

The Washington Metrorail Safety Commission



Safety Audit of the Washington Metropolitan Area Transit Authority Audit of Structures Program



Final Report:
July 25, 2023

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Prepared under the authority of the Washington Metrorail Safety Commission

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Executive Summary

The Washington Metrorail Safety Commission (WMSC) performed this audit of the Washington Metropolitan Area Transit Authority (WMATA) Metrorail's structures program through in-depth interviews, site visits, and document and data reviews conducted in 2022 and 2023. The scope of this audit includes the assessment of structures inspection, maintenance, and engineering practices and procedures, and associated training for purposes of compliance with applicable plans, policies, regulations, and industry best practices. The WMSC appreciates the cooperation of Metrorail personnel during this audit.

This audit's primary focus is on the objectives listed above in relation to tunnels and ancillary rooms, structures-related capital projects, as well as closed corrective action plans that Metrorail developed as a result of the WMSC's Audit of Elevated Structures, Inspection, Maintenance and Repair report issued in January 2021.

The audit demonstrates that Metrorail has maintained the safety improvements developed and implemented through the corrective action plans Metrorail created to address the findings of the WMSC's report issued in 2021. In some

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cases, this audit could not fully assess whether these are remaining long-term due to the corrective action plans being closed in the months just prior to this audit, however this is a positive example of the continuous safety improvement that is possible through the WMSC's Triennial Audit process.

This audit did identify some areas where Metrorail is not following its policies and procedures related to its structures programs. As a result, the WMSC is issuing two findings requiring Metrorail to develop corrective action plans (CAPs):

- Metrorail is not carrying out the safety risk management, safety assurance and safety promotion for the structures program required by Metrorail's Agency Safety Plan to ensure safe and effective structural engineering, maintenance, and operation.
- Metrorail has not formalized and documented its on-the-job training process for structural inspection.

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





Background and Scope

Background and Scope

The scope of this audit includes the assessment of structures inspection, maintenance, and engineering practices and procedures, and associated training for purposes of compliance with applicable plans, policies, regulations, and industry best practices. The WMSC focused primarily on the above objectives in relation to tunnels and ancillary rooms, structures-related capital projects such as the Yellow Line Tunnel and Bridge Rehabilitation Project, as well as closed corrective action plans that were issued as part of the Audit of Elevated Structures, Inspection, Maintenance and Repair issued in January 2021.

Among other areas, this audit focuses on elements of WMATA's Public Transportation Agency Safety Plan, titled the WMATA Transit Agency Safety Plan, Revision 2.0. This revision became effective on December 31, 2021. The specific elements of the Public Transportation Agency Safety Plan covered in this audit are listed in Appendix D.

History

In December 2015 the Federal Transit Administration issued Safety Directive 16-2 based on 2010 and 2015 findings from the Tri-State Oversight Committee that identified concerns regarding document and quality control within WMATA's structures department. Metrorail's Quality Assurance, Internal Compliance & Oversight Department noted the same deficiencies in its June 2017 Metrorail Structural Inspections Internal Review. The WMSC identified similar deficiencies in the Audit of Elevated Structures Inspection, Maintenance and Repair issued in January 2021, which led to Metrorail developing and implementing corrective action plans. Metrorail identified similar issues in internal reviews in 2022 as Metrorail was implementing corrective action plans.

In July 2022, WMATA's Office of Quality Assurance, Internal Compliance and Oversight published a Structures Maintenance Leak Mitigation Process Internal Review that found several safety issues, including ones also observed by the WMSC during the course of this audit.

These included:

- The need for defect reporting into the appropriate system of record in accordance with the Standard Operating Procedures.
- The need to regularly review, track, investigate, and document the status of aged work plans.
- The need to ensure tool and equipment inspections are performed before use.



The scope of this audit includes the assessment of Metrorail's structures inspection, maintenance, and engineering practices and procedures, and associated training.

As described later in this report, the WMSC also observed worker safety issues during on-site observations for this audit.

Similarly, Metrorail's Internal Safety Review of Structures Maintenance and Inspection dated August 4, 2022 found non-compliance with job site safety requirements, noting roadway worker protection violations observed as structures maintenance crews performed concrete repairs. As described later in this report, the WMSC also observed worker safety issues during on-site observations for this audit. The Internal Safety Review's findings also included:

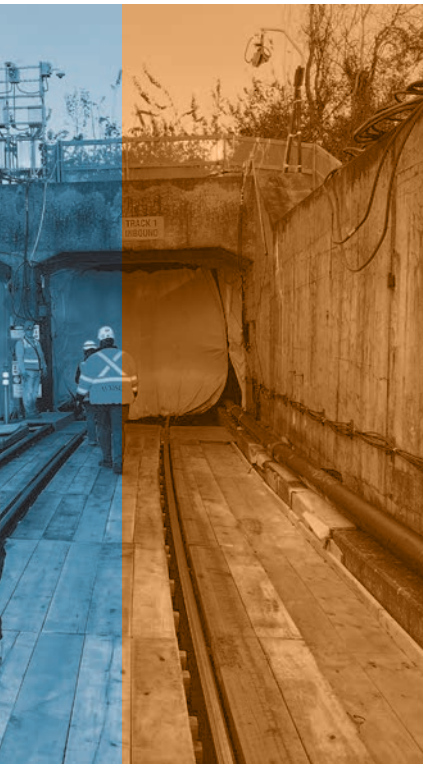
- Use of expired insulation mats. These mats are used to protect against third rail contact.
- Incomplete/improperly completed forms:
 - ◆ Review of 14 Job Safety Briefings found at least one discrepancy on each.
 - ◆ 5 out of 8 tunnel leak reports reviewed contained at least one discrepancy.
- Non-compliance with training requirements:
 - ◆ In a sample of six Structures Inspection (STIN) group employees, only 31 of the 81 combined required classes were completed.
 - ◆ In a random sample of 28 structures personnel requiring a combined 340 classes only 120 classes were completed.
- Lack of standard repair drawings and details.
- Deficiencies in document control.

The report also documented safety issues related to high voltage safety gloves used for checking third rail power. The gloves had no records of testing and had a manufacturer's date of July 8, 2021. The Occupational Safety and Health Administration (OSHA) and WMATA require these gloves to be tested before first use and every 6 months. As described below, the WMSC identified similar safety deficiencies during this audit regarding personnel not understanding and carrying out these safety steps to ensure this piece of personal protective equipment (PPE) would function as designed to protect from electrocution and burns (see Finding 1).



