

Tri-State Oversight Committee



d.



DRPT

Three-Year Safety and Security Review of the Washington Metropolitan Area Transit Authority

Elevator/Escalator Maintenance

Elements 14 and 16

Review Conducted: December 2014

Draft Report: April 22, 2015

Final Report: July 2, 2015

Introduction

Representatives from the Maryland Department of Transportation (MDOT), the District of Columbia Department of Transportation (DDOT), and the Virginia Department of Rail and Public Transportation (DRPT) comprise the Tri-State Oversight Committee (TOC), which provides regular oversight of the Washington Metropolitan Area Transit Authority (WMATA) Metrorail system. To comply with State Safety Oversight Final Rule 49 Code of Federal Regulations Part 659 (Part 659), the Federal Transit Administration (FTA) requires states to designate a State Safety Oversight (SSO) agency to administer safety and security programs for rail transit and fixed guideway systems within their jurisdictions. Specifically, 49 CFR Part 659 requires TOC to conduct an on-site safety review of each element of the WMATA System Safety Program Plan (SSPP) at least once every three years. These reviews must assess WMATA's implementation with all 21 elements of its SSPP and seven elements of its Security and Emergency Preparedness Plan (SEPP), along with related plans and procedures. Beginning in 2013, the TOC has split its Three-Year Safety and Security Review topic areas into separately occurring reviews spread out during a three-year period.

The following report documents the observations and findings of the TOC's review of elevator and escalator maintenance. Generally, this review focused on elevator and escalator conditions and whether WMATA's maintenance program complies with its own written plans as well as industry standards and best practices. These topics are the responsibility of the Offices of Elevator and Escalator Maintenance (ELES), with support from the Department of Safety and Environmental Management (SAFE) and Quality Assurance and Warranty (QAAW). The relevant SSPP elements for this review were all or part of:

- Element 14: Facilities and Equipment Inspections
- Element 16: Training and Certification

The TOC Program Standard and Procedures defines WMATA requirements for these elements in Section 12 and in Appendix B. Specific requirements are cited further, below.

Methodology

In advance of the review, the TOC requested and reviewed relevant WMATA plans, procedures, checklists, and reports. The on-site portions of the review occurred Dec. 11-12 and Dec. 22, 2014. During the on-site review sessions, the review team interviewed WMATA personnel and reviewed various documents and records to assess compliance with procedures. Persons interviewed and documents reviewed are noted at the end of this report. As the review progressed, TOC representatives discussed preliminary findings and addressed questions from WMATA personnel. This report identifies conditions evident during the review period, regardless of the current progress of potential remediation activities.

Findings are categorized as Findings of Non-Compliance or Findings of Compliance with Recommendation. A Finding of Non-Compliance refers to an instance of WMATA operating out of compliance with an applicable internal or external written requirement, plan, policy, rule, standard, or procedure. Findings of Non-Compliance may be safety-critical in nature. If a Finding of Non-Compliance is identified, WMATA is required to develop an appropriate Corrective Action Plan (CAP) and take action to achieve compliance with the applicable requirement.

A Finding of Compliance with Recommendation refers to a condition whereby WMATA may technically be conducting business in compliance with existing WMATA, TOC, or FTA procedures and requirements; however, there may be no relevant written plan, policy, or procedure in place, or the existing plan, policy, or procedure is not in accordance with industry best practices. Even if the issue is not “non-compliant,” these findings may also be safety-critical in nature. In response to a Finding of Compliance with Recommendation, WMATA is required to formally respond in writing, and is strongly urged to develop an appropriate CAP to update relevant plans, policies, rules, and/or procedures, or to address a particular identified resource or organizational issue. If WMATA determines no CAP is necessary, the agency must complete a hazard analysis in accordance with its hazard management procedure in order to justify taking no action and accept the level of risk associated with the finding.

