systems.

Business Impact – Budget/Cost Estimate

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

PLAN STRUCTURE

	Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1)	Incorporate Inspection Checklist Into PSQMP	WMATA and carrier team will define a standardized inspection checklist and incorporate it into PSQMP.	Joseph Butler (IRPG)	11/07/17	1/31/18
2)	Develop Processes/Procedures For Work Acceptance	Define roles and responsibilities of key stakeholders and develop processes/procedures for completion of Substantial Completion Inspections (SCIs).	Joseph Butler (IRPG)	11/07/17	1/31/18
3)	Review Of Work Acceptance Criteria	Perform a detailed review of acceptance criteria to ensure all additions have been incorporated into PSQMP on a quarterly basis.	Karen Fisher (IRPG)	11/07/17	4/02/18
4)	Modify IDR Template	Modify IDR to give a more detailed assessment of work performed in the field.	Stephen Coleman (IRPG)	11/07/17	2/28/18
5)	Establish Requirement For A Modified WMATA IDR Form	Provide construction inspectors with a written directive that the current IDR form has been modified and all sections are required to be completed. Identify the new procedure for review and provide a time for when the report template is required to be in use.	Stephen Coleman (IRPG)	11/07/17	11/30/17
6)	Train Construction Inspectors On How To Use Modified IDR Form	Provide Inspectors with training on the requirements of new form and expectations of the new process.	Stephen Coleman (IRPG)	11/07/17	2/28/18
7)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	4/02/18	5/04/18

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

COMPLETION DOCUMENTATION

Performance Measures

- Evidence that inspection checklist and acceptance criteria updates have been incorporated into PSQMP as prescribed under actionable item #1 and #3.
- 100% of active inspectors assigned to the project receive training as prescribed in actionable item #5, 6.

RESPONSIBLE PARTIES

IRPG	Allen Wonder	[redacted]	11/6/17
IRPG	Kelly Reahl	[redacted]	11/6/2017

SECOND LEVEL RESPONSIBILITY

IRPG	Kenneth Spain	[redacted]	11/7/17

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Metrorail Radio Infrastructure Replacement Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-RIRP-17-02.

QICO Finding	QICO Recommendation
F-RIRP-17-03: Consistent enforcement of design package requirements is essential to ensure program reliability.	- Establish processes and controls to ensure IFC packages are completed and approved prior to the start of distinct construction activities.

Required Action

QICO-RIRP-17-02: Establish requirements to secure approval of Issued For Construction (IFC) plan and have plans certified prior to installation of equipment on the railroad.

(Risk Rating: Elevated)

ACTION PLAN

Description

F-RIRP-17-03: Radio project management team will develop procedures that will establish processing controls to ensure IFC drawings are completed and approved prior to the start of distinct construction activities.

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)	Review of WMATA's manual of Design Criteria	Review WMATA's manual of design criteria to confirm processes/procedures are being adhered to for the development of construction drawings.	Anderson Bray (ENGA)	11/7/17	1/31/18
2)	Create project specific controls for design packages	Create project specific controls for development and issuance of approved design packages.	Anderson Bray (ENGA)	11/7/17	3/31/18
3)	Update Project Specific Quality Management Plan	Update PSQMP accordingly with processes/procedures identified in WMATA's manual of design criteria and newly established controls.	Karen Fisher (IRPG)	11/2/17	5/31/18
4)	Establish monthly design package review working session	Recurring monthly meetings between ENGA and IRPG to review all approved construction activities in accordance with design package content for the duration of the project.	Anderson Bray (ENGA)	10/31/17	2/28/17
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	5/31/18	7/02/18

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

COMPLETION DOCUMENTATION

Performance Measures

- Evidence of design criteria review as prescribed under actionable item #1.
- Updated PSQMP developed under actionable item #3 contains all project controls outlined in actionable item #2.
- Evidence of design package working sessions as prescribed under actionable item #4, including sign-in sheets and meeting agendas to demonstrate items discussed and resulting actions.

RESPONSIBLE PARTIES

IRPG	Allen Wonder	[redacted]	11/6/17
IRPG	Kelly Reahl	[redacted]	11/6/2017

SECOND LEVEL RESPONSIBILITY

IRPG	Kenneth Spain	[redacted]	11/7/17

CORRECTIVE ACTION PLAN

Purpose and Scope

On October 25, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Metrorail Radio Infrastructure Replacement Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-RIRP-17-01.

QICO Finding	QICO Recommendation
F-RIRP-17-01: Identification of clear roles and responsibilities of project management personnel is essential to effective project implementation.	- Establish specific responsibilities for project management personnel as required in the PSQMP.
F-RIRP-17-02: Effective control of project documentation is required to provide verification and traceability of activities.	- Establish document controls to comply with requirements set forth in the PSQMP.

Required Action

QICO-RIRP-17-01: Establish consistency between the Project Specific Quality Management Plan (PSQMP) and WMATA's new Quality Management System Plan (QMSP) and ensure clearly defined personnel responsibilities and document control measures are included.

(Risk Rating: Elevated)

ACTION PLAN

Description

F-RIRP-17-01: The radio project management team will develop a document identifying roles and specific responsibilities of management personnel as well as a succession plan for the whole project management staff.

F-RIRP-17-02: The radio project management team will update its Project Specific Quality Management Plan (PSQMP) in accordance with WMATA's new Quality Management System Plan (QMSP) issued August 2017 and include document control measures.

Business Impact – Budget/Cost Estimate

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

PLAN STRUCTURE

	Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1)	Identify project management personnel's specific responsibilities	Create a document identifying and defining project management personnel's specific responsibilities.	Eric Feazel (IRPG)	10/30/17	11/30/17
2)	Establish a project communication plan to guide information to project staff and stakeholders	The communication plan will ensure effective delivery of information (e.g. management personnel's specific responsibilities) to project staff and affected stakeholders.	Eric Feazel (IRPG)	11/30/17	12/9/17
3)	Develop a Succession Plan	Create a succession plan for key management positions.	Allen Wonder (IRPG)	11/2/17	11/30/17
4)	Review and Update current Project Specific Quality Management Plan (PSQMP)	Review and update current PSQMP in accordance with WMATA's new QMSP with document controls and clearly defined personnel roles.	Karen Fisher (IRPG)	11/2/17	1/31/18
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	1/31/18	3/2/18

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

COMPLETION DOCUMENTATION
Performance Measures
- 100% of active project staff signature acknowledgement of specific responsibilities as prescribed under actionable item #2. - Project Specific Quality Management Plan (PSQMP) developed under Actionable Item #4 conforms to requirements established under the Quality Management System Plan (QMSP).

RESPONSIBLE PARTIES		
IRPG	Allen Wonder	[redacted] 11/6/17
IRPG	Kelly Reahl	[redacted] 11/6/2017

SECOND LEVEL RESPONSIBILITY		
IRPG	Kenneth Spain	[redacted] 11/7/17

SYSTEM-WIDE CAPITAL PROGRAM MANAGMENET CAPS

Return to Summary of Required Actions

CORRECTIVE ACTION PLAN

Purpose and Scope

On November 1, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report regarding the current policies, procedures, and practices associated with WMATA's Capital Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per QICO-CPM-17-01.

QICO Finding	QICO Recommendation
F-CPM-17-01: Incorporation of performance-driven targets in WMATA's long-term capital planning process will improve alignment of project planning with the authority's mission and goals.	- Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.

Required Action

QICO-CPM-17-01: Establish standards for asset condition and/or useful life benchmarks and their use in capital program planning to better align with WMATA's strategic objectives.

(Risk Rating: Elevated)

ACTION PLAN

Description

The department of Capital Planning & Program Management (CPPM, established April 2017), in support of the General Managers restructuring directive of November 9, 2017 will establish the standards and performance targets to be used in the development of a performance-driven, long-term capital program.

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)	Update the asset management policy (P/I 1.18)	The policy will identify the approach to gathering requirements for asset condition and establish the frequency to update the conditions.	CPPM	10/01/17	10/31/18
2)	Develop a procedure to review the conditions of key assets and create asset performance targets for the capital program	The procedure will identify the condition details of key assets to be reviewed. Determine their associated performance targets for the capital program. This procedure will be incorporated in to the forthcoming Capital Program Development Playbook.	CPPM	12/01/17	05/31/18
3)	Develop a capital program plan that is performance driven and aligned with WMATA's strategic goals.	A prioritized capital program plan that drives towards established performance targets will be created beginning with FY2020 of the Capital Program. The forthcoming Capital Program Development Playbook will establish the requirements for activities to be considered for entry into the FY2020 Capital Program.	CPPM	07/01/18	09/30/19
4)	Establish a procedure to monitor and track conditions of key assets and performance indicators	The procedure will identify the process to ensure monitoring and reporting on the conditions of key assets and performance indicators that are being impacted by ongoing capital investments. The procedure will define the required content of the reports including a comparison between current conditions and performance indicators.	CPPM	03/01/18	05/31/18

PLAN STRUCTURE					
Actionable items		Description	Responsible Party	Estimated Start	Estimated Completion
5)	Establish an organizational communication plan to announce newly established policy and inform WMATA staff, stakeholders and end users	The communication plan will ensure effective information sharing of newly established organizational policies to include outreach to the Capital Program Advisory Committee (CPAC) and inclusion of corporate partners in the Chief Operating Officer (COO), Chief Financial Officer (CFO), Internal Business Operations (IBOP) and Capital Planning and Program Management (CPPM) organizations in adoption of the new policy. The plan will also include methods, upon adoption, to communicate and inform the wider WMATA community and end users.	CPPM	05/17/18	06/30/18
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	10/01/19	11/01/19

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

COMPLETION DOCUMENTATION
Performance Measures
- Signature acknowledgement of the processes developed under actionable items 2 and 3 by applicable management representatives (director level positions and above as listed as responsible parties in the Capital Program Development Playbook).

RESPONSIBLE PARTIES		
CPPM	Shyam Kannan	[redacted]

CORRECTIVE ACTION PLAN

Purpose and Scope

On November 1, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report regarding the current policies, procedures, and practices associated with WMATA's Capital Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per **QICO-CPM-17-02**.

QICO Finding	QICO Recommendation
F-CPM-17-02: Standard project controls for managing cost and schedule will support effective project execution and promote accountability.	- Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.

Required Action

QICO-CPM-17-02: Standardize project controls for managing cost and schedule, defining methods to measure project performance in accordance with these requirements.

(Risk Rating: Elevated)

ACTION PLAN

Description

The department of Capital Planning & Program Management (CPPM) will establish policies and procedures to define baseline project budgets and schedules. The baseline budget definition may be different from the approved funding. This process will establish how to track changes to baseline project budgets and schedules, including any associated scope changes.

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 needs an estimated $150,000 of resources to improve the process.

PLAN STRUCTURE

	Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1)	Establish a standard to identify project budgets	Identify a standard for the establishment of a project budget. The standard will establish the requirements for updates to project scopes, based on changes to project budgets. This standard will be reviewed with corporate partners in the departments of the Chief Operating Officer (COO), Chief Financial Officer (CFO) and Internal Business Operations (IBOP). This will be incorporated in to the forthcoming Capital Program Development Playbook.	CPPM	11/06/17	05/31/18
2)	Establish a standard to identify the project schedule	Identify a standard for the establishment of a project schedule, with standardized milestones. The standard will establish the requirements for updates to project scope, based changes to project schedules. This standard will be reviewed with corporate partners in the departments of the COO, CFO and IBOP. This will be incorporated in to the forthcoming Capital Program Development Playbook.	CPPM	11/06/17	05/31/18
3)	Establish procedures to monitor and track budget and schedule performance	Identify the processes to evaluate the performance of projects against the baseline budget and schedule. This standard will be reviewed with corporate partners in the departments of the COO, CFO and IBOP. These processes will be incorporated in to the forthcoming Capital Program Development Playbook.	CPPM	11/06/17	05/31/18
4)	Establish an organizational communication plan to announce newly established policy and inform WMATA staff, stakeholders and end users	The communication plan will ensure effective information sharing of newly established organizational policies to include outreach to the CPAC and inclusion of corporate partners in the COO, CFO, IBOP and CPPM organizations in adoption of new policy. The plan will also include methods, upon adoption, to communicate and inform the wider WMATA community and end users.	CPPM	05/01/18	06/30/18

PLAN STRUCTURE					
Actionable items		Description	Responsible Party	Estimated Start	Estimated Completion
5)	QICO CAP Verification Report	QICO will evaluate actionable items submitted to confirm there is reasonable evidence that the findings and this required action have been resolved, taking into account the actionable item descriptions and performance measures.	QICO	07/01/18	07/31/18

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

COMPLETION DOCUMENTATION
Performance Measures
- Signature acknowledgement of standards and processes developed under actionable items 1-3 by applicable management representatives (director level positions and above as listed as responsible parties in the Capital Program Development Playbook).