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

Areas for Improvement	Required Action(s)	Metrorail Status
<p>Defect reporting into the appropriate system of record in accordance with the Standard Operating Procedures supports accurate tracking and timely scheduling of leak mitigation activities.</p> <p>Regularly reviewing, tracking, investigating, and documenting the status of aged work plans would promote on-time completion of scheduled work providing a good state of repair.</p>	<p>Appropriately reporting defects into the system of records, eliminating any duplicate work orders, performing regular reviews, and evaluating the status of aged work plans for accurate traceability.</p>	<p>Open – Expected Date of Completion: 09/2023</p>
<p>Following leak mitigation Work Instructions would support quality work, produce consistent results, and may prevent employee injury.</p>	<p>Follow the guidance provided in the Standard Operating Procedures and Work Instructions when performing job functions.</p>	<p>QICO-STLM-22-02 Closed</p>
<p>Performing tool and equipment inspections prior to utilization enhances work production and decreases job hazards.</p>	<p>Perform inspections and assure the removal of defective tools to avoid use at job locations.</p>	<p>QICO-STLM-22-03 Closed</p>
<p>Complying with job site safety requirements would improve worker safety on the roadway, providing standardized reporting, management, and mitigation processes for hazards observed while on the Roadway.</p>	<p>Implement job site procedures and perform documented quality control to verify compliance.</p>	<p>Open – Expected Date of Completion: 09/2023</p>
<p>Adhering to inspection report requirements would promote continuity and accuracy while reducing waste and re-work.</p>	<p>Establish an effective quality control plan for inspection report review.</p>	<p>Open – Expected Date of Completion: 07/2023</p>
<p>Utilizing the master repository for all project documents is critical in storing, organizing, tracing, and accessing inspection reports.</p>	<p>Perform quality control to verify inspection reports and required documentation are attached to work orders</p>	<p>QICO-STRC-22-03 Closed</p>
<p>Reviewing and updating governing documents within the required periodicity optimizes applicability, consistency, and incorporates changes in a timely manner.</p>	<p>Review and update all governing documentation past due for review.</p>	<p>Open – Expected Date of Completion: 10/2023</p>
<p>Maintaining compliance with current training requirements assists WMATA personnel in identifying hazards and areas of concern while working within the transit system and promotes increased knowledge levels.</p>	<p>Review training transcripts and create a training plan to fully train all TRST Structures personnel.</p>	<p>Open – Expected Date of Completion: 11/2024</p>



As of spring 2023, the Metrorail system includes approximately 128 miles of two-track mainline, 98 stations, and 10 rail yards.

WMSC Oversight

On January 25, 2021, the WMSC issued an Audit of Elevated Structures Inspection, Maintenance and Repair as part of the WMSC's first triennial safety audit of Metrorail. The audit resulted in 12 findings and one recommendation.

As of spring 2023, Metrorail had completed implementation of corrective action plans (CAPs) to address 11 of the 2021 audit's findings. Two CAPs, C-0072 and C-0083, remain open and are being implemented by Metrorail. Metrorail has submitted some of the actionable items as it works to implement each CAP to address the identified safety issues in a systemic way.

The assessment of the status of the 2021 audit's findings and associated corrective action plans is provided later in this report.

The WMSC also monitors the implementation and effectiveness of Metrorail CAPs on an ongoing basis through other elements of our oversight program such as inspections, investigations, safety certification oversight, and other work.

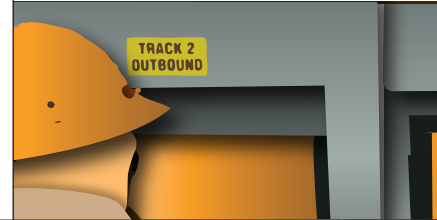
Organizational Structure

The structures maintenance and inspection division within the Office of Track and Structures is responsible for maintaining assets and structures throughout the system. As of spring 2023, the Metrorail system includes approximately 128 miles of two-track mainline, 98 stations, and 10 rail yards. Structural maintenance and inspection responsibilities include regular inspection, repair, and rehabilitation of bridges, garages, fence lines and retaining walls, tunnels, stations, elevator and escalator structures, and shafts.

When this audit began, the Office of Track and Structures was led by a General Superintendent who reported to the Vice President of Rail Infrastructure Maintenance & Engineering (RIME), under the Senior Vice President of Rail Transportation (RAIL), who reported to the Executive Vice President and Chief Operating Officer. Track maintenance standards and engineering concepts regarding functional requirements of structures throughout the Metrorail system were the responsibility of Maintenance-of-Way Engineering Track Engineering (MOWE-TE). Maintenance-of-Way Engineering Track Engineering was led by the Chief of Maintenance-of-Way Engineering Track Engineering, who reported to the Vice President of Rail Infrastructure Maintenance & Engineering. Maintenance-of-Way Engineering Track Engineering and Office of Engineering and Architecture (ENGA) Civil Structural Group provided structural engineering support to the Office of Track and Structures including development, review, and management of design criteria, specifications and drawings, work instructions, engineering and maintenance standards, associated testing, and acceptance.

Metrorail changed these reporting structures during the on-site work for this audit as part of a broader realignment (which is not yet reflected in Metrorail's Public Transportation Agency Safety Plan that is the basis for this audit).

As part of the initial realignment announcement, the Track and Structures General Superintendent and personnel reporting to them, as well as certain track and structures related engineering personnel such as those in Maintenance-of-Way Engineering Track Engineering



were reassigned to report to the newly titled Chief Infrastructure Officer as part of the Track and Structures department.

Under the Office of Track and Structures General Superintendent there are three divisions, each led by an Assistant General Superintendent. One of the divisions is structures maintenance and inspection. Track and Structures has personnel that serve as maintenance and inspection superintendents, assistant superintendents, managers, supervisors, equipment operators, track repairers, track inspectors, structural repairers, structural evaluation technicians, mechanics, welders, and laborers.

Most training for structures maintenance and inspection personnel is conducted by Technical Skills and Maintenance Training, a separate department that, at the time this audit began, was a part of Operations Management Services. Metrorail stated that due to the reorganization, this training group would now be part of a new division within the Department of Safety and Readiness.

Strategy, Planning and Program Management was responsible for structures-related capital project programming, including development, prioritization, and evaluation. Metrorail also stated this group was shifted during the reorganization.

Audit Work

The WMSC received initial documents related to this audit from WMATA in September 2022, made subsequent document requests, and reviewed the documents provided by Metrorail throughout the course of this audit. The WMSC conducted an entrance conference in November 2022, and conducted site visits and extensive interviews with Metrorail personnel in November and December 2022. The WMSC held an exit conference with Metrorail in January 2023.

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

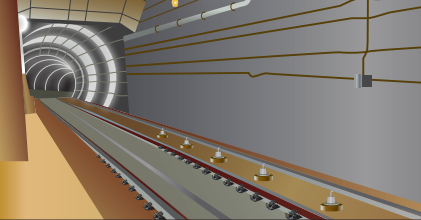
The WMSC later provided a draft of this report to WMATA for technical review and incorporated any comments or technical corrections as appropriate.

Metrorail inspects, repairs, and maintains bridges, garages, fence lines and retaining walls, tunnels, stations, elevator and escalator structures, and shafts.





What the **WMSC** Found



What the **WMSC** Found

Metrorail is carrying out important structural rehabilitation work.

Positive Practices

Multiple personnel observed during onsite activities for this audit demonstrated skill and attention to detail while performing their structures-related duties.

Metrorail's Structural Inspection Manual (TRST-SMI-SIM-Rev -2.0, 2021) and the delineation of responsibilities for structural work (SOP 208-7-Rev. 5.0) were both revised as a result of the WMSC's 2021 Elevated Structures Audit and are being used. Metrorail is maintaining the associated safety improvements implemented as part of corrective action plans by providing training on these updated procedures and implementing training and certification/recertification standards for structural inspectors.

WMATA is beginning to provide improved training to structural repairers, starting with a fence repair class that, at the time of this audit, had been provided to 92% of structural repairers. Metrorail stated it has plans to develop grout injection, concrete repair, and joint repair courses that it plans to incorporate into new hire training for structural repairers and a future structural repairer course.

Metrorail was carrying out important structural rehabilitation work on the Yellow Line to improve the integrity of the Metrorail system. The WMSC observed this work on the Yellow Line bridge and tunnel between L'Enfant Plaza Station and Pentagon Station.