This review, including all findings presented in this report, intends to assist WMATA with enhancing system safety throughout Metrorail operations. WMATA received a draft of this report and provided comments, which were considered for integration into this Final Report. Upon receipt of this Final Report, WMATA has 45 days to submit CAPs in response to each finding. Each proposed CAP must include the planned action, person responsible, and estimated completion date. TOC thanks WMATA for providing updates on progress already made toward addressing the findings. TOC requests that WMATA resubmit the material along with its proposed CAPs so that they can be consistently approved and verified.

The TOC would like to thank WMATA personnel for their time, cooperation, and forthrightness throughout the review process.

Current Conditions

ELES Maintenance Program

ELES is responsible for the inspection, maintenance, repair and annual certification of Metrorail elevators and escalators. The ELES inspection and maintenance function is currently organized into five geographic regions (various ELES documentation from earlier periods may contain different versions of the organization chart showing four regions). Each region has a Service & Repairs/Maintenance Superintendent and four Maintenance Supervisors. At least one supervisor is assigned to each of three daily work shifts in each region. There are about 200 mechanics assigned to the five regions covering all days and shifts. According to ELES, about 60 to 65 percent of mechanics

are assigned to the night shift, when escalator preventive maintenance is performed to avoid interference with patrons. Each region is responsible for all escalators and elevators in the stations assigned to that region. The ELES System Map for 2014 provides a breakdown of elevators and escalators by region and by station. This document identifies a total of 613 escalators and 315 elevators, including elevators at Metro maintenance facilities.

All elevators and escalators on the Silver Line and from Rosslyn to Vienna on the Orange Line are maintained by KONE under contract to WMATA. These are specifically identified on the ELES System Map and are included in the escalator/elevator count for Region 4 and the Metrorail system. Preventive maintenance (PM) scheduling is generated by Maximo; ELES PM Check Sheets (checklists) are completed by KONE contract employees or WMATA personnel, depending on equipment location noted above. QAAW audits include PM performed by both WMATA and KONE. All annual certification inspections are performed by WMATA ELES inspectors.

PM is scheduled to occur monthly for all revenue and non-revenue elevators and escalators. A team of two mechanics performs each PM and records the results on PM Check Sheets. The Check Sheet lists components to be checked or serviced with a brief description of the procedure to be followed for each. Original Equipment Manufacturer (OEM) Manuals provide additional, detailed procedural information and are available in hard copy and by online access. ELES is also developing inspection procedure manuals to cover all escalators and each type of elevator, starting with a draft for hydraulic elevators. All Check Sheets list B-level (monthly) and E-level (annual) items. There are four types of PM Check Sheets used to record inspection and maintenance based on the type of equipment being serviced:

- Escalator PM Check Sheet, B-items 1-21, E-items 22-27
- Elevator PM Check Sheet – Hydraulic Units, B-items 1-15, E-items 16-20
- Elevator PM Check Sheet – Traction Units, B-items 1-18, E-items 19-24
- Elevator PM Check Sheet – Lifts/Dumbwaiters, B-items 1-11, E-items 12-13 (this equipment is non-revenue only)

A second version of the Escalator PM Check Sheet with B-items 1-20 and E-items 21-26 is also used. This version does not include item 18, Step Run-in, from the 27-item Check Sheet (see Finding CWR-3 below). The remaining items are unchanged except for numbering above item 17. The mechanic checks off the appropriate column indicating whether each item is “OK” (acceptable), “NG” (no good), or “NA” (not applicable). Measurement values are also required for some items. Fields are provided for comments by item or in general, and there is a section to list repair work orders. Signature blocks are provided for the mechanics and supervisor.

All monthly PM is scheduled through work orders generated by Maximo. A work order report for the month of December 2014 showed PM inspections scheduled for 612 escalators and 309 elevators, which covers 99.8% of all escalators and 98.1% of all elevators; the rest appear to be under rehabilitation. Work orders are identified as B-PM

or E-PM indicating the PM items required to be completed. Work orders are closed in Maximo when PM has been completed. ELES has a policy to retain completed Check Sheets for a period of seven years.