RESPONSIBLE PARTIES		
CPPM	Devintia Headen	[redacted] 12/18/17

CORRECTIVE ACTION PLAN

Purpose and Scope

On November 1, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report regarding the current policies, procedures, and practices associated with WMATA's Capital Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per **QICO-CPM-17-03**.

QICO Finding	QICO Recommendation
F-CPM-17-03: Consistent methods for reporting project progress and status will improve coordination of project activities and promote accountability.	- Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.

Required Action

QICO-CPM-17-03: Establish standard reporting requirements for projects and define methods to measure project performance in accordance with these requirements.

(Risk Rating: Elevated)

ACTION PLAN

Description

The department of Capital Planning & Program Management (CPPM) will establish policies and procedures for the collection, monitoring, and reporting of capital project's status and progress. CPPM will also oversee the development of a reporting tool, including appropriate training curriculum.

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 needs an estimated $1,592,000 of resources to improve the process.

PLAN STRUCTURE

	Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1)	Establish a standard for project reporting	This standard will identify the required elements to be included in an agency-wide capital project report. It will also establish a standard for reporting frequency. This will be incorporated in to the forthcoming Capital Program Development Playbook.	CPPM	10/01/17	05/31/18
2)	Establish processes for reporting data and ensuring quality of project reports	Identify the requirements for project reporting, the roles and responsibilities of the departments of Chief Operating Officer (COO), Chief Financial Officer (CFO), and Internal Business Operations (IBOP), including quality control and quality assurance.	CPPM	10/01/17	05/31/18
3)	Establish a reporting tool	Develop an electronic reporting tool to collect and store report data. There will be two phases: an initial tool will be Excel based until more robust software can be implemented.	CPPM	06/01/18	10/31/18
4)	Establish training curriculum for staff on project reporting requirements	Develop training curriculum on project reporting requirements and the reporting tool. The training will occur on an established schedule and define a requirement for initial training and refresher trainings.	CPPM	05/01/18	06/30/18
5)	Establish an organizational communication plan to announce newly established policy and inform WMATA staff, stakeholders and end users	The communication plan will ensure effective information sharing of newly established organizational policies to include outreach to the Capital Program Advisory Committee (CPAC) and inclusion of corporate partners in the COO, CFO, IBOP CPPM organizations in adoption of new policy. The plan will also include methods, upon adoption, to communicate and inform the wider WMATA community and end users.	CPPM	05/17/18	06/30/18
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	11/01/18	11/30/18

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

COMPLETION DOCUMENTATION

Performance Measures

- Signature acknowledgement of the standard and processes developed under actionable items 1-3 by applicable management representatives (director level positions and above as listed as responsible parties in the Capital Program Development Playbook).
- Evidence of a documented training plan, including who is conducting the training, how it will be delivered, the schedule for the training, and a list of initial staff to be trained on the standards and processes established in the Capital Program Development Playbook.
- Evidence of compliance with newly established project reporting requirement for project reports produced within the first four months.

RESPONSIBLE PARTIES

CPPM	Devintia Headen	[redacted] 12/18/17

CORRECTIVE ACTION PLAN

Purpose and Scope

On November 1, 2017 the office of Quality Assurance, Internal Compliance & Oversight (QICO) issued a comprehensive internal review report, regarding the current policies, procedures, and practices associated with WMATA's Capital Program. This Corrective Action Plan (CAP) has been developed to address the finding and required action per **QICO-CPM-17-04**.

QICO Finding	QICO Recommendation
F-CPM-17-04: Clearly defining the roles and responsibilities for capital planning and monitoring will promote effective interdepartmental coordination and project execution.	- Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

Required Action

F-CPM-17-04: Establish a framework of roles, responsibilities and processes for capital program planning that incorporates stakeholder departments and promotes cooperation.

(Risk Rating: Elevated)

ACTION PLAN

Description
The department of Capital Planning & Program Management (CPPM) will establish policies and procedures to ensure inclusion of appropriate staff throughout the organization in the development of a performance-driven, long-term capital program.
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 needs an estimated $1.5 million of resources to improve the process.

PLAN STRUCTURE

	Actionable items	Description	Responsible Party	Estimated Start	Estimated Completion
1)	Develop and issue a Capital Program Delivery Playbook	Develop a Capital Program Delivery Playbook to establish procedures and processes for planning, initiation, implementation, delivery and monitoring of capital projects within WMATA's Capital Program.	CPPM	10/01/17	05/31/18
2)	Establish a policy to identify key WMATA staff that participate in the development of the capital program	Develop a policy that indicates the roles of departments of Chief Operating Officer (COO), Chief Financial Officer (CFO), Internal Business Operations (IBOP) and Capital Planning and Program Management (CPPM), in the development of the capital program. The policy should also address the requirements to utilize the forthcoming Capital Program Development Playbook. This playbook will include procedures for advancing projects both for inclusion in the annual update to the capital program plan and between planning cycles.	CPPM	11/06/17	08/31/18
3)	Establish an organizational communication plan to announce newly established policy and inform WMATA staff, stakeholders and end users	The communication plan will ensure effective information sharing of newly established organizational policies to include outreach to the Capital Program Advisory Committee (CPAC) and inclusion of corporate partners in the COO, CFO, IBOP, and CPPM organizations in adoption of new policy. The plan will also include methods, upon adoption, to communicate and inform the wider WMATA community and end users.	CPPM	05/17/18	06/30/18
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	09/01/18	09/30/18

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

COMPLETION DOCUMENTATION

Performance Measures

- Policy Instructions are enterprise-wide and are adopted in adherence to the established process for review and implementation, prior to final distribution.

RESPONSIBLE PARTIES

CPPM	Daniel C. Anderson, Jr	[redacted] 12/18/17

SUPPLEMENTAL MATERIALS

APPENDIX A: REVIEW CRITERIA AND RISK ASSESSMENT

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

RISK ASSESSMENT SUMMARY	**Note:** Required actions are rated based on severity of risk, which ranges from 'Insignificant' to 'High' scale.			
Definitions				
Insignificant	Low	Moderate	Elevated	High
Reasonable assumption that this risk will not occur and unlikely to cause the activity to fail to meet part of its objective.	Reasonable assumption that this risk will likely not occur & may cause a failure of the business process to meet part of its objectives.	Reasonable assumption that this risk may occur & may cause a failure of the business process to meet a significant part of its objectives.	Reasonable assumption that this risk will likely occur & likely to cause a failure of the business process to meet a significant part of its objectives.	Reasonable assumption that this will occur & will cause a failure of the business process to meet its objectives or cause objective failure in other activities.

RISK ASSESSMENT

Risk Assessment Methodology

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

- What can go wrong? – The Risk
- How 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 probability ratings are rated on a scale of 1 (minimum) to 5 (maximum) and are driven by the metrics shown on the next page. The impacts ratings are also rated on a scale of 1 (minimum) to 5 (maximum) and are driven by the category of risks, which are then aligned on the metrics shown on the next page.

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

RISK ASSESSMENT

Risk Assessment Methodology

Figure 1: Risk Assessment Matrix

Probability	Impact: 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 of Occurrence ↑

Potential Impact of Risk →

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

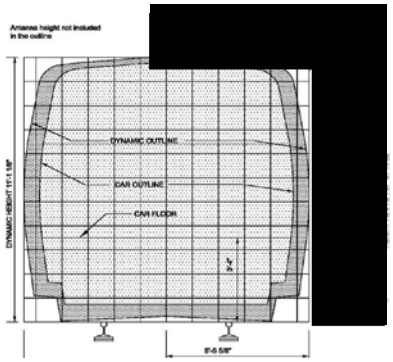
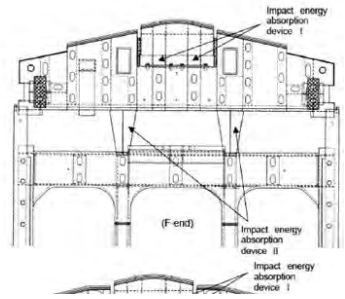
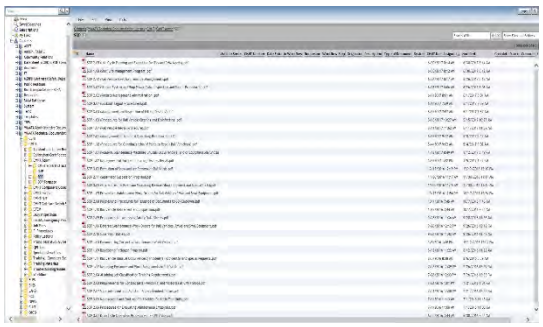
APPENDIX B: DEFINITIONS

DEFINITIONS

Terms and Description	
Automatic Train Operation (ATO) The Automatic Train Operation (ATO) system is that part of ATC which provides automatic train stopping and starting at passenger station platforms and provides speed control compensation for varying conditions of grade and curvature.	
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. Most BTEs require some form of calibration/read out validation.	
Bi-Directional Antenna (BDA) A BDA has two high-gain directions, customarily oriented antithesis to each other in space. It's an omnidirectional antenna that radiates or intercepts radio-frequency (RF) electromagnetic fields equally well in all horizontal directions in a flat, two-dimensional (2D) geometric plane.	
Buy America Section 165 (49 U.S.C. § 5323(j)) of the Surface Transportation Assistance Act, of 1982; not to be confused with the Buy American Act (1933). Applies to purchases related to rail or road transportation that are federally funded. Stipulates that steel, iron and manufactured goods must be domestically sourced and domestically manufactured. Rolling stock has relaxed requirements, and currently specifies domestic content percentages as follows: FY 2016 and FY 2017 – more than 60 percent. FY 2018 and FY 2019 – more than 65 percent, and FY 2020 & beyond – more than 70 percent. https://www.transit.dot.gov/buyamerica.	

DEFINITIONS

Terms and Description

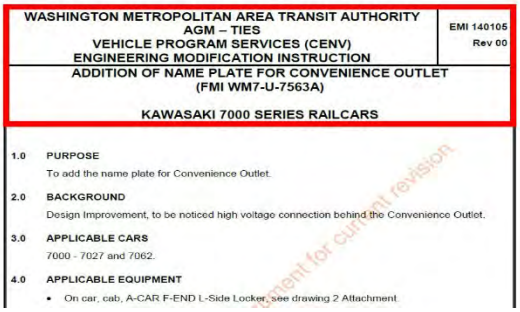
Budget Estimated cost to complete a project. Usually broken down by sub-categories. Constitutes the necessary funds for implementing the project and producing the deliverables.	
Clearance Envelope The space occupied by the dynamic outline (the greatest outline expected given train movement) of the 10'-1¾" wide design vehicle plus an additional allowance of 2" around the dynamic outline.	
Crash Energy Management System (CEMS) The carbody is designed to crush and absorb energy in a controlled manner when subjected to collision-induced end loads that exceed the static load capability of the structure. The carbody structure and supplemental energy absorption devices are designed to absorb maximum energy in a collision without override, telescoping, jackknifing, or overturning while transmitting minimum accelerations to passengers.	
Documentum Software system that provides a single source for documentation storage and controlled access. Long term asset-configuration (e.g. as-builts) should be stored here.	
Door Spindle A mechanism assembled within the railcar door assembly (screw drive system) that as it as rotates it allows the doors to slide to an open position or a close position.	

DEFINITIONS

Terms and Description

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 a developed by Vehicle Engineering groups (CENV, ENGA, & MOWE).



WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
AGM – TIES
VEHICLE PROGRAM SERVICES (CENV)
ENGINEERING MODIFICATION INSTRUCTION

EMI 140105
Rev 00

ADDITION OF NAME PLATE FOR CONVENIENCE OUTLET
(FMI WM7-U-7563A)

KAWASAKI 7000 SERIES RAILCARS

1.0 PURPOSE
To add the name plate for Convenience Outlet.

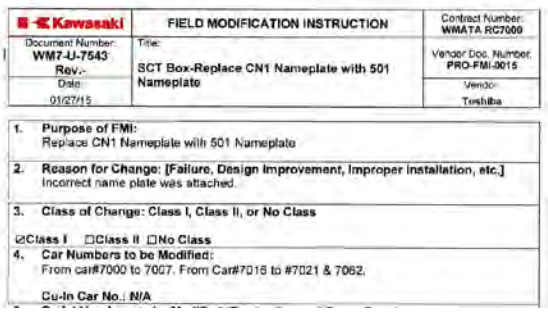
2.0 BACKGROUND
Design Improvement, to be noticed high voltage connection behind the Convenience Outlet.