Metrorail is maintaining the safety improvements implemented as part of corrective action plans.



Assessment of Corrective Action Plans from Previous WMSC Audit Findings

▶ **2021 Finding 1: Metrorail departments involved in structures inspections and maintenance operate in unacceptable silos, which creates safety risks.**

◆ **Corrective Action Plan C-0071**

- ▶ The WMSC closed this corrective action plan in March 2022 after Metrorail established meetings and regular status updates shared among departments involved in the process.
- ▶ During this audit, Metrorail announced a realignment that Metrorail stated may further contribute to this collaboration. Given that the realignment had effectively not yet occurred at the time of this audit, the WMSC could not assess the impact of this realignment.
- ▶ The audit did demonstrate that interactions among structures program personnel previously reporting to RIME, TRST and ENGA had improved since the previous audit.

▶ **2021 Finding 2: WMATA does not have load ratings for its bridges and aerial structures.**

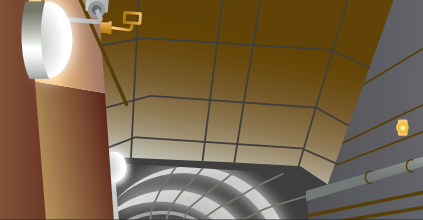
◆ **Corrective Action Plan C-0072**

- ▶ Metrorail was still in the process of implementing this CAP at the time of this audit.
- ▶ Metrorail had implemented interim mitigations, then developed and began to implement a load rating process. The documented process is sound. Metrorail was continuing to conduct these load rating assessments of its bridges and aerial structures at the time of this audit.
- ▶ As described below, at the time of this audit, Metrorail developed a series of Engineering Modification Instructions (EMIs) to restrict speeds on aerial structures to match the safe design speed.

▶ **2021 Finding 3: Metrorail has not clearly assigned responsibility for the Structural Inspection Manual and has not set a timeline for review of the manual.**

◆ **Corrective Action Plan C-0073**

- ▶ The WMSC closed this corrective action plan in March 2022 after Metrorail developed and implemented a structural inspection manual update addressing these issues. These responsibilities and timelines were still in place at the time of this audit.



Metrorail personnel now have access to tools such as dye penetrant kits and D-meters.

▶ **2021 Finding 4: A new Structural Inspection Manual was made effective without any associated training for the employees responsible for implementing it.**

◆ **Corrective Action Plan C-0074**

- ▶ The WMSC closed this corrective action plan in May 2022 after Metrorail developed and provided initial training on the manual, and established requirements moving forward.
- ▶ Documents reviewed and interviews conducted as part of this audit showed this training was carried out and the sampled personnel were familiar with the manual.

▶ **2021 Finding 5: Standard Operating Procedure 208-07 (dated March 2020) contains outdated and conflicting references.**

◆ **Corrective Action Plan C-0075:**

- ▶ The WMSC closed this corrective action plan in May 2022 after Metrorail reviewed and updated this procedure and notified personnel of the updates.
- ▶ Documents reviewed as part of this audit showed this standard operating procedure now contains current information.

▶ **2021 Finding 6: Metrorail does not have important structural steel inspection tools available that are listed in its Structural Inspection Manual.**

◆ **Corrective Action Plan C-0076**

- ▶ The WMSC closed this corrective action plan in September 2022 after Metrorail obtained and provided these tools.
- ▶ Interviews and document review related to CAP submittals and this audit demonstrate that Metrorail personnel now have access to tools such as dye penetrant kits and D-meters that are listed in Metrorail's manuals as necessary for certain inspections.

▶ **2021 Finding 7: Metrorail does not have consistent requirements for refresher or additional training for structures inspection and maintenance teams.**

◆ **Corrective Action Plan C-0077**

- ▶ Metrorail was still in the process of implementing this CAP at the time of this audit. This CAP was subsequently closed in May 2023.



▶ **2021 Finding 8: Structures inspection supervisors are not able to spend adequate time in the field, creating concerns about work quality and workload.**

◆ **Corrective Action Plan C-0078**

- ▶ Metrorail conducted an assessment of the workload and assignments for structures inspection supervisors and determined an additional supervisor was necessary, raising the number of supervisors from two to three, to improve quality of work and to allow the supervisors to conduct their required field visits and quality control procedures.
- ▶ In this audit, interviews demonstrated that some supervisors now spend more time in the field providing hands-on oversight and others spend more time in the office providing oversight of documentation and reports.

▶ **2021 Finding 9: Department of Engineering and Architecture (ENGA) does not document its findings when inspectors call for an engineer to examine a potential problem in person or through review of an inspection report.**

◆ **Corrective Action Plan C-0079**

- ▶ The WMSC closed this CAP in March 2022 after Metrorail provided access to the Office of Engineering and Architecture to directly review the Office of Track and Structures' inspection reports and created reporting requirements when engineering is asked to perform a structural review.
- ▶ Interviews and document reviews for this audit demonstrated that Metrorail has incorporated this into SOP 208-07.

▶ **2021 Finding 10: Metrorail inspection, repair and design data are spread across disparate systems in a way that makes certain work challenging, creating the risk that safety issues could be misidentified or slip through the cracks.**

◆ **Corrective Action Plan C-0080**

- ▶ The WMSC closed this CAP in September 2022 after Metrorail developed file naming conventions, provided training to personnel on software systems, and established review processes.
- ▶ According to interviews for this audit, this has improved Metrorail's work and provides for more timely access to safety information.



Metrorail established requirements for, and checks of, contractor credentials and qualifications and provided evidence of these checks occurring.



▶ **2021 Finding 1 1: Metrorail does not review contractor credentials, qualifications or training before a contractor conducts an elevated structures inspection.**

◆ **Corrective Action Plan C-0081**

- ▶ The WMSC closed this CAP in September 2022 after Metrorail established requirements for, and checks of, contractor credentials and qualifications and provided evidence of these checks occurring. This audit did not identify any deficiencies in this area.

▶ **2021 Finding 1 2: Metrorail does not have a written procedure for spot checks of TRST structural inspections.**

◆ **Corrective Action Plan C-0082**

- ▶ The WMSC closed this CAP in March 2022 after Metrorail created a new position to oversee and manage these spot checks and created and implemented a procedure requiring engineering personnel to review structural inspection reports.
- ▶ Interviews and document reviews for this audit demonstrated that Metrorail has established the process and designated appropriate personnel to carry out these reviews, and that Metrorail is carrying out this work.

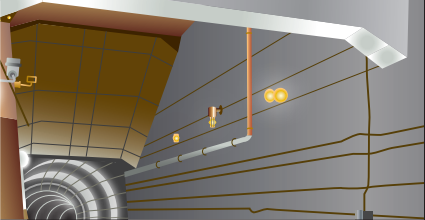
▶ **2021 Recommendation: Ten Metrorail structures have steel rocker bearings, which creates a seismic risk in the event of an earthquake or other seismic events.**

◆ **Corrective Action Plan C-0083**

- ▶ Metrorail is in the process of implementing a plan as part of its capital program to incorporate the replacement of these steel rocker bearings with elastomeric or spherical bearings into other capital projects on these bridges.
- ▶ In April 2023, Metrorail informed the WMSC that it had determined that the information relied upon by Metrorail and provided to the WMSC during the prior audit was incorrect, and that some of the 10 structures that Metrorail had believed had rocker bearings in fact do not have such bearings.
- ▶ Metrorail has replaced the bearings on one of the structures that did have rocker bearings, the Cheverly Aerial Structure, as part of this CAP, and plans to replace the bearings on other structures that have rocker bearings. As the draft of this audit report was being finalized, the WMSC was continuing to gather information from Metrorail on this issue.