TOC reviewed samples of completed PM Check Sheets for nine stations between June and September 2014, encompassing 10 elevators and 31 escalators. This involved a total of 40 elevator and 144 escalator Check Sheets provided for review, which indicated the following discrepancies:

- 446 items were not indicated as checked (12% of Check Sheet items). The majority of items not checked occurred at King Street, Federal Center SW, and Friendship Heights. Items that were not indicated as checked by mechanics occurred most frequently as follows:
 - 1 - Job Hazard Analysis, missed on 44 Check Sheets excluding Anacostia, DuPont Circle, Virginia Square, and West Hyattsville
 - 10 - Hand Rail Bell, missed on 20 escalator Check Sheets at Federal Center SW, Friendship Heights, and West Hyattsville
 - 10.3 - Hand Rail Tracking System, missed on 21 escalator Check Sheets predominantly at Capitol Heights and Federal Center SW
 - 18 - Step Run-in, missed on 15 escalator Check Sheets, predominantly at Capitol Heights and Friendship Heights
 - 20/21 - Fire Extinguisher, missed on 47 Check Sheets at Capitol Heights, Friendship Heights, Virginia Square, and West Hyattsville

At Friendship Heights, seven check sheets had no items indicated as checked on the first or both pages (measurement values were entered for items 15 and 17). Other Check Sheet items were marked with small faint dots, making it difficult to verify the status of items. At King Street, elevator PM for item 11.1 (door operator closing force) was not completed on three occasions in August due to a tool not being available, according to mechanic comments.

- 151 items were marked as NA (4% of Check Sheet items). Items marked NA were exclusive to escalator PM and were specific to the following Check Sheet items:
 - 1 - Job Hazard Analysis, occurred on 24 Check Sheets at Capitol Heights and Friendship Heights
 - 18 - Step Run-in, occurred on 111 Check Sheets at all stations. There is another version of the escalator PM check sheet that does not include this item.
 - 21 - Fire Extinguisher, occurred on 16 Check Sheets at Capitol Heights and Friendship Heights
- 63 Check Sheets were signed by only one mechanic (34% of Check Sheets). Instances of only one mechanic signing the Check Sheet occurred at seven stations.

- 28 Check Sheets had no supervisor signature (15% of Check Sheets). Check Sheets without supervisor signatures are nearly exclusive to Virginia Square which is under contract to KONE and may follow a different signature protocol.
- 2 Check Sheets had no mechanic signatures (Capitol Heights G02X03, 8/27/14)
- 1 Check Sheet had no date (Capitol Heights G02X03)

The inclusion of mechanics' service notations and comments on Check Sheets is a best practice providing additional useful information regarding tasks performed and equipment condition. There were 127 Check Sheets that included service and repair comments (69% of Check Sheets). The number of notations and comments as a percentage of items checked was greatest at Virginia Square and is shown for all stations in the table below.

The frequency of Check Sheet field completion for each station is summarized in the table below:

| Station | PM type | PM check sheets | % of sheets with 1 mechanic signature | % of items not checked | % of items indicated as NA | % of items with Notes and Comments |
|--------------------|---------|-----------------|---------------------------------------|------------------------|----------------------------|------------------------------------|
| Anacostia | ELEV | 10 | 0% | 0% | 0% | 5% |
| Brookland | ELEV | 6 | 33% | 4% | 0% | 1% |
| Dupont Circle | ELEV | 12 | 50% | 0% | 0% | 7% |
| King St | ELEV | 12 | 0% | 18% | 0% | 14% |
| Capitol Heights | ESC | 27 | 52% | 3% | 7% | 9% |
| Federal Center SW | ESC | 29 | 24% | 16% | 4% | 13% |
| Friendship Heights | ESC | 45 | 60% | 25% | 5% | 4% |
| Virginia Square | ESC | 25 | 0% | 3% | 5% | 26% |
| West Hyattsville | ESC | 18 | 39% | 8% | 3% | 12% |
| All 9 stations | | 184 | 34% | 12% | 4% | 11% |

The number of items not checked, in combination with items marked NA is significant for the following items (see Finding NC-1 below):