3.0 APPLICABLE CARS
7000 - 7027 and 7062.

4.0 APPLICABLE EQUIPMENT
- On car, cab, A-CAR F-END L-Side Locker, see drawing 2 Attachment

Field Modification Instruction (FMI)

Generated by the car builder (e.g. Kawasaki) for modifications that will be completed to railcars *prior* to conditional acceptance.



Kawasaki | FIELD MODIFICATION INSTRUCTION | Contract Number: WMATA RC7000

Document Number: WM7-U-7543 Rev.:- Date: 01/27/15

Title: SCT Box-Replace CN1 Nameplate with 501 Nameplate

Vendor Doc. Number: PRO-FMI-0015

Vendor: Toshiba

1. Purpose of FMI:
Replace CN1 Nameplate with 501 Nameplate

2. Reason for Change: [Failure, Design Improvement, Improper installation, etc.]
Incorrect name plate was attached.

3. Class of Change: Class I, Class II, or No Class

☑Class I ☐Class II ☐No Class

4. Car Numbers to be Modified:
From car#7000 to 7007. From Car#7016 to #7021 & 7062.

Cu-In Car No.: N/A

First Article Inspection (FAI)

Performed jointly by the Authority and the Contractor on all major systems and components (example: traction motor), subassemblies and fully assembled Pilot A-car and B-car chosen by the Authority and also the first production A-car and B-car.

Fleet Management Plan

The Metrorail Fleet Management Plan (the Plan) is a statement of the processes and practices by which the Washington Metropolitan Transit Authority (WMATA) establishes its current and projected Metrorail revenue vehicle fleet size requirements and operating spare ratio. It documents how service goals are applied to existing and forecast levels of ridership to establish fleet requirements for Metrorail service, and how these requirements are affected by vehicle maintenance needs, expansions of the Metrorail system, and other factors affecting the operation of the system.

Metrorail

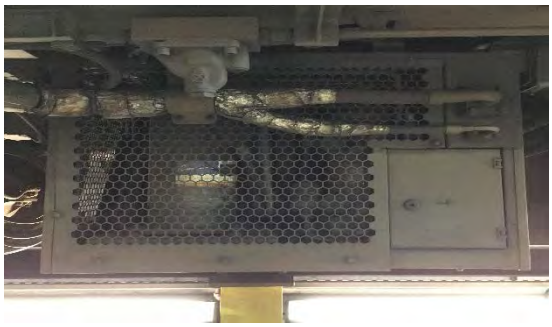
Fleet Management Plan

DEFINITIONS

Terms and Description

Heating, Ventilating & Air Conditioning (HVAC)

HVAC (heating, ventilating, and air conditioning; also heating, ventilation, and air conditioning) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub-discipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics, and heat transfer.



Jumper Cable

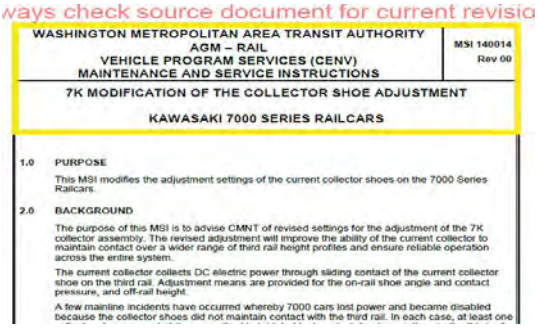
Coaxial cables (jumper cables) are used as flexible connections between radiating cable in the tunnels and control cabinets.

LIDAR

Surveying technology that measures distance by illuminating a target with a laser light. LIDAR units are attached to a high-rail vehicle (allowing travel on the rails) for scanning Metrorail tunnels. The result is a highly accurate survey of the track bed and elements of the tunnel walls.

Maintenance Service Instruction (MSI)

An MSI delineates responsibilities and procedures for performing certain maintenance overhaul/repair functions. MSI documents are developed by Vehicle Engineering group (CENV).


ways check source document for current revisio

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
AGM – RAIL
VEHICLE PROGRAM SERVICES (CENV)
MAINTENANCE AND SERVICE INSTRUCTIONS

MSI 140014
Rev 00

7K MODIFICATION OF THE COLLECTOR SHOE ADJUSTMENT

KAWASAKI 7000 SERIES RAILCARS

1.0 PURPOSE

This MSI modifies the adjustment settings of the current collector shoes on the 7000 Series Railcars.

2.0 BACKGROUND

The purpose of this MSI is to advise CMNT of revised settings for the adjustment of the 7K collector assembly. The revised adjustment will improve the ability of the current collector to maintain contact over a wider range of third rail height profiles and ensure reliable operation across the entire system.

The current collector collects DC electric power through sliding contact of the current collector shoe on the third rail. Adjustment means are provided for the on-rail shoe angle and contact pressure, and off-rail height.

A few mainline incidents have occurred whereby 7000 cars lost power and became disabled because the collector shoes did not maintain contact with the third rail. In each case, at least one

DEFINITIONS

Terms and Description

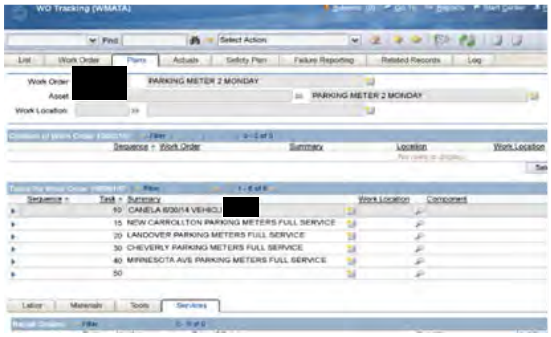
Male and Female Connectors

High performance connectors are designed for use with both copper and aluminium cables. Designed specifically to provide the highest quality connector-cable interface while simplifying and speeding up connector attachment.

Maximo

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

Maximo Work Orders (WO) specifies a particular task and the labor, materials, services, and tools required to complete the task.



Metro Electronic Action Documents (MEAD)

All procurement actions require a MEAD. MEAD documents are required for any action or information item going to the WMATA Board or any of its committees, and for the circulation of procurement-related activities. The MEAD process is intended to assure that documents are complete and that they have had the appropriate levels of review and approval.

On-Site Qualification Test (OST)

OSTs are performed on the first pair or multiple pairs of cars upon delivery to WMATA's acceptance facility. They consist primarily of integrated vehicle qualification tests reliant upon the real-world environment/structures. An example is the 30,000 mile burn-in test simulating revenue service.

Periodic Inspections (PI)

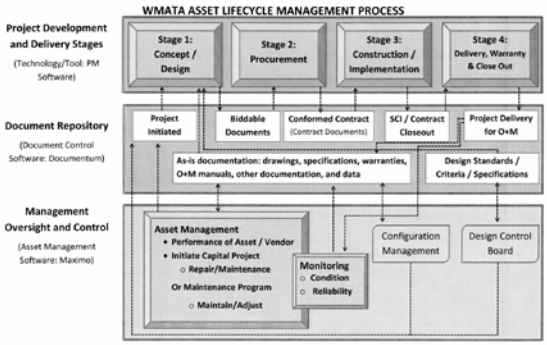
Inspections are conducted at regular intervals at WMATA's service and inspection shops (S&I). With regards to 7000-series railcars, inspections are conducted in rail yards at intervals of 30 days, 90 days, and 180 days, depending upon the type of inspection. Defects are noted for corrective maintenance, and are logged within the Authority's asset management system (Maximo).

DEFINITIONS

Terms and Description

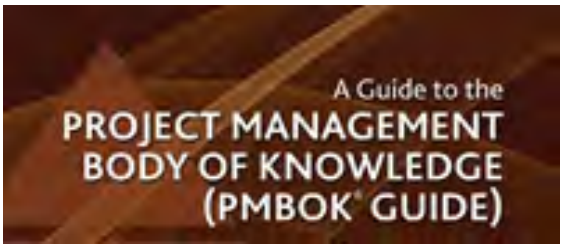
Project Implementation Manual (PIM)

The Project Implementation Manual (PIM) is a guide for WMATA Project Managers. It supersedes the Resident Engineer (RE) Manual, which was used during construction of much of the original 103-mile system. The PIM crystallizes project management into four phases: Concept/Design, Procurement, Construction, and Closeout.



Project Management Body of Knowledge (PMBOK)

A set of standard terminology and guidelines (a body of knowledge) for project management. The PMBOK Guide is intended to be a "subset of the project management body of knowledge that is generally recognized as a good practice."



Project Management Plan (PMP)

A formal, approved document used to guide both project execution and project control. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among project stakeholders, and document approved scope, cost, and schedule baselines.

Project Management Software System (PMSS)

Software for managing project files, including submittals, inspection reports, and references. For many projects at WMATA, Procore is used. At the end of a project, relevant project documents (e.g. engineering modification instructions, as-builts) are moved from the PMSS into WMATA's document repository for long-term storage.

PROCORE™
CLOUD-BASED CONSTRUCTION SOFTWARE

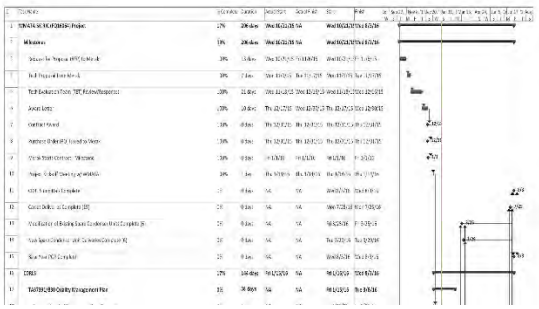
Quality Assurance, Internal Compliance & Oversight (QICO)

QICO provides independent 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.

More information: www.wmata.com/transparency

DEFINITIONS

Terms and Description

Quality Management Plan (QMP) / Quality Assurance Program Plan Quality Management Plan (QMP) ensures that an organization, product or service is consistent. It has four main components: quality planning, quality assurance, quality control and quality improvement. Quality management is focused not only on product and service quality, but also on the means to achieve it.Typically specifies processes for design control, document control, purchasing, inspection and testing, definitions for non-conformance, corrective action procedures, and auditing.	
Radiating Coaxial Cable WAS radiating cable (intended for the WMATA radio system) and CWS radiating cable (intended for cell phone reception) run in parallel along the tunnel walls, terminating at the station boundaries.	
Routine Acceptance Testing (RAT) Performed on every car as part of the on-site commissioning process. Includes static testing, dynamic testing and burn-in testing (100 miles).	
Schedule A listing of a project's milestones, activities, and deliverables, usually with intended start and finish dates.	

DEFINITIONS

Terms and Description

SOP and OAP

An Operations Administrative Policy (OAP) establishes administrative policies applicable to specified Operations administrative and management activities. These policies apply to employees, at all levels. Standard Operating Procedures (SOP) delineate responsibilities and procedures for performing certain Metrorail functions. These are not just limited to safety (e.g. SOP #30 Establishment and Removal of Speed Restriction for the Mainline), but can also refer to engineering procedures.

Washington Metropolitan Area Transit Authority

DEPARTMENTS OF DEPUTY GENERAL MANAGER, OPERATIONS AND ASSISTANT GENERAL MANAGER, BUS SERVICES

Operations Administrative Policy

CATEGORY:		TOPIC:	
Organization and Administration		Operations Administrative Policy (OAP)	
OAP NO.: 100-01	TITLE: Operations Administrative Policy (OAP): Creation, Review, Revision and Rescission		
LATEST REVISION NO.	ORIGINATION DATE	DATE REVIEW DUE	EXPIRATION DATE
8	Unknown	August 28, 2016	None
LATEST REVISION DATE: August 28, 2014	LATEST REVIEW DATE: August 28, 2014		
OAP APPLIES TO: All Departments and Offices reporting to the Department of the Deputy General Manager, Operations (DGMO) and Assistant General Manager, Bus Services			
DEPARTMENT/OFFICE/INDIVIDUAL OF PRIMARY RESPONSIBILITY (OPR): TTDC			
EFFECTIVE PAGES/NOTES: All Pages Changed. New definition of OAP acronym. Now "Operations Administrative Policy". Addition of BUS Departments to administrative groups and matrix. Revised policies. Removed Procedures Section. Finalized OAP matrix.			