Findings and **Minimum** Corrective Actions



Findings and Minimum Corrective Actions



Documents provided by Metrorail during this audit demonstrate that hazards are not being identified and mitigated.

► **Finding 1: Metrorail is not carrying out the safety risk management, safety assurance and safety promotion for the structures program required by Metrorail’s Agency Safety Plan to ensure safe and effective structural engineering, maintenance, and operation.**

Structures maintenance and inspection personnel interviewed for this audit, such as a manager, supervisor, and frontline personnel within Track and Structures, were not aware of WMATA’s Agency Safety Plan or Metrorail’s safety management system approach and associated safety requirements.

Further, documents provided by Metrorail during this audit demonstrate that hazards are not being identified and mitigated, and those mitigations are not then being monitored on an ongoing basis in accordance with Metrorail’s policies and procedures.

Documents provided and interviews for this audit demonstrate that Metrorail’s structures programs do not follow Metrorail’s written procedures regarding recording of hazards and inspection information in specific systems of record.

As described in more detail below, field personnel are also being put at risk because they do not know how to ensure that critical personal protective equipment, high voltage safety gloves, is current and functional.

Metrorail identified similar safety deficiencies in an internal review of WMATA’s Structures Maintenance Leak Mitigation Process (field work February-March 2022, issued July 2022) and an internal safety review of Structures Maintenance and Inspection issued in August 2022. These related to issues such as Metrorail not following job site safety requirements, not providing standardized reporting, management and mitigation processes for hazards observed on the roadway, Metrorail not reporting defects into systems of record or not reporting them in the timely fashion required by Metrorail procedure to ensure accurate tracking and mitigation of hazards and to avoid prolonged exposure of Metrorail components to further degradation, Metrorail personnel not reporting hazards for repair, Metrorail not following documented work instructions thereby creating a risk of injury to personnel or of defects progressing, the need to inspect tools and equipment prior to use to ensure safety, and personnel not completing required training classes. Metrorail had begun working on iCAPAs related to these issues during this audit. Further action is required to address the systemic issues and implement the safety management system approach specified by Metrorail’s Agency Safety Plan.

Structures Maintenance and Inspections department is not managing, tracking, and documenting hazards

Metrorail provided the Office of Track and Structures’ hazard log for this audit that contained only two items, each dated 2019.

Further, several personnel interviewed for this audit stated that they do not record and track hazards unless a follow-up corrective maintenance work order is required. A member of management correctly stated that any hazards identified should be

Training personnel and ensuring hazards are documented and mitigated is critical to effectively and meaningfully implementing a safety management system.



recorded, but, consistent with the responses from other personnel, said this only covers deficiencies that would require corrective maintenance work orders, not broader hazards that might be related to items such as work processes.

WMATA's Hazard Management Program, a component of the WMATA Transit Agency Safety Plan, is designed to identify, mitigate and implement corrective actions for hazards. The Hazard Management Program is managed by the Department of Safety and requires employees at every level, including contractors, to report any perceived safety hazards. WMATA, like the Federal Transit Administration, defines a hazard as any real or potential condition that can cause injury, death, or damage to or loss of equipment or property.

As work on this audit was concluding, Metrorail developed Engineering Modification Instructions (EMIs) to reduce speeds on aerial structures to meet design specifications. As the EMI described, WMATA Aerial structures are designed to sustain trains speed no greater than 70 MPH, but based on ATC design, certain locations in the system have the capability to exceed this threshold and this EMI seeks to mitigate the potential of trains achieving speed greater than 70 MPH by reducing their Maximum allowable speed (MAS). This is a hazard that Metrorail had not previously identified or addressed. It is positive that Metrorail has now begun to address these hazards, but these were not tracked or identified in a systematic fashion.

Metrorail's SOP 208-7 Rev. 5.0, TRST Structures Inspection Procedures Section 11.5 lists Optram as the official system of record for mainline assets and Maximo for non-mainline assets. However, structures personnel interviewed stated that they do not use Optram. This information is entered into Maximo, so Metrorail retains the information, but not in the manner specified in its procedures. In response to a draft of this report, Metrorail stated it would update SOP 208-7 to reflect Metrorail's intended processes, including the use of MaxTrax by structures inspectors.

Metrorail's Office of Quality Assurance, Internal Compliance and Oversight's August 2022 Internal Review Structures Maintenance and Inspection included a finding regarding failure to report a hazard requiring immediate attention. In this instance an Emergency Trip Station Box was disconnected and found on the ground, yet structures personnel did not create a Maximo work order or report the hazard to the Maintenance Operations Center in the Rail Operations Control Center as required by SOP 208-7. In response to a draft of this report, structures personnel stated they did not see this hazard that was raised during the inspection.

The WMSC has documented similar deficiencies in other areas including high voltage traction power, emergency management and fire and life safety, rail operations, and communications systems, which demonstrate that Metrorail is not meeting the safety commitments regarding safety assurance, safety promotion and hazard risk management specified in its Public Transportation Agency Safety Plan and associated procedures.

Training personnel and ensuring hazards are documented and mitigated is critical to effectively and meaningfully implementing a safety management system.

Metrorail planned to take initial steps toward this implementation in operational and maintenance departments in 2023.



Structures personnel lack awareness of and are not participating in safety committee meetings

The WMSC requested minutes from all Office of Track and Structures Departmental Safety Committee meetings that occurred from January 1, 2021 through March 31, 2022, and all Local Safety Committee meetings that occurred during February and March 2022. WMATA provided minutes of just three local safety committee meetings, each Carmen Turner Facility Safety Committee Meetings. Metrorail did not provide minutes for any departmental safety meetings.

The minutes of the Carmen Turner Facility Safety Committee demonstrate that the meetings related to hazards in and around the Carmen Turner Facility, not hazards related to work conducted elsewhere, such as the work generally conducted by structural inspection and repair personnel.

WMATA's Public Transportation Agency Safety Plan lists Departmental Safety Committees as technical management-level safety committees that serve as the intermediary between the respective Local Safety Committees and the Executive Safety Committee, which is comprised of the Accountable Executive and all Executive Vice Presidents reporting to the Accountable Executive. The Executive Safety Committee is the "primary group responsible to provide guidance and direction to the agency and to the Accountable Executive on acceptable and unacceptable risk, resource allocation, the status of SMS implementation for each of their areas of control and the promulgation of safety policy and SMS agency-wide." Local Safety Committees are front-line level safety committees established to address local safety issues through the Safety Risk Management process and to assist in developing effective safety programs.

WMATA's Public Transportation Agency Safety Plan, Section 2.2 Employee Safety Reporting Program, lists local safety committee meetings as a reporting method, stating, "Employees may report any perceived safety issue or hazard to a local safety committee (LSC) representative for investigation and resolution. LSCs capture these concerns on locally managed trackers to document and track to completion. However, concerns are escalated through the Safety Measurement System when a concern may extend beyond the local level or additional help is needed."