- Job Hazard Analysis is not completed on 68 of all 184 elevator/escalator Check Sheets (37%)
- Step Run-in is not completed on 126 of 144 escalator Check Sheets (88%). This item is not listed on 10 of the check sheets used at Federal Center SW and West Hyattsville.
- Fire Extinguisher is not completed on 63 of 144 escalator Check Sheets (44%)

An assessment of the same PM inspections for on-time completion indicates that 57% of PM was completed within 35 days of the previous monthly PM. Shown below are the completion rates for incremental intervals:

- PM completed within 35 days - 81 (57%)
- PM completed within 40 days - 99 (70%), 10 days overdue
- PM completed within 45 days - 119 (84%), 15 days overdue
- PM completed within 50 days - 128 (90%), 20 days overdue

PM completion intervals should be assessed to determine reasons for delayed completion; potential impacts on equipment condition, operation and safety; and development of an acceptance criteria and tolerance for exceeding the monthly schedule (see Finding NC-3)

In addition to monthly PM, all elevators and escalators require an annual code inspection and certification. This is required to verify code compliance in order to retain operating certificates issued by the Authorities Having Jurisdiction (AHJ): the Maryland Department of Labor; the Maryland Department of Licensing & Regulation; the District of Columbia Department of Consumer & Regulatory Affairs; the Commonwealth of Virginia (for Arlington County); and the County of Fairfax, Virginia. ELES has a separate organizational unit of eight inspectors to perform the annual certification inspections. Unlike the PM mechanics, the code inspectors do not perform maintenance or make repairs. Compliance checklists are completed and submitted to the appropriate AHJ, and any required repairs necessitate separate Safety Work Orders to be completed by ELES mechanics. Work must be completed for all Safety Work Orders before a non-compliant unit can be returned to service. An annual schedule assigns specific units to each inspector by month for completion of annual code inspections. Each inspector works alone and is assigned no more than one inspection per day. The ELES inspectors are also responsible for annual code inspection of units maintained under contract to KONE. Code inspectors also perform re-inspections for code compliance after repairs are completed and post-accident inspections as required by the AHJ.

TOC PM Observations

The TOC observed mechanics conduct one escalator PM and one elevator PM. The escalator PM appeared to be fully conducted as stated in the procedure. However, the procedure calls for inspecting exterior items before taking apart the equipment to service interior items. Once the escalator components are reassembled, the exterior checks are thus rendered obsolete because their measurements do not coincide with the escalator's condition following re-assembly (See recommendation in Finding NC-4 below).

During the elevator PM, the crew disconnected power to the elevator unit by opening a main breaker to the unit before they started working on the unit; however, they did not lock out/tag out the main breaker before they removed a cover from the elevator motor unit. They were in the middle of maintenance of the unit (a box that contains an elevator

motor and auxiliary equipment) when another mechanic came down into the elevator pit and brought a lock to lock the breaker. He told the crew to stop and place a lock on the breaker before they could continue the inspection, which they did (see Finding NC-6 below).

A mechanic used a fluke meter that did not have a calibration sticker. The mechanic reported that he was unaware whether the meter was ever calibrated. A senior ELES representative was also unsure regarding the calibration issue either (See Finding CWR-4 below).

Finally, there was no PM procedure being used on site. At times, one crew member had a question, but there was not a more detailed procedure to guide the next step. The mechanics asked a third, more experienced ELES mechanic, who may have only been present due to the TOC's audit; a PM crew usually consists of two people (See Finding NC-7 below).

QAAW Audits/findings

QAAW performs weekly audits of ELES PMs. Audits occur during performance of PM and include both elevators and escalators. QAAW varies the locations and mechanics selected for each audit. QAAW issues a formal report to ELES; a remediation work order to correct deficiencies is required to close the audit report. The monthly QAAW report for November indicated 40 audits completed with 37 closed, two open less than 30 days, and one open 30-45 days. The QAAW audits are comprehensive and detailed reports are provided. Documentation provided by WMATA prior to the review included 13 QAAW audit reports of escalator and elevator PM during the past year. The audit results indicated a 23% non-compliance rate for 638 items on the PM checklists. The QAAW findings are illustrated in the following table:

| audit date | | PM | station | compliance | non-compliance | fail to correct | fail to check | proceedure not followed |
|------------|-----------------------|---------------------------|----------------|------------|----------------|-----------------|---------------|-------------------------|
| 12/12/2013 | ESC | B-30 day | White Flint | 39 | 16 | 4 | 9 | 3 |
| 4/17/2014 | ELEV-2 | Hyd | College Park 1 | 21 | 13 | 7 | 5 | 1 |
| 4/17/2014 | ELEV-2 | Hyd | College Park 2 | 31 | 11 | 4 | 3 | 3 |
| 5/15/2014 | ELEV | Hyd | Metro Center | 37 | 3 | 1 | 1 | 1 |
| 11/6/2014 | ESC | B-30 day | White Flint | 45 | 7 | | 5 | 2 |
| 2/6/2014 | ESC | B-30 day | Woodley Park | 33 | 22 | 5 | 13 | 4 |
| 2/20/2014 | ESC | B-30 day | Navy Yard | 48 | 7 | 2 | 3 | 2 |
| 4/3/2014 | ELEV | Hyd | Foggy Bottom | 39 | 1 | 1 | | |
| 1/23/2014 | ESC | B-30 day | Court House | 39 | 14 | 5 | 8 | 1 |
| 2/27/2014 | ESC | B-30 day | Smithsonian | 48 | 6 | 4 | 2 | |
| 12/19/2013 | ESC | B-30 day | Deanwood | 38 | 15 | 8 | 6 | 1 |
| 1/9/2014 | ESC | B-30 day | Crystal City | 40 | 11 | 2 | 7 | 2 |
| 1/16/2014 | ESC | B-30 day | Gallery Place | 36 | 18 | 1 | 16 | 1 |
| | 13 audits | | audit items | 494 | 144 | 44 | 78 | 21 |
| | 638 total audit items | % of audit items | | 77% | 23% | | | |
| | | % of non-compliance items | | | | 31% | 54% | 15% |

The most prevalent audit finding was a failure to complete specific PM checklist items. Failure to check an item accounted for 54% of the audit non-compliance findings. QAAW audits for the nine escalator PMs identified 71 Failure to Check findings. These findings occurred for 23 specific checklist items on the Escalator PM Check Sheet. The nine checklist items for which Failure to Check was identified most frequently were 10a, 10f, 10g, 10h, 11c, 13a, 13b, 15c, and 16c, occurring for 33% to 100% of the PMs audited as shown in the table below; only items missed most frequently are shown. The reason for non-performance of these PM tasks should be determined and corrected (See Finding NC-1 below).

| PM Audit Date | checklist item: | 10a | 10f | 10g | 10h | 11c | 13a | 13b | 15c | 16c |
|---------------|-------------------------|-----|-----|-----|-----|-----|-----|------|-----|-----|
| | B-30 day | | | | | | | | | |
| 12/12/2013 | White Flint | 10a | 10f | 10g | 10h | 11c | 13a | 13b | 15c | 16c |
| 11/6/2014 | White Flint | | | | | | | 13b | 15c | 16c |
| 2/6/2014 | Woodley Park | 10a | 10f | 10g | 10h | 11c | 13a | 13b | 15c | 16c |
| 2/20/2014 | Navy Yard | | | | | 11c | | 13b | | 16c |
| 1/23/2014 | Court House | | 10f | 10g | 10h | 11c | 13a | 13b | 15c | 16c |
| 2/27/2014 | Smithsonian | | | | | | | 13b | | |
| 12/19/2013 | Deanwood | 10a | | | | 11c | | 13b | 15c | 16c |
| 1/9/2014 | Crystal City | | 10f | | | 11c | | 13b | 15c | 16c |
| 1/16/2014 | Gallery Place | | 10f | 10g | 10h | 11c | 13a | 13b | 15c | 16c |
| | 9 checklists | | | | | | | | | |
| | fail to check findings: | 3 | 5 | 4 | 4 | 7 | 4 | 9 | 7 | 8 |
| | % of checklists: | 33% | 56% | 44% | 44% | 78% | 44% | 100% | 78% | 89% |