Spectrum Analyzer

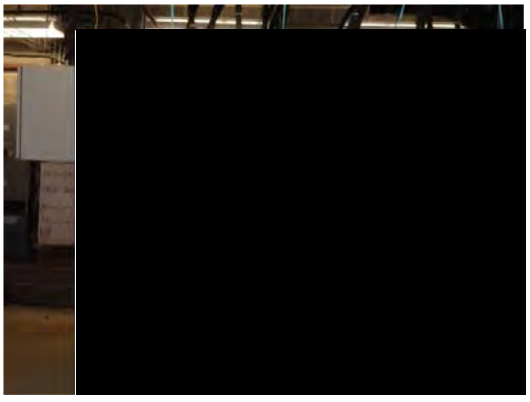
Test equipment widely used within the electronics industry for analysing the frequency spectrum of radio frequency (RF) and audio signals. It measures the magnitude of an input signal versus frequency within the full frequency range of the instrument

Test Track and Greenbelt Commissioning Facility

The Test Track is located alongside Green Line tracks and CSX right-of-way. It is for the testing of the 7000-series rail vehicles before they are put into service. The commissioning facility is located at Greenbelt Yard.

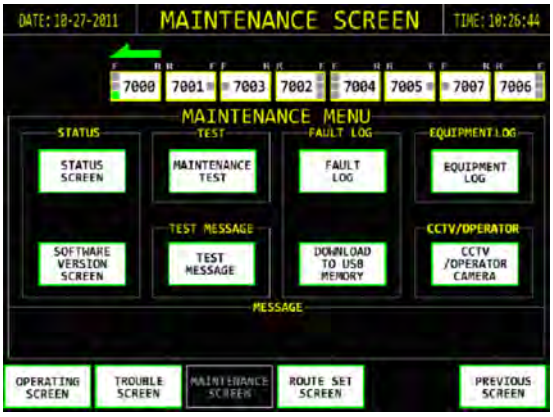
Tie Breaker Station

Tie breakers facilitate power sectionalizing for special track work and other power isolation needs, such as bypassing a section of track (one or both tracks). TBS are located in between two traction power substations (TPSS) and/or near special track work such as double cross-overs. Each TBS observed had either four or five DC circuit breakers installed in a metal enclosed switchgear on a high dielectric insulation pad to isolate it from ground.



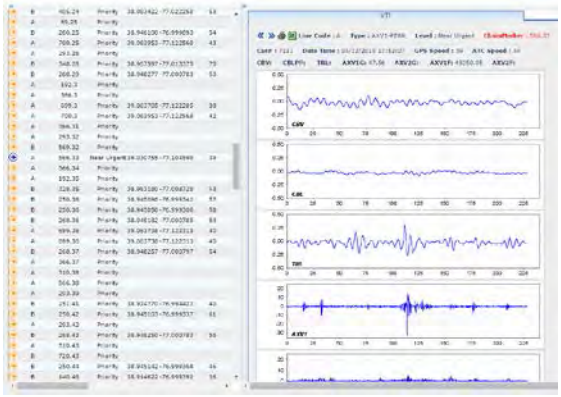
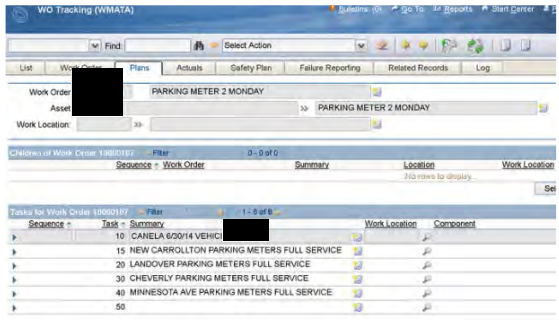
DEFINITIONS

Terms and Description

Traction Power Substation Traction power substations provide power to the Metrorail system. Traction power substations take either 13.8 or34.5 kVA alternating current from a regional power utility and converts it to 750 volts direct current to deliver power to the contact rail and the rail yards. There are more than 100 Traction Power Substations within the system, spaced at one to two miles apart. Within each rail yard, there is a traction power substation for the service and inspection maintenance facility. Each substation facility is designed to accommodate up to three Transformer Rectifier Units (TRUs), each rated at 3000 kW, for a total of 9 MW.	
Train Control Display The VMDS Train Control Display (TCD) on the train operator console is where troubleshooting starts on the 7000-series car. The TCD provides trouble messages and allows the user to troubleshoot down to the system / subsystem and component level. When this is not possible or further troubleshooting is required, such activities are accomplished through the use of a laptop / notebook computer-based PTU.	
Train-to-Wayside Data Transfer (TWDT) The Train-to-Wayside Data Transfer (TWDT) system is a wireless system to connect the onboard network to the wayside network. The TWDT collects and aggregates selected data from the onboard subsystems for transfer to the wayside network and maintenance server and vice versa.	

DEFINITIONS

Terms and Description

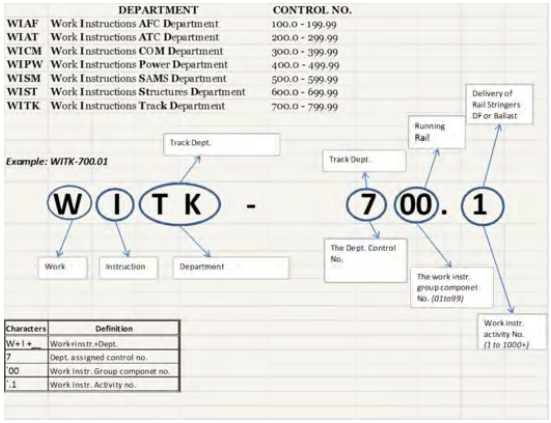
Truck Each railcar has two trucks, each consisting of two wheel and axle sets along with the traction motors (which provide propulsion) and friction brakes. The truck also houses the primary and secondary suspension along with the current collector (which draws power from the third rail).	
Vehicle Monitoring and Diagnostic System (VMDS) The VMDS collects consist and equipment information via its Ethernet and Multifunction Vehicle Bus (MVB) interfaces. The VMDS detects the equipment statuses from all cars in a consist and displays them as trouble messages on the Train Control Display (TCD) when outside of normal operating parameters. The VMDS Fault Log records events from all monitored systems.	
Vehicle Track Dynamic Monitor System (V/TI) A ride quality system that measures carbody lateral, carbody vertical, truck lateral, and axle vertical accelerations. 7000 series cars are equipped with a system of accelerometers that are mounted on 15% of the B cars.	
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.	

DEFINITIONS

Terms and Description

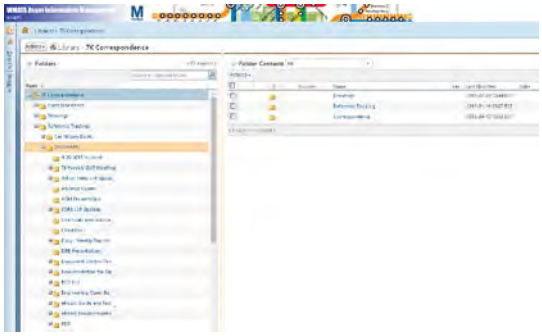
Work Instruction

Work procedures used for a particular maintenance or construction task. Each maintenance department typically has a set of work instructions for their body of work.



Windchill

Product Lifecycle Management (PLM) software used across the Authority for Parts Action Forms (PAF), and used for document control when applicable.



Other Terms

Capital Needs Inventory (CNI)

A list of WMATA's performance/safety needs (investments that maintain and replace assets on a regular life cycle basis in order to deliver the same level of service) and customer/demand/safety needs (investments that help meet growing ridership and improve the rider's experience).

Conditional Acceptance (CA)

Conditional acceptance indicates that the cars and parts meet minimum standards for revenue service. Transit cars are accepted as four car (quad) units. At its discretion, the Authority may conditionally accept the cars when not completely conforming to the specifications in all respects.

Contingency

Refers to costs that will probably occur based on past experience, but with some uncertainty regarding the amount. As risks occur on a project, and money is needed to pay for them, the contingency can be transferred to the appropriate accounts that need it.

Contracting Officer (CO)

An employee with authority duly delegated from the powers of the Chief Procurement Officer to legally bind the Authority by signing a contractual instrument. The Contracting Officer is the Authority's primary point of contact for pre-award administration, modifications above the limits of the Contracting Officer Representative, and Final Settlement.

DEFINITIONS

Terms and Description

Contracting Officer's Technical Representative (COTR)

An authorized representative appointed by the Contracting Officer. The Contracting Officer's Technical Representative performs those contract administration functions specifically delegated in writing by the Contracting Officer. COTRs have no contractual authority and cannot enter into contractual agreements.

Design Qualification Test (DQT)

DQTs are performed once if successfully completed, or unless otherwise specified. They are performed on individual components, systems, and vehicles primarily before vehicle delivery. Examples include the event recorder crashworthiness test and railcar seat deflection tests.

Distributed Antenna System (DAS)

A network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure.

Failure

Any malfunction that requires unscheduled equipment maintenance action, repair, or replacement. Some failures are non-chargeable (not the constructor's fault), as they may have been caused by operator error or failure to follow procedures.

Factory Acceptance Testing (FAT)

FATs are performed on all vehicle equipment during its manufacture, installation, and performance verification before vehicle delivery. Examples include truck frame magnetic particle inspections and final functional tests.

Force Account

The term for WMATA employees (in-house) engaged in construction work.

Master Radio Controller

The hardware and related software that manages the radio system communication traffic. It also continuously monitors the status of the system and can diagnose system issues.

Master License Agreement

In a typical licensing agreement, the licensor grants the licensee the right to produce and sell goods, apply a brand name or trademark, or use patented technology owned by the licensor. In exchange, the licensee usually submits to a series of conditions regarding the use of the licensor's property and agrees to make payments known as royalties.

As an example, the Radio Project Agreement between WMATA and the four major cell phone carriers, negotiating the leasing of Metrorail tunnel walls for the provision of cell phone service.

Mean Distance Between Delays (MDBD)

Typically expressed as a fleet-wide average, MDBD is the mean revenue service mileage between passenger delays of four or more minutes on mainline track. Delay information is gathered from the Authority's asset management system (Maximo), and MDBD values can differ depending upon the end user. For example, delays caused by sick passengers are pruned out of reliability statistics for the 7000-series contract, as they do not suggest an issue with the quality of the railcar.

As stated in the contract, required vehicle level MDBD = 200,000 miles.

DEFINITIONS

Terms and Description

Mean Distance Between Failures (MDBF)

Defined as the ratio of the total operating miles accumulated to the total number of chargeable failures; not all equipment failures result in delays to operation. Expected MDBF values for subsystems (HVAC, propulsion, etc) are specified in the technical specification of the contract.

As stated in the contract, required vehicle level MDBF = 20,080 miles.

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.

Neutral Host

Not carrier-specific. Radiating coaxial cable for cellular service will be useable by the four major cell-phone carriers.

Project Management

Project management is the centralized management to plan, organize, control and deploy key milestones, deliverables and resources from conception through retirement, according to customer goals.

Program Management

Programs encompass a series of projects that in aggregate achieve an overarching set of objectives. Program management is the active process of managing multiple global work streams or projects which need to meet or exceed business goals according to a pre-determined methodology or life-cycle.

Project Work Plan

A formal, approved document used to guide both project execution and project control. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among project stakeholders, and document approved scope, cost, and schedule baselines.

Railcar Availability

The probability that a car will be in operable condition and suitable for revenue service. The Availability is defined as ratio of the total number of cars available for revenue service (S) to the total number of cars in the reliability test fleet (F). The Authority requires high availability of its railcars, in particular to meet the requirements of the a.m. and p.m. peak periods. The fleet Availability must be 85%. The calculation of Availability is performed twice daily at 7:00 a.m. and 3:00 p.m., Monday through Friday (with the exception of holidays).

Quality Assurance

Quality Assurance is a set of activities for ensuring quality in the process or construction (e.g. reviewing specifications, developing work instructions).

Quality Control

Quality Control typically involves inspection and in-field testing of constructed (or manufactured) elements, noting discrepancies that will be tracked to closure.

DEFINITIONS

Terms and Description
Scope Involves determining and documenting a list of specific project goals, deliverables, features, functions, tasks, deadlines and ultimately costs.
Soft Cost Project-related costs other than actual construction. Examples include design costs, project administration costs and other oversight cost.
Warranty A written guarantee issued by the contractor promising to repair or replace railcar components within a specified period of time after conditional acceptance. Section 12 of the Special Provisions to the 7000-series contract details the warranty for the various railcar systems, and defines what equipment failures merit a warranty claim.