Safety Committee meetings provide an opportunity to raise and discuss open action items and their progress as well as concerns that have arisen since the previous meeting regarding safety. According to WMATA's Public Transportation Agency Safety Plan, Local Safety Committee Meetings are typically held once a month at every major facility, and all crafts and employee categories must have available representation on a Local Safety Committee.

The lack of representation across departments, job functions and hierarchy represent a missed opportunity to gather and share information from varying perspectives that could potentially identify and address concerns to make the Metrorail system safer.

Metrorail did not provide minutes for any departmental safety meetings.

The WMSC audit team identified that structural repairers did not know how to check whether their high voltage safety gloves were safe for use.

| Further demonstrated gap in safety promotion

During onsite activities, the WMSC audit team identified that structural repairers did not know how to check whether their high voltage safety gloves were safe for use. Specifically, they did not know to check, or how to identify, whether the gloves were within their required use date. These gloves are used to prevent electrical burns or electrocution. OSHA 1910.137 requires these gloves to be tested before they are used and again every 6 months thereafter.

A similar issue was identified in WMATA's August 2022 Internal Safety Review Structures Maintenance and Inspection report, which found "TRST has no official system or a process for tracking high voltage glove testing prior to usage." Metrorail's Internal Safety Review team had identified this safety issue in the field on April 15, 2022, when they also observed the use of an insulated mat that was beyond its expiration date.

Despite the direct connection to life-safety, Metrorail had not implemented changes at the time of this audit, including during the WMSC's on-site observations more than six months later.

Under the Track and Structures internal corrective action plan (iCAPA), QICO-STRC-22-01, WMATA has committed to update equipment calibration procedures to include testing of rubber insulating gloves and to submit a roster of personnel who received rubber insulating gloves, and evidence of testing, disposal, or purchase. As of May 1, 2023, work for this iCAPA was 20 percent complete.

It is crucial that Metrorail ensure these personnel understand how to provide for their safety by using only current and functional safety equipment.

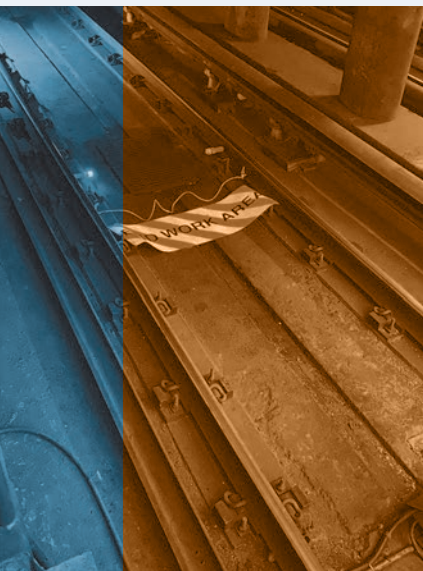
◆ Minimum Corrective Action:

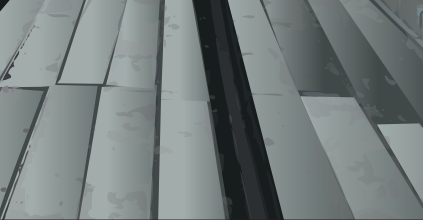
Metrorail must implement its safety management system for structures personnel as specified in its Public Transportation Agency Safety Plan. WMATA must ensure that personnel understand their essential role in an effective safety management system. This must include ensuring, on a recurring basis, that personnel are appropriately trained on the identification of hazards, including departmental hazards, the reporting of hazards (including reporting methods), the documentation of hazards (including logging and tracking), and the assessment and mitigation of hazards.

► Finding 2: Metrorail's Structures Maintenance and Inspections department has not formalized and documented its on-the-job training process for structural inspection.

On-the-job training is being conducted for structural inspections, but there is no formalized documented process to ensure that this occurs for all personnel or that the same information is covered for all personnel.

According to WMATA's Structural Inspection Manual TRST-SMI-SIM-REV-2.0, Section 2.1.5.2, Inspection Supervisors must "Ensure structural inspection personnel are trained in the proper use and operation of all equipment. Provide on-the-job training to subordinate personnel!" However, Metrorail does not have a standard process for





this training and does not document this training, and therefore cannot demonstrate that it occurs. Structural inspector on-the-job training is currently dependent upon senior inspectors mentoring new inspectors with no curriculum, standards, checklist or evaluation reports.

According to personnel interviewed, most new inspectors hired do not have a background in inspecting bridges and other existing structures, putting additional pressure on more experienced personnel to complete the work. Although inspectors are required to take a 10-day National Highway Institute inspection training course that provides important fundamental understanding, on-the-job training is essential to ensure inspectors learn processes and applications specific to WMATA. This includes navigating locations within the Metrorail system, appropriate tool selection based on location and job tasks, other logistical considerations, and proper formatting and completion of WMATA forms and reports. These are necessary skills to ensure timely action on identified hazards, efficient use of resources, and reliable information for future inspections and maintenance.

Personnel interviewed for this audit said Metrorail would benefit from experienced personnel such as supervisors providing formalized one-on-one guidance in the field to new structural inspectors in a dedicated and documented way, specifically focusing on topics such as how inspections should be conducted at Metrorail and photographing and rating defects. This guidance is necessary due to the unique working environment of structural inspections on and around an active rail transit system.

♦ **Minimum Corrective Action:**

WMATA must create a formal, structured on-the-job training program that includes standards, curricula, and documentation as well as selection criteria and training for those serving as On-the-job Training Mentors to meet the requirements of its Structural Inspection Manual. Metrorail must create procedures to document and review on-the-job training and evaluations, including specific requirements that trainees must meet, the scoring requirements, and specific steps to be taken if a student requires additional instruction or experience.

This guidance is necessary due to the unique working environment of structural inspections on and around an active rail transit system.

Next Steps

WMATA is required to propose Corrective Action Plans for each finding no later than 30 days after the issuance of this report. Each proposed Corrective Action Plan must include specific and achievable planned actions to remediate the deficiency, the person responsible for implementation, and the estimated date of completion. Each proposed Corrective Action Plan must be approved by the WMSC prior to WMATA implementation.