Findings of Non-Compliance (NC)

Finding of NC 1: QAAW audits of ELES PM indicate a high rate of non-compliance with procedures. Overall QAAW results for 13 audits showed 23% of Check Sheet items were not in compliance due to failure to check an item, failure to correct a defect, or failure to follow procedure. A large number of non-compliance issues were related to a few specific Check Sheet items as described earlier in this report. Similar issues were noted by TOC in this report regarding the PM program. Although all QAAW audit findings must be addressed by remediation work orders, there does not appear to be a strategy or process that would result in department-wide, improved compliance over time.

Recommended CAP: ELES should assess common audit findings and consider ways to improve compliance for specific Check Sheet items. Procedures, equipment and personnel training should be evaluated to determine the reason for repeated non-compliance for the same item. ELES should then make improvements to procedures, equipment, and/or training based on the result of its assessment. The QAAW audit process should assess trends to determine if the overall process results in a reduction of non-compliance issues as well as to target those areas most frequently found to be deficient. WMATA should provide TOC with a report of results

from the assessment of trends and information demonstrating the reduction of non-compliance issues.

Finding of NC 2: PM Check Sheets are inconsistently completed, with some steps skipped often. Check Sheet discrepancies are described in detail in the description of the PM program. Those of the greatest concern include 34% of Check Sheets signed by a single mechanic, 12% of Check Sheet items not being completed (most commonly items 1, 10, 10.3, 18, 20/21), items commonly marked NA (1, 18, 21), and Check Sheets with most items blank (specific to Friendship Heights Check Sheets). A few Check Sheets had no supervisor or mechanic signatures. The greatest numbers of discrepancies occur with the Job Hazard Analysis, Step Run-in and Fire Extinguisher items. These items are inconsistent in being left blank, marked NA, or marked as completed among the Check Sheets reviewed. Item 18 on PM Check Sheet 50.300 10/12 does not exist on the 07/11 version of the Check Sheet which is simultaneously in use.

Recommended CAP: ELES should review the reported deficiencies, assess causes and determine a means to reduce or eliminate continued occurrences. WMATA should provide TOC with a summary of actions taken to address this finding.

Finding of NC 3: Nearly half of monthly PM inspections are not occurring on time. The monthly PM interval was more than 35 days for 43% of the PM Check Sheets provided for review. Extending the PM interval significantly beyond the monthly schedule could adversely impact equipment condition, operation, and patron safety.

Recommended CAP: ELES should have a standard and tolerance for determining the acceptable number of days between monthly PM and monitor compliance with that standard. ELES should conduct an evaluation of its manpower and the amount of time it takes to efficiently conduct a full PM in order to determine whether more resources are needed. WMATA should provide TOC with its assessment, and then implement resulting actions to define and comply with a PM interval standard. WMATA should also provide a report of PM completions for a 3-month period demonstrating compliance with the interval standard.

Finding of NC 4: Several escalator units were found to have panel gaps exceeding the 1/8 inch requirement. TOC field observations conducted throughout the system on December 11, 2014, found four instances of wide gaps between side panels on three escalator units. Other conditions noted included two uneven panel joints and three deck panels with loose/raised edges. At least one of these conditions were found on eight out of 28 escalators checked. TOC provided a list of deficient conditions after the review for immediate follow-up and corrective action. The summary of escalator defects observed is included in this report following the list of documents reviewed. TOC noted while observing a PM inspection of an escalator that a visual assessment and measurements of the exterior of the equipment occurs before side panels are removed for inspection of the interior of the escalator (Item 10). When

escalator side panels are re-assembled there is no requirement to check gaps between the panels or evenness of the panels.

Recommended CAP: WMATA should revise its escalator PM procedures so that exterior checks and measurements of the equipment occur at the end, after the escalator components are taken apart and reassembled for public use. WMATA should provide TOC with revised preventive maintenance procedures.