APPENDIX C: POWER SYSTEM UPGRADE DOCUMENT REVIEW AND FIELD ASSESSMENT

QICO INTERNAL REVIEW
Summary of Document Review

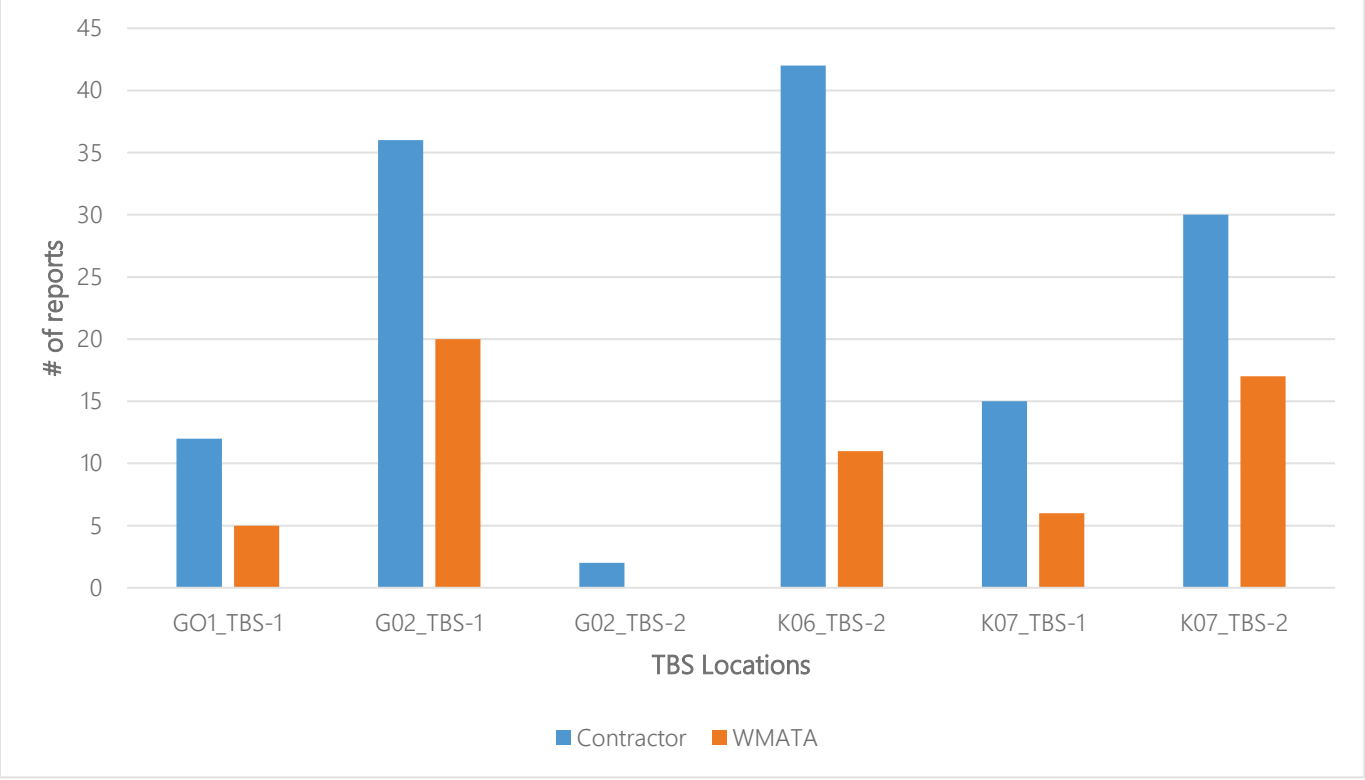
SUBJECT	FQ15237R Six (6) Tie Breaker Stations Upgrade Orange and Blue Lines VA, DC, MD
DATE	December 2016 to September 2017

OVERVIEW

Document	Issues Noted
WMATA Daily Reports	- The WMATA sign-in sheet did not have any indication that it was a WMATA form - 13% of the WMATA records did not have sign-in sheets attached (8 out of 59) - There were more contactor reports than WMATA reports.

Volume of Contractor Daily Reports vs WMATA Daily Reports

Daily reports from December 2016 - September 2017



SUBJECT	Systra Report and the 100% 8-Car Train Program Scope Comparison
DATE	September 2017

OVERVIEW	
Document	**Description**
11-FQ10061-ENSS-01 Service Evaluation Study (Systra Report)	- The project team indicated this 2012 report provided the scope for the 100% 8-Car Train Project. The report identifies nine scope elements for WMATA to address to achieve 100% 8-Car Train service as defined as running all 7000 series eight car train consists at two minute headways. The report identifies two scope elements not present in the Program Plan: changing the nominal traction power voltage and installing composite contact rail. WMATA elected not to change the nominal voltage and not to pursue adding composite rail, which are not identified in the 100% 8-Car Train Program Plan.
100% 8-Car Train Power Upgrades Program Plan	- The project team indicated this document identifies the current deliverables for the project and the schedule for completion of the entire program. This document provides five scope elements, four of which correllate to the Systra report scope elements when encorporatding the elements denoted with a (*). The fifth scope element is an additional scope element not present in the Systra report recommended scope elements; this is denoted with an (†).

Scope Element Comparison – Orange Line

Identified Scope Element	# of TPSS Upgrades	Upgrade Rectifier Main Circuit Breakers	Upgrade DC Circuit Breakers	# of TBS Upgrades	Positive Feeder Cables	Negative Return Cables	Negative Cross Bond Cables	Linear feet of Cable
Systra Report	11	13	37	5	87	67	10	†
Program Plan	9	*	*	9	32	*	20	130,767

Scope Element Comparison – Blue Line

Identified Scope Element	# of TPSS Upgrades	Upgrade Rectifier Main Circuit Breakers	Upgrade DC Circuit Breakers	# of TBS Upgrades	Positive Feeder Cables	Negative Return Cables	Negative Cross Bond Cables	Linear feet of Cable
Systra Report	6	3	11	11	46	39	9	†
Program Plan	8	*	*	9	31	*	20	68,200

Scope Element Comparison – Red Line								
Identified Scope Element	# of TPSS Upgrades	Upgrade Rectifier Main Circuit Breakers	Upgrade DC Circuit Breakers	# of TBS Upgrades	Positive Feeder Cables	Negative Return Cables	Negative Cross Bond Cables	Linear feet of Cable
Systra Report	11	16	36	9	50	16	12	†
Program Plan	16	*	*	26	0	*	10	106,050

Scope Element Comparison – Green Line								
Identified Scope Element	# of TPSS Upgrades	Upgrade Rectifier Main Circuit Breakers	Upgrade DC Circuit Breakers	# of TBS Upgrades	Positive Feeder Cables	Negative Return Cables	Negative Cross Bond Cables	Linear feet of Cable
Systra Report	5	10	9	7	22	29	12	†
Program Plan	13	*	*	16	0	*	0	71,400

Scope Element Comparison – Yellow Line								
Identified Scope Element	# of TPSS Upgrades	Upgrade Rectifier Main Circuit Breakers	Upgrade DC Circuit Breakers	# of TBS Upgrades	Positive Feeder Cables	Negative Return Cables	Negative Cross Bond Cables	Linear feet of Cable
Systra Report	41,000	4	7	3	6	14	9	2
Program Plan	0	1	*	*	1	0	*	0

WEST FALLS CHURCH and DUNN LORRING Tie Breakers

OR

Field Assessment Overview

QICO Assessment Team	M. Jimoh & R. Ganeriwal		
Assessement Date/Time	October 04, 2017 10:20am – 2:20pm	Contract	FQ15237R 6 Tie-Breaker Station Upgrade Orange an Blue lines VA, MD, DC
Activity	Tie Breaker Station Upgrades	Contractor	Clark Construction

Descriptions

WMATA Tie Breaker Stations (TBS) facilitate power sectionalizing for special track work and other power isolation needs, such as bypassing a section of track (one or both tracks). TBS are located in between two traction power substations (TPSS) and/or near special track work such as double cross-overs. Each TBS observed had either four or five DC circuit breakers installed in a metal enclosed switchgear on a high dielectric insulation pad to isolate it from ground. The newly installed equipment replaced older equipment to facilitate increased load currents required for operating newer trains and continuous 8-car trains through the system; provides new monitoring capabilities; as well as end-of-life of replacement of electrical equipment.

Tie Breaker Locations

Work Observed

QICO performed an assessment of the installation of equipment in two (2) TBS, K06 TBS – 2 Greenwich St and K07 TBS – 2 Prosperity Ave, that have been upgraded through the contract *FQ15327R Six Tie Breaker Station Upgrades Orange Blue Lines VA, DC, and MD*. These stations were turned over to operations on July 28, 2017 and August 21, 2017 respectively, but still have outstanding punch list items.

The QICO field team confirmed installation was in compliance with the contract design specifications by verifying and inspecting equipment at K06 TBS 2 Greenwich St and K07 TBS 2 Prosperity Ave tie breaker stations, tasks included observing:

- Equipment grounding and bonding of various equipment to station ground bus and grid
- Installation normal and emergency pendent mounted lighting
- Installation of new 480V and 208V panels
- Installation of various 15 KVA and 3 KVA transformers as scope required
- Installation of new battery plant
- Installation of new battery monitor
- Installation of new battery charger
- Installation of new DC surge arrestors for breakers
- Installation of new 200A enclosed circuit breaker
- Installation of DC breaker test cabinet
- Installation of digital trace recorder
- Installation of shield monitoring relay
- Installation of new DC switchgear and its clearances from grounded structures
- Installation of protective relays on DC breakers – Microprocessor Relay (MPR) relay, hot structure relay, cable shield relay
- Confirm installation of SCADA equipment:
  - Human Machine Interface (HMI)
  - Remote Terminal Unit (RTU) panel
  - Distributed Input/Output (DIO) panel

Areas for Improvement	
Area of Review	**Description**
Scope Management	The contract requires the installation of electrolyte absorbing "pillows" beneath the battery bank (*FQ15237R: Section 16265, Part 1, 2.2 A., 6 Battery Electrolyte Spill Containment*), in the event of liquid spillage from the batteries. The pillows are not present at K06 TBS – 2 because they were installed by the office of Traction Power Maintenance (TRPM) prior to the initial advertisement of the contract.

APPENDIX D: 7000-SERIES RAILCAR PROGRAM INFORMATION

7000-SERIES RAILCAR PROJECT OVERVIEW

Overview

Concept and History

The 7000-Series Railcar Project is a major capital project to acquire up to 748 new railcars. By 2020, the 7000-series will comprise more than 50% of the Metrorail fleet; the 7000-series has a projected asset life of 40 years. In comparison to other railcar procurements in North America, significant grant money from the FTA is used to fund the 7000-series project; because of this, the 7000-series program has periodic reporting requirements to the FTA along with additional manufacturing requirements (e.g. Buy America). [redacted]. At this point (October 2017), all five options have been approved by the Board.

7000-Series Railcar Procurement			
Contract Options	Reason	Number	Est. Cost**
Base Contract	Dulles Phase I	*64 cars	125 M
Option #1	Dulles Phase II	64 cars	125 M
Option #2	Growth 75% Eight-Car Trains	130 cars	255 M
Option #3	4000 Series Replacement	100 cars	196 M
Option #4	1000 Series Replacement	300 cars	588 M
Option #5	Growth 100% 8-Car Trains	90 cars	176 M
	Total	748 cars	1.47 B

**Includes four pilot cars and four prototype cars*
***Calculated by multiplying the number of cars by the purchase price indicated for each asset in Maximo.*

The 7000-series represents a break with the past railcar procurements, which all maintain interoperability and backwards compatibility with the 1000-series cars. In other words, during revenue service, trains cannot be a combination of 7000-series cars and any other railcar series due the technological advances in train control and communication system.