Appendices

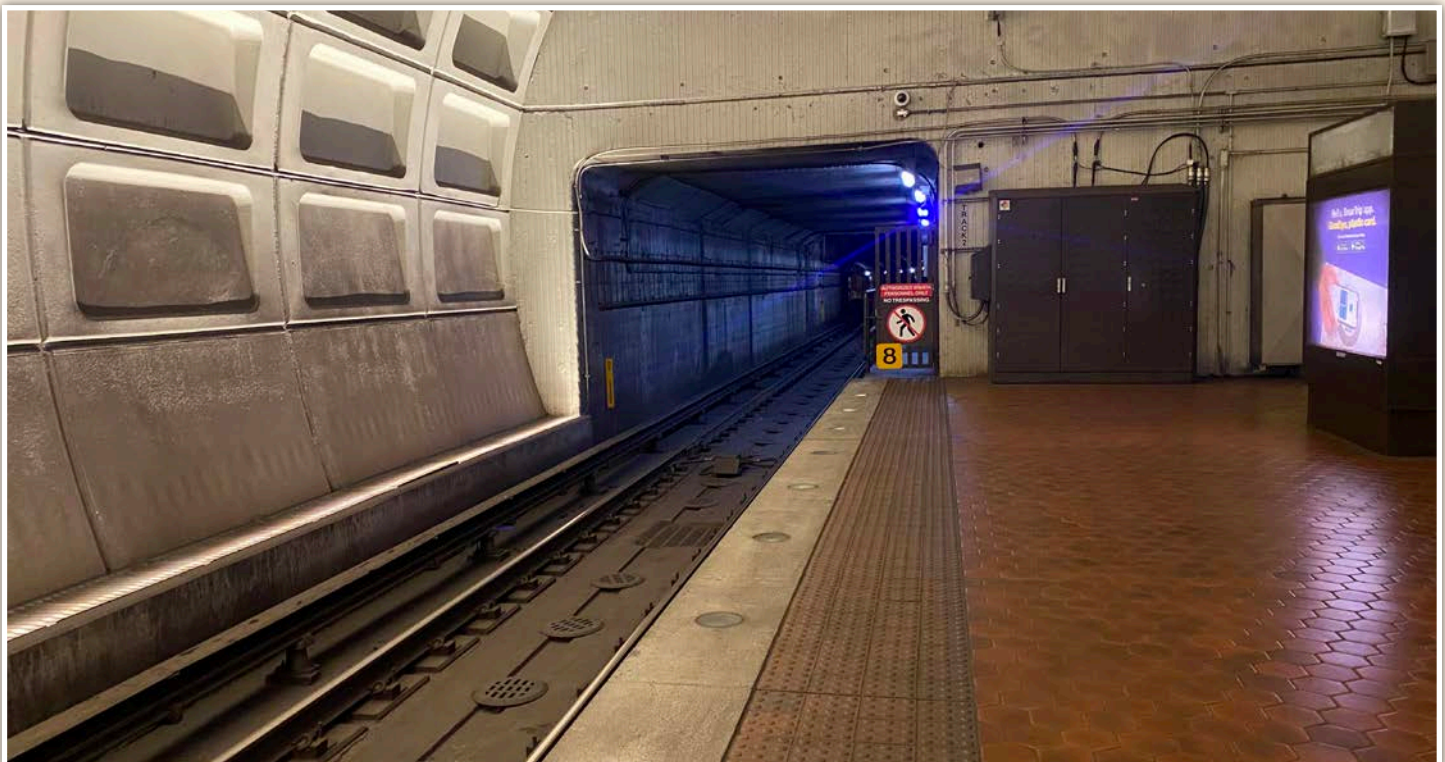
Appendices **A, B, C** and **D**

Appendix A: Personnel Interviewed

- Engineering and Architecture
 - ◆ Assistant Chief Engineer
 - ◆ Senior Structural Design Engineer
- Maintenance Of Way Engineering
 - ◆ Senior Program Manager Structural Operations Engineering
 - ◆ Quality Assurance Engineer
- Office or Track and Structures
 - ◆ General Superintendent
 - ◆ Superintendent (3)
- ◆ Assistant Superintendent
- ◆ Structure Repairer (2)
- ◆ Supervisor (2)
- ◆ Structural Evaluation Technician (2)
- Technical Skills and Maintenance Training
 - ◆ Training Instructor
 - ◆ Training Supervisor
- Office of Capital Program Management
 - ◆ Director Capital Planning and Program Development

Appendix B: Site Visits

- D Line Tunnel Inspection (11/30/2022)
- Gallery Place Floating Slab (12/1/2022)
- L Line Tunnel and Bridge Rehabilitation (12/1/2022)



Appendix C: Documents Reviewed

ORGANIZATIONAL CHARTS AND DEPARTMENT RESPONSIBILITIES:

- Descriptions of structures-related departments (no date)
- Office of Engineering and Architecture Civil Structural Group Organization Chart (9/1/2022)
- General Description of Structural Engineering Team Members (no date)
- Maintenance of Way Engineering Organization Chart (8/25/2021)
- Organization charts, roles, and responsibilities, slides (9/1/2022)
- Structures personnel list, spreadsheet (no date)
- Track and Structures Division 3 Organization Chart (9/26/2022)
- Office of Technical Skills Maintenance Training/Office of Track and Structures Training Organization Chart (9/1/2022)
- WMATA Updated Organizational Structure (12/6/2022)

PROCEDURES/POLICIES/MANUALS/FORMS:

- Demolition Site Assessment and Recommended Demolition Sequence (6/24/2022)
- FHWA Tech Brief, Use of Small Unmanned Aerial Systems for Bridge Inspection (10/2019)
- Inspection and Repair Procedures for Wall Cracks, for Gaps between a Wall and a Concrete Slab, and for Cracks on Concrete Slabs (9/29/2022)
- Memorandum, Process for Using Drones for Structural Inspections (no date)
- MOW-SOE-SMI-WI-44, Typical Leak Repair work instruction (Rev. 0, 4/4/2022)
- Repair Procedures for a Hole (Spall) in a Structure's Concrete Roof (11/16/2022)
- Repair Procedures for Escalator Machine Room Girder and Panel (9/30/2022)
- Repair Procedures for Platform Canopy Concrete Damages
- SOP 201-18, TRST Track Bed Cleaning Preventative Maintenance (PM) Procedure (last revised 1/24/2022)

- TRST-SMI-WI-42-REV-0.0, Tunnel Track Bed Cleaning work instruction (Rev. 0, 8/8/2020)
- Procedure Number 123-01: Rail Infrastructure Asset Maintenance and Engineering Roles and Responsibilities (Rev. 1, 7/14/2021)
- SOP 208-07 TRST Structures Inspection Procedures (Rev. 4, no date)
- Repair Procedures for Vent Shaft Concrete Deteriorations (6/16/2022)
- SOP 208-07, Structures Inspection Procedures (Rev. 5, 7/13/2021)
- Repair Procedures for Deteriorated Concrete Topping (7/21/2021)
- 2021 Structural Inspection Manual (Rev. 2, 9/27/2021)
- Drone Inspection Request (12/22/2021)
- Floor Tile Inspection and Recommendations (6/29/2022)
- Parking Garage Assessment and Recommendations (7/13/2022)
- Concrete Column Assessment and Repair Procedures (7/14/2022)
- Double T Beams Assessment and Repair Procedures (7/14/2022)
- Concrete Condition Assessment and Recommendations (8/2/2022)
- Repair Procedures for Bridge deck and underside (8/29/2022)



**PROCEDURES/POLICIES/MANUALS/FORMS
(CONTINUED)**



- MOWE-SOP-121-12 (9/13/2022)
- Room Ceiling Leak Assessment and Repair Procedures (10/5/2022)
- Repair Procedures for a Non-Structural Crack (11/21/2022)
- SMI-WI-43, Replacement of Grout Pads work instruction (Rev. 1, 2/11/2022)
- Inspection and Repair Procedures for Slab Concrete Damages (9/28/2022)

TRAINING:

- Aerial Lift Training course materials (6/2022)
- Confined Space Entry, slides (no date)
- Confined Space Entry, slides (no date), Respiratory Protection, slides (no date)
- Confined Spaces, WMATA Refresher Training, slides (11/1/2022)
- Fall Protection Initial Training, slides (8/2022)
- Fence Repair Combined Course materials (various dates 2022)
- FHWA-NHI-130078, Fracture Critical Inspection Techniques for Steel Bridges, participant guide (8/2016)
- Intro to Structural Evaluation Technicians (SET) course materials (various dates 2022)
- Ladder and Scaffold Certification Training course materials (various dates 2022)
- List of Fall protection training provided to Structural Evaluation Technicians and Structure Repair Personnel