Finding of NC 5: The required Job Hazard Analysis is frequently not performed by mechanics at the work site. A Job Hazard Analysis form is available for employees to record specific hazards and corrective measures at the job location prior to performing work. The ELES Course Manual for Hydraulic Elevator Maintenance, Section 1 - General Safety Employee Responsibilities, Item 11, states that a Job Hazard Analysis is to be performed before starting work. The first item (1) on all ELES PM Check Sheets is Perform a Job Hazard Analysis. However, the Job Hazard Analysis form is not required to be completed and it does not appear to be in use. A review of 184 completed ELES PM Check Sheets indicated that Item 1 (Job Hazard Analysis) was checked as being performed on 63% of Check Sheets and was otherwise marked "NA" or left blank.

Recommended CAP: ELES should establish a firm, written policy enforcing the requirement for performance of a Job Hazard Analysis and require consistent use of the form and indication of completion on the Check Sheet. The use of "NA" for Job Hazard Analysis on Check Sheets should not be considered acceptable. WMATA should provide TOC with any new or revised policies, procedures, and/or training reinforcement requiring Job Hazard Analysis performance and new evidence of consistent compliance, such as copies of completed JHA forms.

Finding of NC 6: During the observation of elevator PM, the crew disconnected power at the main breaker and began work by removing the motor cover before a lock was later applied by another mechanic. This does not appear to meet the requirements of SOP 212-23, ELES Management of Electrical Lockout/Tagout. TOC also observed that mechanics did not have PM procedures to refer to during inspection.

Recommended CAP: WMATA should take steps to better ensure compliance with SOP 212-23, such as adding emphasis and explanation of the importance of compliance with lockout/tagout procedures during training. WMATA could also discuss this deficiency with mechanics during upcoming shift meetings/toolbox talks, and target rule compliance and quality assurance activity toward this procedure. WMATA should also ensure that mechanics have documentation available during PM performance that includes detailed procedures to be followed for PM completion. WMATA should provide TOC with written documentation of the steps taken to better ensure compliance with the applicable lockout/tagout procedure and availability of PM procedure documentation.

Finding of NC 7: During the observation of an elevator PM inspection, mechanics lacked information on calibration requirements and PM procedures. Crew

members did not know if a calibration sticker was required for a fluke meter being used and were in need of additional information on the PM procedure. A list of ELES tools requiring calibration and their dates of calibration was not provided for the review.

Recommended CAP: ELES should ensure that detailed procedures identify tools that require calibration and are available at locations where PM inspection is performed. ELES should also maintain a list of calibrated tools with calibration dates to ensure that calibration by SAMS is performed as required. ELES should provide procedures identifying tools requiring calibration to TOC along with documented verification that they are available to personnel on-site. A list of all calibrated ELES tools and calibration dates should also be provided.

Findings of Compliance with Recommendation (CWR)

Finding of CWR 1: The open Limited Maintenance (LM) work order list shows 1,256 being open, some dating back to February 2013. LM work orders do not require immediate maintenance and allow the equipment to operate without being completed. Many open LM work orders are presumed to be duplicate tickets for the same item, but there is no way to verify without opening each work order if, in fact, it is a duplicate ticket or a defect that has not been corrected. There may be hundreds of uncorrected deficiencies dating back many months among the 1,256 open work orders. Duplicate tickets will continue to accrue, as they can be generated from different sources.

Recommended CAP: ELES should develop a means of periodically checking open work order status to determine if reported defects have been corrected in a timely manner. Mechanics conducting PMs could check for open work orders on the equipment under inspection as part of their regular duties. Also, the Elevator/Escalator maintenance desk should check for existing open work orders before opening new ones when personnel call in deficiencies. WMATA should provide TOC with written documentation of its strategy and action to address the large volume and unknown status of open LM work orders.

Finding of CWR 2: ELES does not have a documented maintenance plan describing the organization, schedules, procedures, and inventory for escalators and elevators. Some of this information is contained in separate documents and stand-alone files, but there is no single document providing and describing this information. Documents containing information such as procedures or organization charts have conflicting information and are not dated, so it is not possible to determine which information is current. ELES compiled a draft plan into a binder for one type of PM, and planned to do so for its remaining three types of PMs.