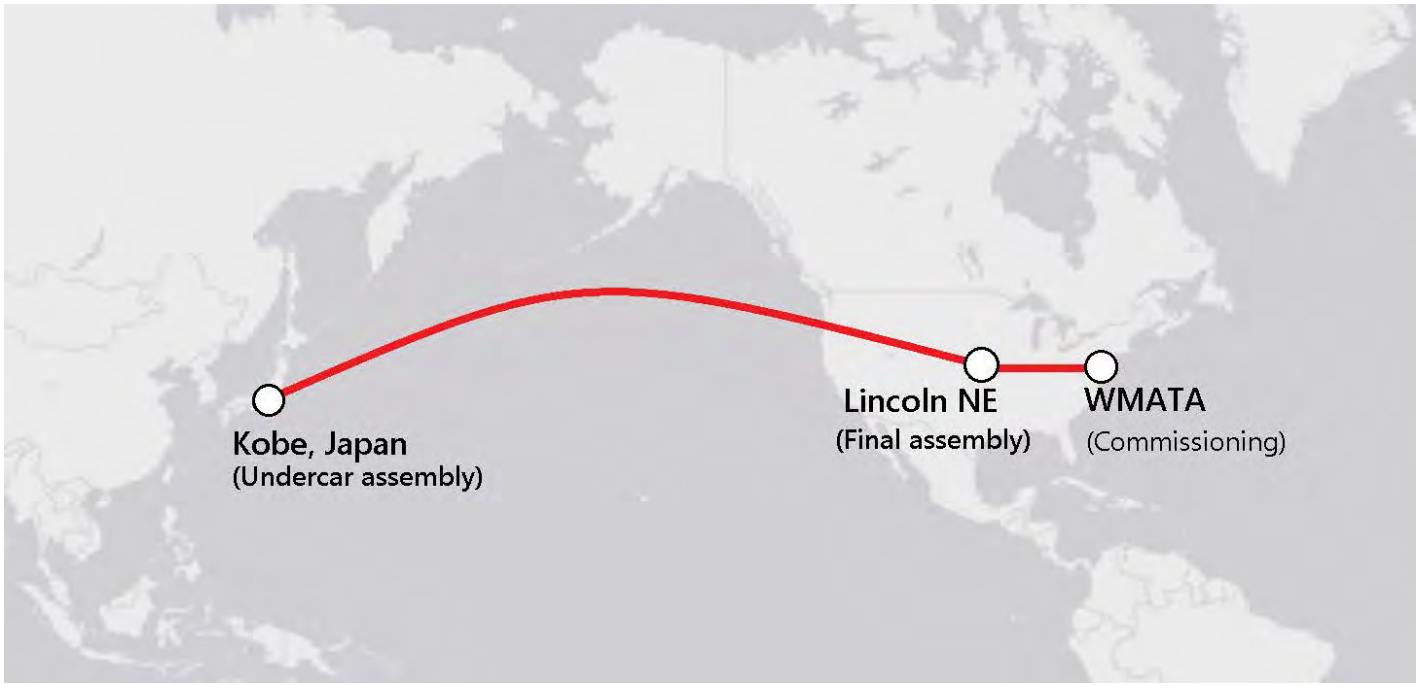
Design & Concept (2007-2009) → **Procurement (2009-2010)** → **Manufacturing & Assembly (2012 - Present)** → **Delivery & Commissioning (2013 - Present)** → **Closeout**

The concept and initial specifications were developed from 2007-2008, with the request for proposal issued in January 2009. Kawasaki was awarded the contract in March 2010. Hard-mockups of the interior (display only) were delivered to WMATA in October 2012; the first four cars (quad) were delivered to WMATA in January 2014. The first 7000-series train subsequently entered service on the Red line on June 8, 2015. As of October 1, 2017, more than half (420) of the 748 cars under contract have been accepted.

7000-SERIES RAILCAR PROJECT OVERVIEW

Overview

7000-Series Assembly, Delivery and Commissioning



In order to meet Buy America requirements, over 60 percent of the 7000-series cars must be domestic content, and final assembly must be completed in the United States. As a result, only the assembly of the undercar occurs in Kobe, Japan by Kawasaki Heavy Industries (KHI). WMATA's quality team has representation to observe and safeguard this process. Final assembly of the car is conducted by Kawasaki Motors Manufacturing (KMM) in Lincoln, Nebraska; WMATA's resident inspectors provide quality assurance (e.g. checking welds, concealed wiring work) and ensuring field modifications occur upstream.

Cars are shipped by motor carrier to WMATA's Greenbelt Yard; commissioning is conducted before WMATA issues a conditional acceptance (CA) of a 7000-series vehicle. Steps include:

1. Receiving inspections (damage occurring due to shipment)
2. Static testing - checks of all train functions in the commissioning facility
3. Dynamic testing - observing proper braking, propulsion, and ATC functions on the test track
4. Burn-in testing - 100 miles of simulated revenue service to ensure proper stopping at stations, maneuvering through interlockings, etc.

Upon condition acceptance, WMATA assumes ownership of the car, with Kawasaki Rail Car (KRC) providing warranty support as defined in the contract's special provisions. Each railcar has a two-year "bumper-to-bumper" warranty, 10 years for the carbody, and five years for traction motors.

Project Organization

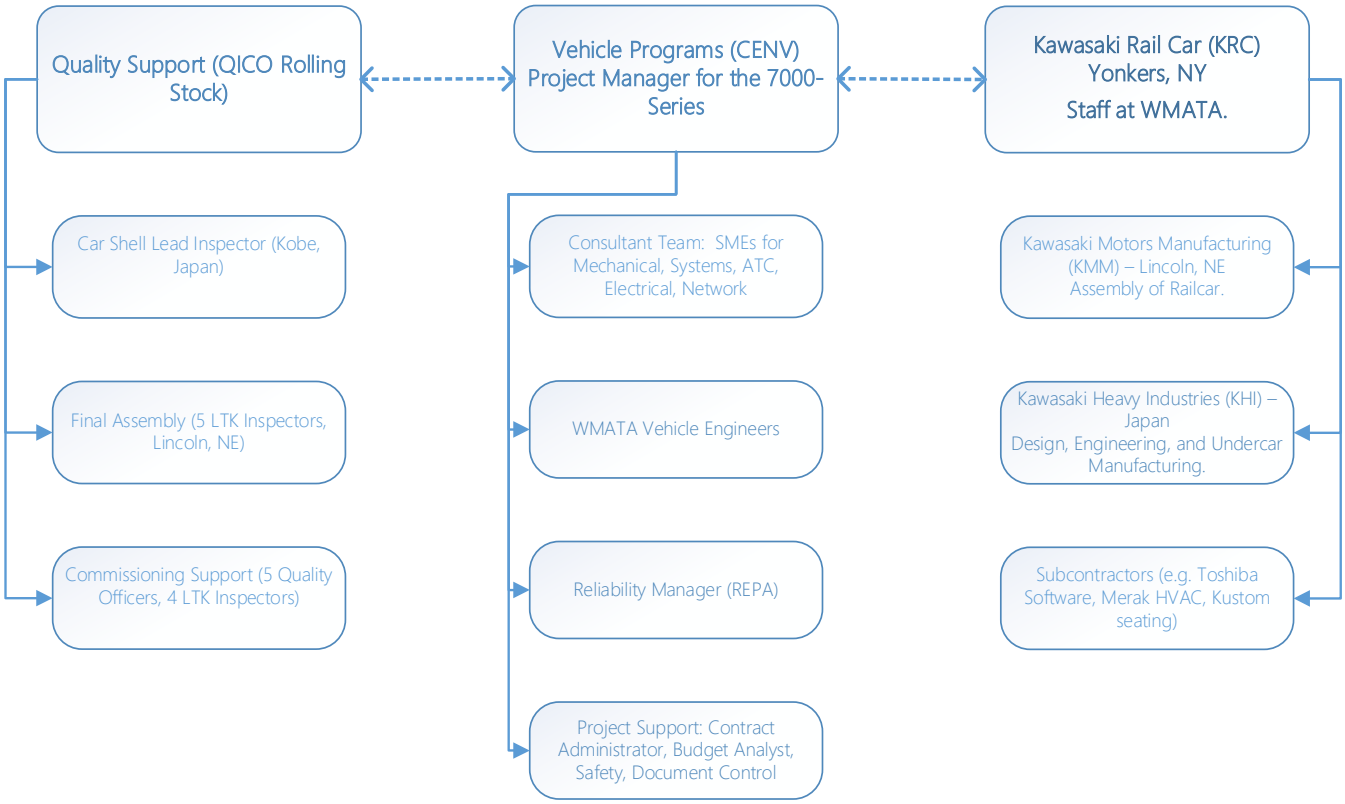
WMATA's project management for the 7000-series car is responsible for ensuring the car builder delivers a railcar in accordance with contract documents and the project proceeds within scope, schedule, and budget. The end goal is for the 7000-series car is the most reliable car series at WMATA, holding the contractor responsible for major issues encountered with the final product.

To accomplish this, a team of WMATA and consultant subject matter experts (SMEs) compile and maintain a list of engineering issues requiring closure by the car builder. Many issues arise from observing cars during mainline operation and tracking reliability data produced from daily rail operation. Joint meetings are conducted between the car builder, WMATA engineers and WMATA quality officers with regard to warranty and reliability issues. WMATA's office for reliability, engineering, and performance analysis (REPA) provides support by providing 7000-series reliability statistics and scrutinizing statistics provided by the car builder. The

Overview

project team produces engineering modification instructions (EMI) for vehicles requiring equipment and configuration changes post conditional acceptance (after it becomes WMATA property).

The quality team for the project is the rolling stock assurance team from Quality Assurance, Internal Compliance & Oversight (QICO). Its reporting structure is independent of the 7000-series project management and the quality manager can refuse signing off on conditional acceptance of a railcar; however, with regards to contractual matters the responsibility ultimately lies with the CENV project manager (as the designated contracting officer's technical representative). The quality team largely consists of contracted inspectors at all points in the delivery process (Kobe Japan, Lincoln NE, and Greenbelt Yard). Quality manages a list of quality control open items for each car; cars can be approved for conditional acceptance (CA) while having open items, but the goals is to reduce or eliminate this list over time.

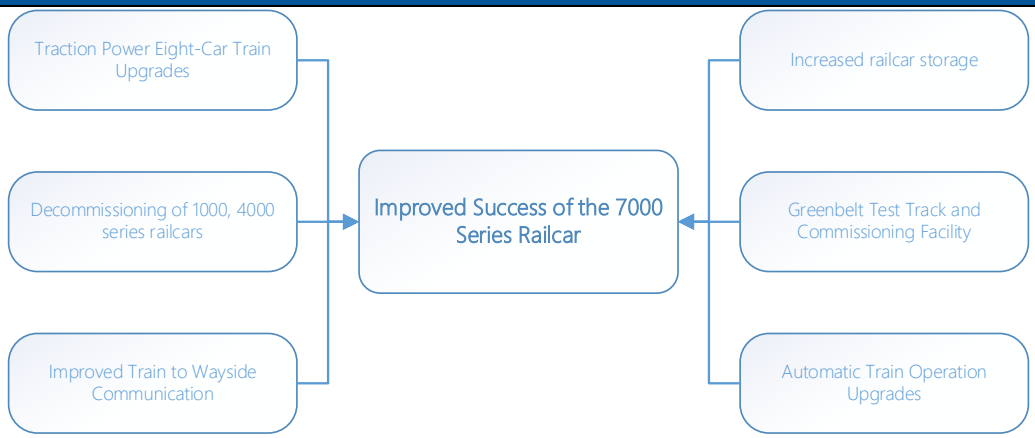


Dependencies Impacting The Strategic Effectiveness Of The 7000-Series

The effectiveness of the 7000-series railcar has a number of dependencies on other Authority initiatives. Some of these are long term strategic programs (traction power upgrades) that broadly affect train performance, whereas others have direct effects on the 7000-series project (test track).