- Lockout/Tagout (11/1/2022)
- Memorandum, Re: Training Course Materials for D-Meters, Dye Penetrant, and Fall Protection (dated 11/2/2022)
- Memorandum, Re: Training Course Materials for D-Meters, Dye Penetrant, and Fall Protection (dated 11/2/2022)
- Required Training for Structural Inspection (STIN) Personnel, email (9/26/2022)
- Respiratory Protection, slides (no date)
- Structural Repairer training records, fence and joint replacement courses, spreadsheet (no date, received 2/1/2023)
- Structures Maintenance and Inspection Training Records, spreadsheet (no date)
- Supervisor (Structural Maintenance) Fundamental Course training records (no date, received 2/1/2023)
- Unit Systems and Inspections Presentation (Aspen Aerials) (9/2022)

INSPECTION AND MAINTENANCE:

- Aspen Aerial Vehicle Maintenance Log, spreadsheet (1/1/2021 through 10/22/2022)
- Authorized Construction Site Safety Plan, WMATA Yellow Line Steel Tunnel and Bridge Rehabilitation Project (Rev. 5, 8/12/2022)
- Contract FQ19172, Scope of Work, Bridge Conditions and Inspection Services (6/9/2021)
- Critical/Urgent Defect Memo to CVST, Addison Road Parking Garage Level 1 Underside, Axis I/5 (7/13/2022)
- Critical/Urgent Defect Memo to CVST, Woodley Park Station (2/18/2022)
- D Line Inbound Track 2, D07 to D08, Structural Maintenance Inspection Report (inspect date 11/30/2022, report date 1/6/2023)
- Daily TRST Priority 1 list reports, Maximo (9/1/2021, 3/1/2022, 9/1/2022, 11/1/2022)
- ENGA Priority List (7/21/2021)
- ENGA Structural Priority List, spreadsheet (9/2022)
- Frequency of Routine Structural Inspections, table (no date)

INSPECTION AND MAINTENANCE (CONTINUED)

- Gannett Fleming/Parsons, Bridge Underwater Inspections for WMATA (10/2017)
- Gannett Fleming/WMATA contract for Bridge Conditions and Inspection Services (5/25/2021)
- InspectTech Tunnel Structural Ratings Report for inspections rated 4 and below (no date)
- List of all structural inspections scheduled for April 1, 2021 through August 1, 2022, spreadsheet
- List of Safety Performance Targets Related to Structure Inspection, Maintenance, and Engineering (2022)
- MOWE-SOP-121-12, Standard Operating Procedure for Quality Assurance of Structures Inspections (9/13/2022)
- Quality Assurance Report Review Checklist, Georgia Avenue Inbound Bridge (inspected 8/10/2021, reviewed 10/20/2021)
- Quality Assurance Report Review Checklists for structure inspections (September and October 2022)
- Quality Control Field Review Checklists for structure inspections (August and September 2022)
- Quality Assurance Field Reviews conducted after the inspection was performed for the period April 1, 2021 through August 1, 2022:
 - Quality Assurance Field Review Checklist, Ronald Reagan National Airport Aerial Structure (various report dates 2021)
 - Quality Assurance Field Review, Rhode Island Ave Station, Pedestrian Bridge, Parking Garage and other structural aspects (various report dates 2020 and 2021)
 - Quality Assurance Field Review, Springfield parking garage (various report dates 2020)
 - Quality Assurance Field Review, College Park parking garage (various report dates 2021)
 - Quality Assurance Field Review, Landover Station (report date 7/28/2021)
 - Quality Assurance Field Review, New Carrollton Station (report date 7/22/2021)
 - Quality Assurance Field Review, Georgia Avenue Inbound (CSX Eastbound) Bridge (report date 8/17/2021)
 - Quality Assurance Field Review, West Hyattsville Station (report date 10/25/2021)
 - Quality Assurance Field Review, Wheaton Parking Garage Bridge (various report dates 2021 and 2022)
 - Quality Assurance Field Review, New Carrollton Amtrak Station Bridge (various report dates 2021)
 - Quality Assurance Field Review, Vienna Pedestrian Bridge track 2 (various dates 2021)
- Quality Assurance Field Review Checklists completed concurrent with the structural inspection by TRST-STIN personnel for the period April 1, 2021 through August 1, 2022:
 - Rhode Island Ave Pedestrian Bridge (6/2/2021)
 - New Carrollton Aerial (6/8/2021, 6/18/2021, 6/25/2021)
 - Silver Spring CSX Bridge (7/21/2021)
 - Silver Spring OB (CSX) Bridges, Metro Station Bridge (8/5/2021)
 - Eisenhower Ave Aerial Structure (8/24/2021, 8/31/2021, 9/7/2021)
 - W&OD Trail (9/7/2021)
 - E08-PG Plaza Station (9/14/2021)
 - Greensboro Pedestrian Bridge WB (9/20/2021)
 - McLean Pedestrian Bridge (9/20/2021)
 - Spring Hill Station Pedestrian Bridge West (9/23/2021)
 - Tysons Corner Pedestrian Bridge (9/23/2021)
 - D Line Fan Shaft FD 05350 Washington Ave, stairs (10/1/2021)
 - D02 Shaft Inspections (10/14/2021)



INSPECTION AND MAINTENANCE (CONTINUED)



- D03 Shaft Inspections (10/14/2021)
- FE 12 (10/15/2021)
- FE 13 6722 Baltimore Ave CM 490+00 (10/15/2021)
- VE 15 (10/15/2021)
- FF 09A (10/21/2021)
- FF 09B (10/21/2021)
- EF 03 (10/21/2021)
- VC 10 (10/22/2021)
- V 06 IB (10/27/2021)
- V 06 OB (10/27/2021)
- A04 Woodley Station (11/30/2021)
- C03 Farragut West (12/9/2021)
- Rockville Pedestrian Bridge (12/16/2021)
- Cheverly Aerial special inspection (12/22/2021)
- Waterfront Station (1/12/2022)
- Navy Yard Station (1/12/2022)
- Dunn Loring Parking Garage (2/4/2022)
- Benning Road Station (2/8/2022)
- C Line Arlington to Pentagon, CM 213+75 to 220+50 Track 1 and 2; Rosslyn, CM 171+65 to 174+50 (2/11/2022)
- Court House Dome Relief (2/18/2022)
- Clarendon Station (2/18/2022)
- Archives Station (3/4/2022)
- Brentwood Railyard S&I Pit (3/10/2022)
- Rhode Island Station special inspection (3/16/2022)
- L Line Bridge (3/18/2022)
- Addison Road Parking Garage (3/22/2022)
- Anacostia Parking Garage (3/22/2022)
- Frederick Avenue Pedestrian Bridge (4/8/2022)
- Grosvenor Station platform edges special inspection (4/12/2022)
- New Carrollton Parking Garage (4/24/2022)
- Vienna Parking Garage, south (5/5/2022)
- L Line Steel Tunnel liner special inspection (5/24/2022)
- Silver Spring Transit Center Pedestrian bridge (6/22/2022)
- Minnesota Ave Parking Garage (6/29/2022)
- Silver Spring Transit Center (6/29/2022)
- Branch Ave Station (7/6/2022)
- Anacostia Parking Garage, Addison Road Parking Garage special inspections (7/20/2022)
- Lower Huntington Parking Garage (7/27/2022)
- Huntington Middle Parking Garage (7/27/2022)
- **REAM Track and Structures Performance reports (January 2020 through June 2022)**
- **Reliability Reports for TRST, memorandum (9/7/2022)**
- **Shady Grove Platform Canopy Concrete Damages**
- **Southern Avenue Bus Garage Bus Maintenance Service Area Concrete Deterioration Assessment (12/14/2022)**
- **STRC CM & PCM Open Work orders Opened Before 2021 (9/8/2022)**
- **STRC CM & PSM Work Orders Opened in 2021, spreadsheet (9/8/2022)**
- **STRC Tunnel PM work orders opened in 2021, spreadsheet (9/8/2022)**
- **Structural Inspection Maintenance Report B Line, Georgia Avenue Inbound (CSX Eastbound) Bridge (8/10/2021)**
- **Structural Maintenance Inspection Reports, A03 Dupont Circle to A04 Woodley Park Inbound Track 1 (3/1/2021)**
- **Structural Maintenance Inspection Reports, A08 Friendship Heights to A09 Bethesda Inbound Track 1 (2/20/2021)**