Recommended CAP: ELES should complete maintenance plans to capture, in a single document, information that is currently but separately available. This would reinforce which tables, charts, procedures and descriptions are considered up to

date and eliminate the use of out-of-date materials. WMATA should provide these plans to TOC for review.

Finding of CWR 3: There are two versions of the ELES Escalator PM Check Sheet in use. One version includes a procedure for Step Run-in (O&K) as item 18 and the other version does not. On the version that includes it, the Step Run-in item is frequently marked NA or not completed. PM requirements for completion of this item are not clear.

Recommended CAP: ELES procedures should clearly indicate which version of the form is required for each specific escalator type being inspected and when completion of item 18 is required. ELES should provide the updated procedures to TOC.

Persons Interviewed

- [REDACTED]
- [REDACTED] ELES
- [REDACTED] ELES
- [REDACTED] ELES
- [REDACTED] ELES

Documents Reviewed

- Escalator and Elevator work order completion/availability Oct/Nov 2014
- Elevator O&M Manuals
 - Ballston East Mid-American Elevator - manual 2001
 - ELE-ESC Skills Assessment Form - Elev & Esc forms
 - Greenbelt S&I freight Elev - O&M Manual 6/23/06
 - Greenbelt S&I freight Passenger Elev - O&M Manual 6/28/06
 - Shady Grove MCE
 - West Falls Church - manual, 2002
- Escalator O&M Manuals
 - Fujitech Mt Vernon – manuals
 - Fujitech NY Ave - manuals, 2006 O&M/PM
 - Fujitech Outer B & E Lines - manuals
 - Kone - Largo Esc - manual
 - O&K -O&M manual parts 1 & 2
 - WMATA Red Line O&M manual - Foggy Bottom 2011
- 13 QAAW audit reports, Dec 2013-Nov 2014
- Silver Line Esc/Elev KONE O&M Manuals
- PM Check Sheets for Escalator, Elevator (Hydraulic, Traction, Lift)

- Supervisor QA audits
- Maintenance Guide - Hydraulic Elevators
- PM Schedule 12-12-14 (Maximo December W.O.)
- QAAW ELES Nov Monthly Report
- 184 Completed PM Reports (9 stations, 10 elevators, 31 escalators)
- Annual & Quarterly Inspection Reports (QAAW)
- Annual Certification Reports
- ELES Continuity of Operations Plan
- ELES Document Control Procedure
- ELES Business Plan
- ELES Internal Controls Programs/Procedures
- ELES Organization Chart
- ELES Training Policy/Procedures
- ELES AHJ MOUs (2008-09, signed)
- Employee A/I reporting SOP
- Employee Performance Evaluation template
- ELES LSC minutes
- ELES Maintenance Programs & Policies (draft for Hydraulic Elevator)
- ELES Supervisor Manual 1 (draft/undated)

Escalator Conditions

Noted on December 11, 2014, and provided to WMATA during the review:

| <u>Station</u> | <u>Unit</u> | <u>Condition</u> |
|----------------|-------------|---|
| Gallery Place | N15 | first side panel joint at bottom – raised edge |
| Judiciary Sq | N01 | 2 side panel joints at top - wide gap |
| Judiciary Sq | N01 | 1 side panel joint at top – joint uneven due to bowed panel |
| Judiciary Sq | N03 | 1 side panel joint at top – wide gap |
| Judiciary Sq | N03 | side panel joint at bottom and 3rd from bottom – wide gap |
| Metro Center | N05 | horizontal deck panel joint at bottom – raised edge/loose |
| Metro Center | S04 | horizontal deck panel joint at top – raised edge |
| Metro Center | S06 | horizontal deck panel next to last bottom joint – raised edge |
| New Carrollton | X01 | missing unit number at bottom |
| New Carrollton | X03 | side panel joint 3rd from top – wide gap |