7000-SERIES RAILCAR PROJECT OVERVIEW

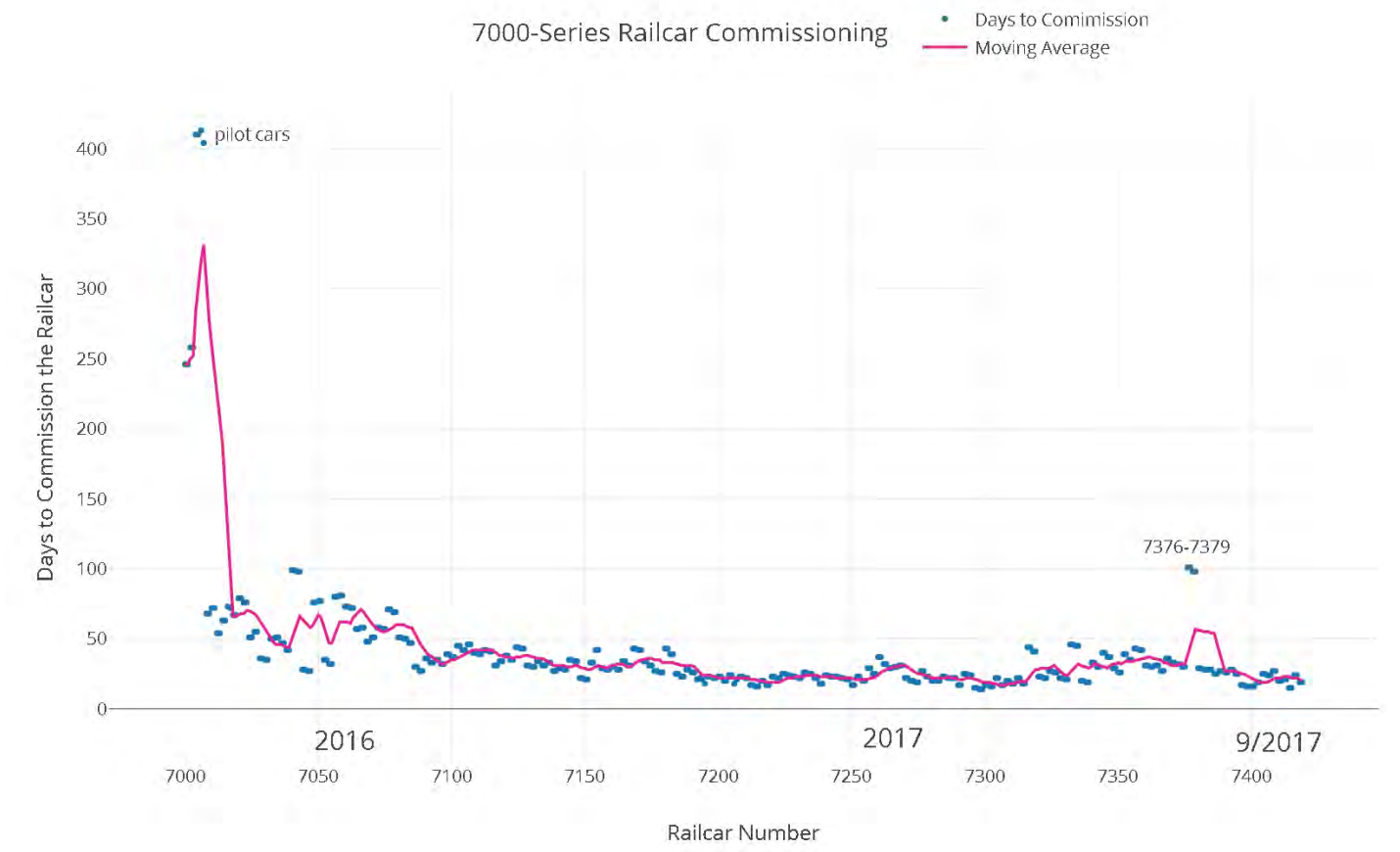
Overview

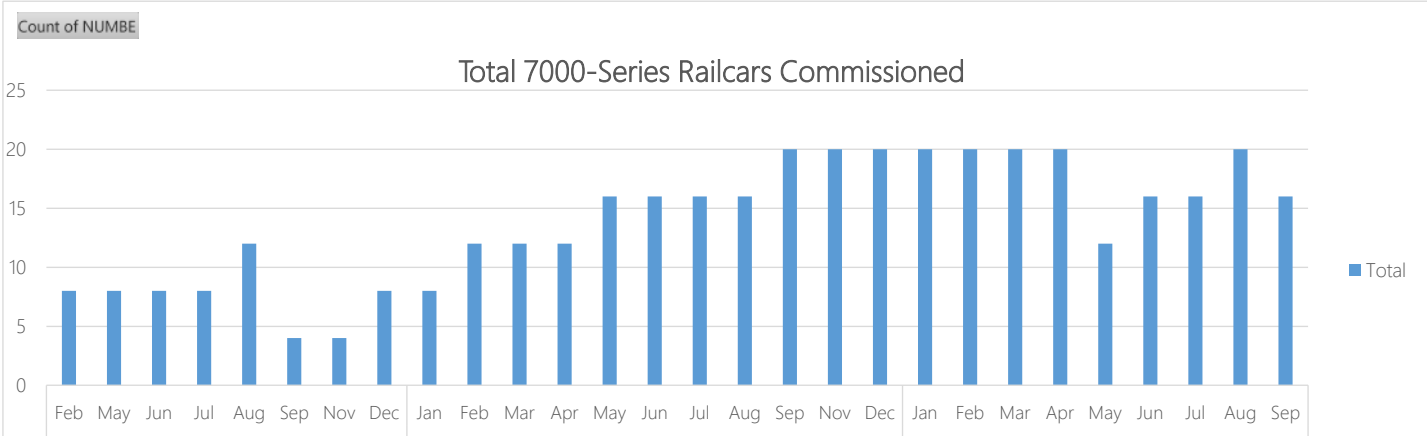


Dependency	Status	Overview	Risks
100% Eight-Car Train Upgrade Project	In-Progess	7000-series cars typically operate in eight car consists, which draw more power; some traction power zones are not adequately configured for 100% eight-car train operation during peak service hours. Orange/Blue line upgrades complete by 2021, with the rest of the system by 2028. The project also will potentially address regenerative braking upgrades.	Inability to operate at peak vehicle requirements safely.
Decommissioning of 1000, 4000, 5000 Series Cars	Complete In-Progess	1000 and 4000-series cars have been decommissioned and largely removed from the property. 5000-series cars are in decommissioning process. Project to remove 2000 and 3000-series initiated (CENV).	Decreased fleet reliability, storage concerns.
Train-to-Wayside-Data-Transfer (TWDT)	In-Progess	Higher bandwidth, wireless train-to-wayside data transfer at yards and passenger stations. Wi-Fi is now present at all yards, and TWDT software is to be installed on the entire fleet by November 2018. Some passenger stations are outfitted for TWDT.	Less-than-optimal asset/maintenance management.
Increasing Railcar Storage (Dulles)	In-Progess	The 7000-series railcar project along with the decommissioning of old cars will result in a net addition of approximately 200 railcars to the fleet by 2020. This coincides with the addition of Dulles Yard by 2020, with a projected capacity for 178 new railcars.	Storage concerns for increased fleet from 7000-series procurement.
Test Track and Commissioning Facility	Complete (Late)	Dedicated test track and commissioning facility for 7000-series static and dynamic testing. The test track was delivered late, which impacted early commissioning of the 7000-series. Both the test track and commissioning facility are operational.	Inefficiency to 7000-series commissioning and testing.
Automatic Train Operation Upgrades	Complete	Automatic Train Operation allows for smoother acceleration and breaking. System was taken offline after the 2009 Fort Totten crash to replace ATC infrastructure. Upgrades are complete but the system is operating in manual mode due to roadway worker protection issues.	Decreased ride quality, increased energy consumption.

COMMISSIONING HISTORY OF 7000-SERIES THROUGH SEPTEMBER 2017

Chart



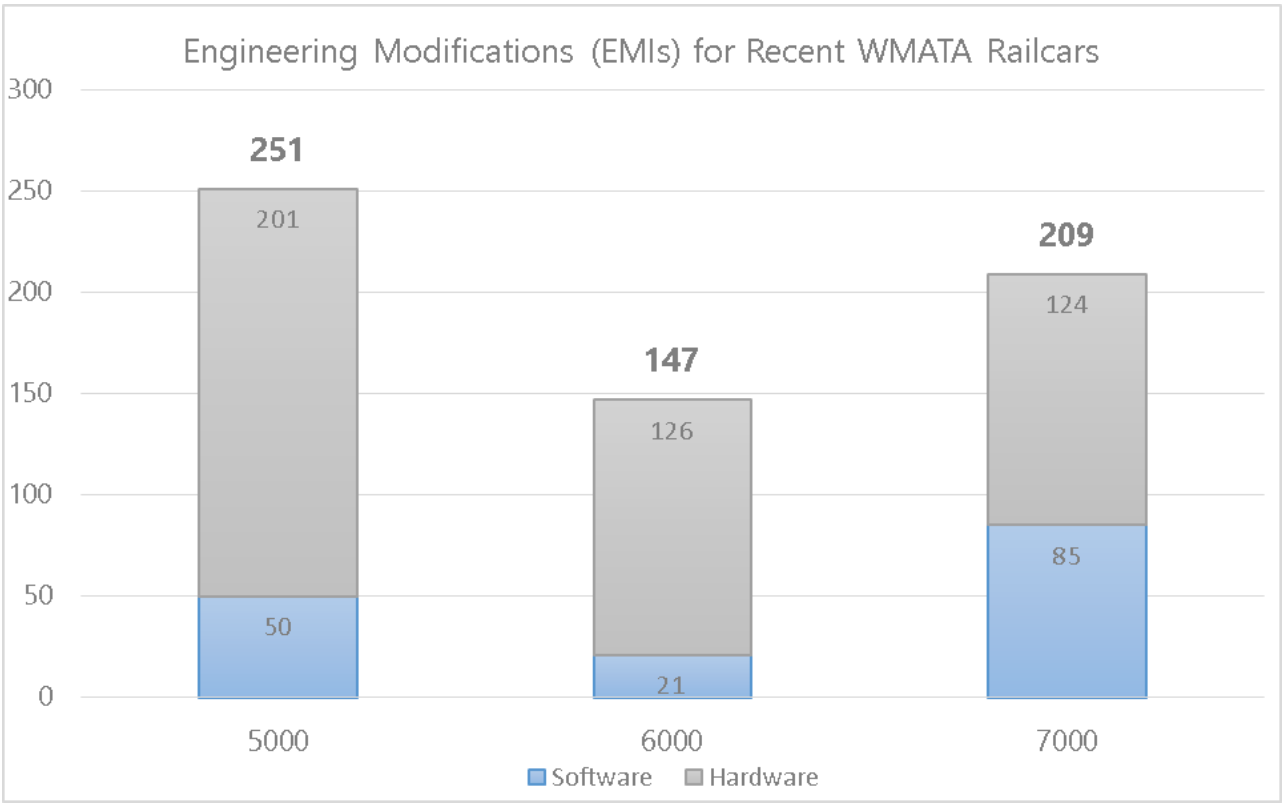


ENGINEERING MODIFICATION INSTRUCTION NUMBERS

Chart

Transit railcars are generally not interchangeable across transit systems due to differing operating environments, power requirements, station layouts and track geometry. Thus, railcars procurements are highly specialized orders that lack economies of scale, which can make ensuring quality a challenge. Inevitably, some issues do not arise until after railcars are used extensively in revenue service (in spite of pilot-car testing); in such cases, Engineering Modification Instructions (EMIs) are necessary to retroactively make changes to the fleet after conditional acceptance. Nonetheless, it is preferable to catch these problems and resolve them earlier in the process.

The total number of Engineering Modification Instructions (EMIs), or configuration changes issued after conditional acceptance, issued during the 7000-series program is higher than that of the WMATA 6000-series vehicle, but lower than the 5000-series. In contrast to the other procurements, the 7000-series has a high percentage of software EMIs (85, or 40% of the total); these changes are usually easier to implement, as the software upgrades can be uploaded to each train consist through the train network. With regards to hardware changes, the 7000-series has had the same number of modifications as the 6000 series.