INSPECTION AND MAINTENANCE (CONTINUED)

- Structural Maintenance Inspection Reports, C08 Pentagon City to Crystal City Outbound Track 2 (12/13/2021)
- Structural Maintenance Inspection Reports, C09 Crystal City to Crystal City Portal Outbound Track 2 (1/13/2021)
- Structural Maintenance Inspection Reports, Silver Spring Portal to B09 Forest Glen Inbound Track 2 (3/19/2021)
- Structures Maintenance and Inspection Internal Safety Review (Rev. 2, 8/4/2022)
- TRST Active STRC PM work orders, spreadsheet (9/8/2022)
- TRST Hazard Log, spreadsheet (9/15/2022)
- WMATA Field Inspection of Potomac Yard Station, 6 Issues Observed (9/1/2022)
- Woodley Park Station Pilot Tunnel Steel Column Repair diagrams (6/2022)

EQUIPMENT:

- List of Wayside Strobe and Alarm Devices (WSAD) and handheld radios, spreadsheet (2022)
- List of WSADs, handheld radios, and equipment, spreadsheet (no date)
- Personal Protective Equipment list (no date)
- Storeroom PPE List, spreadsheet (no date)

SAFETY CERTIFICATION:

- Preliminary Hazard Analysis, FQ15191 19-FXFC-014 Railcar Rooftop Access Platforms at Branch Avenue, spreadsheet (7/8/2021)
- Safety and Security Certification Program Certifiable Item List: F20164 WMATA Station Rehabilitation Project Contract 3, spreadsheet (2/25/2021)
- Safety and Security Certification Program Construction Specification Conformance Checklist: FIRPG21113 WMATA Structures Package A, spreadsheet (11/23/2021)
- Safety and Security Certification Program Operational Hazard Analysis: FIRPG211121 WMATA Station Rehabilitation Project Contract 4, spreadsheet (4/12/2022)

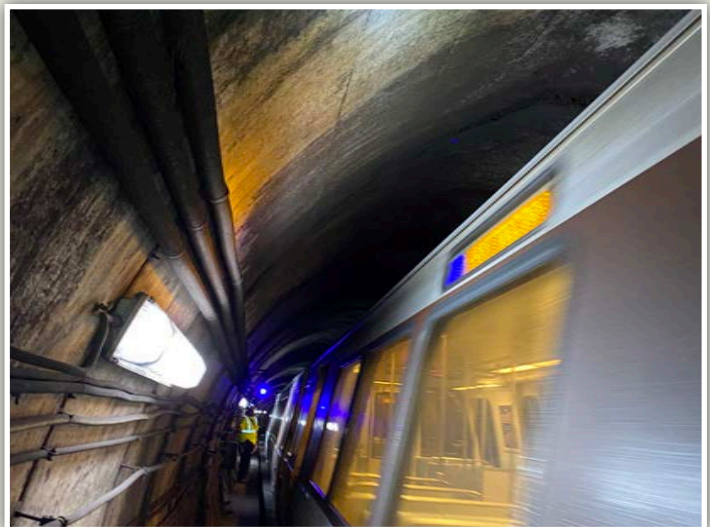
- Safety and Security Certification Program Work Package 1: Yellow Line Project Certifiable Items List for WP1-WP4 Systems, spreadsheet (2/17/2022)

MEETINGS:

- CTF Safety Committee Meeting Minutes (3/17/2022)
- CTF Safety Committee Meeting Minutes (5/20/2022)
- Track and Structures SOGR Coordination Meeting (7/14/2022)
- CTF Safety Committee Meeting Minutes (7/15/2022)
- Track and Structures SOGR Coordination Meeting (8/11/2022)
- Mill Road Duct Banks Pre-Activity Meeting, slides (8/29/2022)

CAPITAL PLANNING:

- Capital Plan: New Needs Identification intake form (no date)
- FY 2023 Capital Planning Process Meetings to Confirm Needs and Identify Gaps
- Structures Capital Investments and Needs (Version 2, no date)
- P/I 5.17/0, Capital Program Planning Policy (3/24/2022)
- Memorandum, FY2024–FY2033 Capital Planning Guidance (8/9/2022)
- Capital Program Requests process (12/7/2022)
- Current Capital Program, FY23 Budget (12/7/2022)
- FY2024 Capital Program Resources (12/7/2022)



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

1. Safety Management Policy

- a. Safety performance targets
- c. Organizational SMS Accountabilities and Responsibilities
- d. SMS documentation

2. Safety Risk Management

- a. Safety Risk Management (SRM) process
- b. Risk Assessment Process
- c. Risk assessment methodology
- d. Hazard identification
- e. Hazard investigation
- f. Hazard analysis and evaluation of safety risk
- g. Hazard resolution (mitigation, elimination)
- h. Hazard tracking

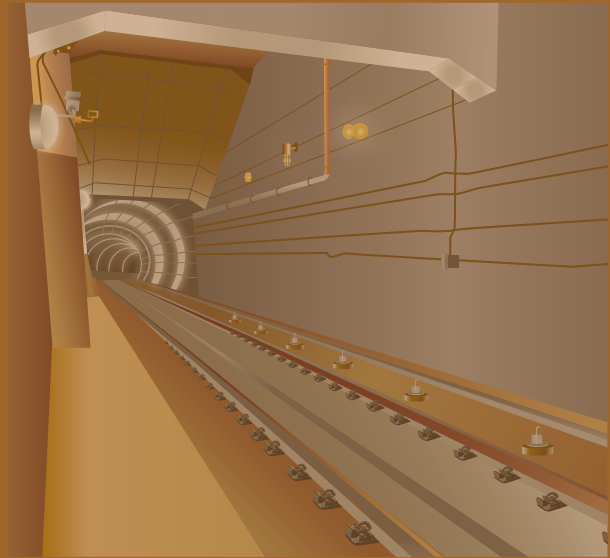
3. Safety Assurance

- a. Systematic, integrated data monitoring and recording of safety performance
- b. Real-time assessment with timely information
- d. Departmental controls
- e. Compliance and sufficiency monitoring (i.e., quality management system plan (QMSP))
- f. Document assurance activities
- g. Preventive, Predictive, and Corrective Maintenance
- i. Change management
- j. Safety and Security Certification
- k. Corrective action plans

4. Safety Promotion

- a. Training
- b. Contractor Safety
- c. Safety Communications
- d. Hazard and safety risk information
- e. Safety committees
- f. Hazardous materials and environmental management





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