APPENDIX E: RADIO INFRASTRUCTURE FIELD ASSESSMENTS

APPENDIX D: RADIO PROJECT FIELD ASSESSMENT REPORTS

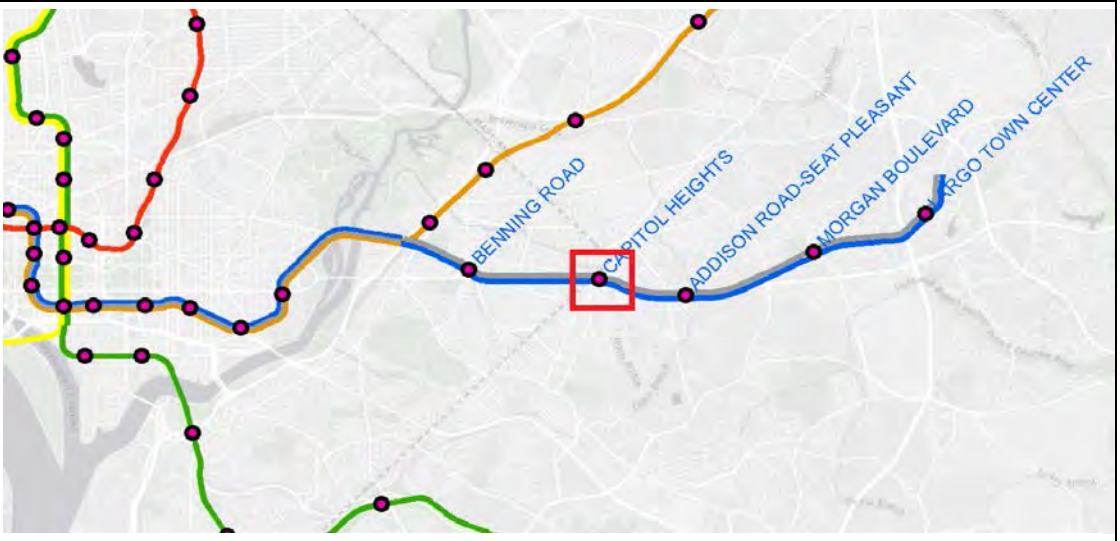
Table of Contents

1. CAPITOL HEIGHTS

BL SV

Field Assessment Overview			
QICO Assessment Team	M. Alexander		
Assessement Date/Time	July 18/19, 2017 / 10:00pm – 4:30am	Activity	Jumper Cable Installation
Departments	Infrastructure Renewal Program Group (IRPG)	Contractor	C3M

WORK OBSERVED

Site Map	
Work Observed	QICO's infrastructure assurance group observed contractor C3M (supervised by WMATA FACP) install coaxial cables at Capitol Heights metro station during the midnight shift: - WAS radiating cable (intended for the WMATA radio system) and CWS radiating cable (intended for cell phone reception) run in parallel along the tunnel walls, terminating at the station boundary. A strut channel and hanger system is used to advance radiating cables across columns - Coaxial cables (jumper cables) are used as flexible connections between radiating cable in the tunnels and control cabinets. The work observed involved installing coaxial cable to form a connection between cell phone radiating cable to the Remote Hub Group (RHG) cabinet in the station. - C3M personnel drilled 3/8" holes in the station concrete walls and subsequently installed wedge anchors ("thunder studs") and clips to guide jumper cables to the RHG. - At the RHG, personnel used a hacksaw to cut jumper cable in order to install a connector fitting. A male connector fitting was installed onto the jumper cable for connection to the RHG. - In the tunnel, personnel connected the jumper cable to the radiating cable using 7-16 DIN female and male connectors.

AREAS FOR IMPROVEMENT	
Area of Review	**Description**
Compliance with Standards	The contractor (C3M) did not have installation instructions/guidelines and drawings on hand at all times. It was not apparent that all personnel knew the specifics on the installation of the new equipment. There was confusion on how the jumper cable should be positioned over the station portal. Design drawings show jumper cable parallel to concrete wall on the face of tunnel portal. Location: Capitol Heights Platform (Track 2)
Follow Up: Radio project management team informed QICO that installation instructions/guidelines was located in the cab of the Prime Mover which was used to transport the field personnel and materials throughout the system.	

2. BENNING ROAD & FAN SHAT FG03

BL SV

Station Assessment Overview			
QICO Assessment Team	M. Alexander		
Assessement Date/Time	July 19/20, 2017 / 10:00pm – 4:30am	Activity	Juper Cable Installation
Departments	IRPG	Contractor	C3M

WORK OBSERVED

Site Map	
Work Observed	QICO observed the installation of jumper cables (coaxial cables) at Benning Road Metro Station and Fan Shaft FG03 during the midnight shift: - C3M assessed the amount of jumper cable needed for to connect the Remote Hub Group (RHG) cabinet to the radiating cable connection in the tunnel. - C3M used a 3/8" drill bit to bore holes into the concrete station end wall for wedge anchors (thunder studs) and clip installation - C3M positioned jumper cable for connection between the RHG and the radiating cable connection in the tunnel. - For the connection between the jumper cable and the CWS radiating cable (intended for tunnel cell phone reception), C3M personnel applied a blowtorch flame to activate heat shrink sealant. A 7/16" DIN male connector ensures a proper cable connection. - C3M installed a chain barrier in Fan Shaft FG03. - C3M installed clips into the tunnel crown to guide jumper cable over track to the fan shaft corridor.

AREAS FOR IMPROVEMENT	
Area of Review	**Description**
Performance of work	C3M (contractor) ran out of materials (Cold Shrink Sealing Kit) towards the end of the work shift. This resulted in C3M wrapping the ends of both the jumper cable and radiating cable in plastic bags and elastic bands. Field personnel should have all requisite materials to execute work properly. Location: Fan Shaft (FG03)

3. FAN SHAFT FG04

BL SV

Station Assessment Overview			
QICO Assessment Team	M. Alexander		
Assessement Date/Time	July 20/21, 2017 10:00pm – 4:30am	Activity	Jumper Cable Installation
Departments	IRPG	Contractor	C3M, GFP

WORK OBSERVED	
Site Map	
Work Observed	QICO performed a field assessment observing the installation of four jumper cables (coaxial cables) at Fan Shaft FG04 during the midnight shift: - Prior to work, radiating cable and jumper cables were situated on bendable cable tray (snake tray) before the application of male and female connectors. Jumper cables were situated in the fan shaft corridor for the future location of a Remote Hub Group (RHG) cabinet. - On the radiating cable, 7-16 DIN female connectors were installed. C3M then used a blow torch flame to activate heat shrink sealing kit situated on the radiating cable. - On the jumper cable, C3M used an impact driver to install male connectors. The jumper cable and radiating cable were then connected, with cold shrink sealing kit prepped. One connection used a cold shrink alternative (plastic wrap and tape). - Along the tunnel wall across from the fan shaft, C3M bored holes into concrete for clip installation. Four (4) clips were installed into concrete with jumper cables secured.

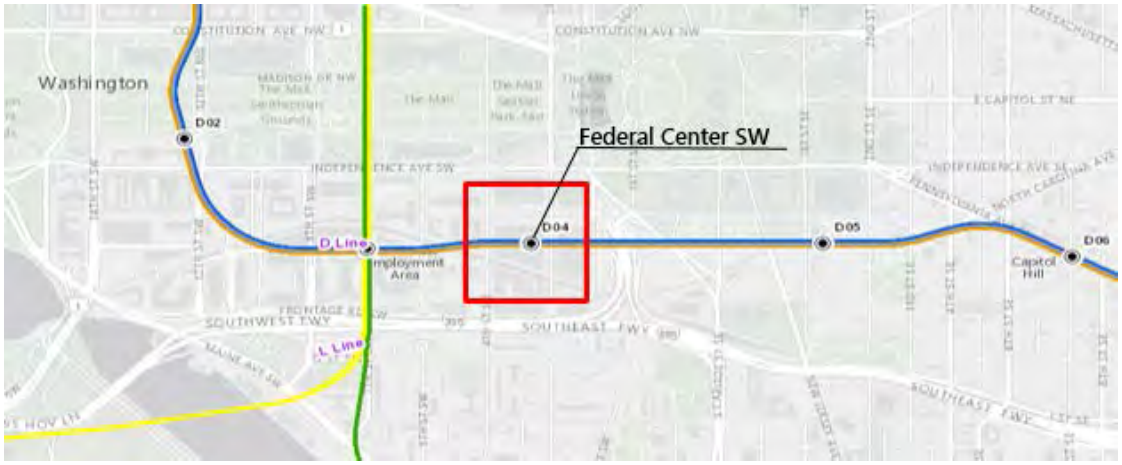
AREAS FOR IMPROVEMENT	
Area of Review	**Description**
Safety	After the safety briefing and establishment of the work zone limits (which included the station), a contractor left the work zone (under proper escort protection). However, upon returning to the work zone, the contractor was not in line-of-sight for period of time while trying to locate the work gang. Better communication should be established between the RWIC (or escort) and contractors to establish line-of-sight upon contractors re-entering a work zone. Location: Capitol Heights Station.

4. Federal Center SW

BL SV OR

Station Assessment Overview			
QICO Assessment Team	M. Alexander		
Assessement Date/Time	August 3/4, 2017 10:00pm - 4:30am	Activity	Antenna Installation
Departments	IRPG	Contractor	C3M

Station Map

Site Map	
Work Observed	QICO observed the installation of a broadband directional antenna inside Federal Center SW Metro Station during the midnight shift: - C3M bored ¼" holes into the concrete wall. - C3M used a level to ensure antenna is properly mounted. - Powers nail anchor (Zamac Nailin®) was used to secure antenna against concrete wall. - Antenna was mounted on concrete wall before cables connected. - C3M was cutting jumper cable in order to install male connector. - Jumper cable with 7/8" N male connector was installed. - WMATA personnel using a spectrum analyzer to test jumper cable for insertion loss before antenna connection.

AREAS FOR IMPROVEMENT

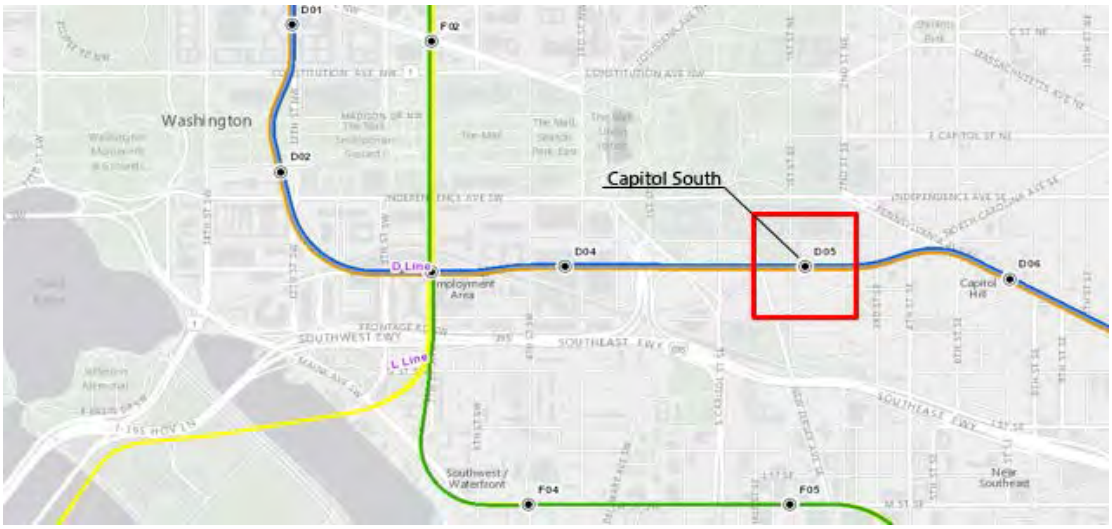
Area of Review	Description
Performance of Work	There was lost time due to inadequate preparation. WMATA personnel had to go back and forth to project headquarters (New Carrollton) to recover tools and equipment needed to perform the job properly. All items on the scope of work were completed; however, a one-hour job became a three-hour job. Personnel should follow work instructions and tool/equipment checklists to ensure that work is completed in a timely manner. Location: Federal Center SW Station Platform

5. Capitol South

BL SV OR

Station Assessment Overview			
QICO Assessment Team	M. Alexander		
Assessement Date/Time	August 4/5, 2017 11:00pm – 3:30am	Activity	Cable Testing
Department	IRPG, ENGA-COMS	Contractor	C3M, Smartlink, GFP

Work Observations

Site Map	
Work Observed	QICO conducted a field assessment observing tests performed on radiating and jumper cables at Capitol South Metro Station during the midnight shift (2300-0330). ENGA COMS & FACP staff performed the tests, C3M & Smartlink assisted, and the Radio Project Quality Management Representative (Gannett Fleming Parsons) was observed the testing as well. The testing consisted of the following activities: - ENGA-COMS calibrated test equipment (Spectrum Analyzer and MXG Analog Signal Generator) by normalizing the loss in equipment connections in order to produce accurate cable measurements. - Smartlink disconnected the jumper cables from active Remote Hub Group (RHG) cabinet in order to make the cables available for testing. - C3M used a box cutter to remove cold shrink sealing kit from cable connection. - C3M disconnected a jumper cable and radiating cable using channel locks. - ENGA-COMS connected a Spectrum analyzer and signal generator connected to jumper cable for the distance to fault (DTF) test and for the insertion loss test between Capitol South and Fan Shaft FD06. - C3M re-connected jumper cable and radiating cable after testing has been completed and reapplied the cold shrink over the connection.

AREAS FOR IMPROVEMENT

Area of Review	Description
No Discrepancies of note. Work instructions were not provided to QICO before start of work and thus work performed could not be compared to any expected work.	