PERFORMANCE EVALUATION

Review of WMATA's Escalator Rehabilitation Replacement and Maintenance Program

Final Report

Internal Operations No. 15-001
December 23, 2014

Washington Metropolitan Area Transit Authority
Office of Inspector General

M E M O R A N D U M

FINAL PERFORMANCE EVALUATION REPORT
Internal Operations No. 15-001

SUBJECT: Performance Evaluation - Review of WMATA's Escalator Rehabilitation Replacement and Maintenance Program

DATE: December 23, 2014

FROM: OIG – Helen Lew */S/*

TO: DGMO – Robert Troup

This **Final Performance Evaluation Report** presents the results of our evaluation of the Washington Metropolitan Area Transit Authority's (WMATA) Escalator Rehabilitation, Replacement and Maintenance Program.

The objective of the performance evaluation was to determine whether WMATA's Escalator Rehabilitation, Replacement, and Maintenance Program is producing results that are consistent with the program's objective. The evaluation focused on whether the Office of Elevator and Escalator Services (ELES) met the business plan targets for the program. The Office of Inspector General (OIG) performed additional analyses, comparing the performance between contractor and ELES, covered and uncovered metro rail station escalators, escalator manufacturers, and other transit agencies.

In conducting our evaluation, we sought to facilitate collaborative working relationships and effective communication with the ELES staff and other interested parties. We interacted with professionalism and respect, worked to carry out our evaluation with a minimum of disruption, and performed our work thoroughly, objectively, and with consideration of management's point of view. Throughout the review, we fostered open communications at all levels and kept management advised of our work. Management was cooperative and responsive throughout the evaluation. The information we provide in this report is intended to be helpful to WMATA management in meeting its performance goals and objectives.

Washington Metropolitan Area Transit Authority

BACKGROUND

ELES operates under the Department of Transit Infrastructure and Engineering Services within the Office of the Deputy General Manager, Operations (DGMO). The mission of ELES is to manage and maintain all vertical transportation equipment within WMATA.[1] In 2012, WMATA had 588 escalators; two were removed from the system during October 2013 (586 escalators). In July 2014,

[1] ELES Fiscal Year (FY) 2013 Operating Budget was $40 million, and FY 2013 Capital Improvement Budget was $25.8 million.

Silver Line Rail service began with an additional 27 escalators, bringing the total to 613 escalators. The Silver Line escalators are not included in the scope of this review.

WMATA has more escalators than any other transit agency with the next closest number in the New York City Transit (NYCT) with 181. WMATA also has the highest vertical height of 115 feet and the next nearest height is 95 feet in the Metropolitan Atlanta Rapid Transit Authority (MARTA).

The manufacturers of WMATA's escalators are Westinghouse Electric Corporation[2] (Westinghouse), KONE Corporation[3] (KONE), Schindler Group (Schindler), Fujitec Corporation Ltd. (Fujitec), Orenstein & Koppel (O&K), and Montgomery Elevator Company (Montgomery). Three of the manufacturers have a business office in the United States - Schindler, Fujitec, and KONE.

WMATA presently uses two escalator contractors. Schindler[4] is responsible for rehabilitating[5] (rehab) escalators, and KONE[6] is responsible for replacements,[7] preventive maintenance and corrective maintenance. KONE only performs preventive and corrective maintenance on the Orange Line between Rosslyn and Vienna, Va.

WMATA's Executive Leadership Team sets the performance targets for ELES to meet quality service. The ELES calendar years *(CY) 2012-2014 Business Plan*, dated August 13, 2012, provides strategic goals, performance measures and targets for ELES programs. For the purpose of this report, all performance metrics refer to a calendar year period unless otherwise noted. The ELES targets support WMATA's strategic goals of delivering quality service, consistently meet customer expectations and be a good steward of WMATA's assets.

In addition, WMATA's Office of Performance, Chief Performance Officer (CPO) consults with ELES management to monitor performance targets. The CPO prepares a Vital Signs Report, which is an analysis of key performance indicators (KPI) that monitors progress in strategic areas of safety, security, service reliability, and customer satisfaction. This report is produced quarterly and presented to the WMATA Board of Directors and communicates whether ELES performance is improving, deteriorating, or remaining steady.

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[2] Schindler acquired Westinghouse's elevator and escalator division in 1989.
[3] KONE acquired O&K in 1989 and Montgomery in 1994.
[4] Schindler was issued a contract in the amount of [redacted] million for the period of August 2011 – December 2016. The contract was issued to Schindler to rehabilitate and replace escalators at various Metro stations.
[5] Rehabilitation includes major component removal and replacement of all existing escalator components, installation of code upgrades with the exception of the truss (framework/skeleton) and truss pan.
[6] KONE was issued a contract in the amount of [redacted] million for the period of July 2012 – July 2015. The contract was issued to KONE to perform elevator and escalator maintenance.
[7] Replacement occurs when all parts of an escalator are removed and new components are installed including the truss.

ELES technicians are responsible for maintaining escalators. ELES technicians must have certification with either the National Association of Elevator Safety Authorities, National Association of Elevator Contractors, International Brotherhood of Electrical Workers, or the International Union of Elevator Constructors. WMATA has a four year apprenticeship program for technicians to qualify for certification. The apprenticeship program includes classroom/laboratory training and on-the-job experience.

Contract personnel augment ELES' workforce rehabilitation, replacement, and maintenance of escalators. Contractors also are required to have certification or enrollment in an apprenticeship program similar to ELES employees.

Vertical Transportation Excellence (VTX) specializes in elevator/escalator consulting. On November 15, 2010, VTX issued a report entitled *Assessment of Elevator and Escalator Maintenance and Repair Program.*

The VTX report found WMATA had significant challenges maintaining 100 percent of the elevators and escalators. There are no comparable installations like WMATA in the United States in either the public or private sector. Additionally, the report found there are areas that needed improvement for ELES to achieve its full potential. It was recommended ELES establish a continuing education program as an effective and more efficient means of analyzing and determining labor skill levels that would allow supervisors to best utilize personnel. Also, ELES should increase the frequency of supervisory maintenance inspections and audits to confirm preventive maintenance is being performed in accordance with criteria. According to ELES, WMATA satisfied the VTX findings and recommendations.

ELES Escalator Programs

ELES has several programs for maintaining, rehabbing, and replacing escalators. The maintenance is based on scheduled preventive maintenance intervals and outage analysis.

ELES performs two types of maintenance for escalators. Preventive Maintenance Inspections (PMIs) are routine scheduled maintenance designed to reduce outages and prevent more costly major repairs. Most escalators are given a PMI each month, with a more detailed inspection annually, excluding those that are in the process of being rehabbed or replaced. The second type of maintenance is Corrective Maintenance, which is performed when outages occur.

Replacement occurs when all parts of an escalator are removed to include the truss (the framework/skeleton). Rehabilitation (Rehab) occurs when most major escalator components are replaced excluding the truss. Mini-modernization is when limited rehab is done to a major part, such as an electrical code upgrade.

Photos of an old and new escalator truss at the Van Ness Station are shown as Exhibit 1.

EXHIBIT 1 - VAN NESS ESCALATOR TRUSS REPLACEMENT

Old Escalator Truss

New Escalator Truss

ELES Funding

The ELES rehab, replacement, and maintenance program is funded by WMATA's Capital Program. The WMATA Capital Program includes the Capital Improvement Program, Reimbursable Projects Program, American Recovery and Reinvestment Act Program and the Safety and Security Program.

According to the Office of Accounting, Budget Variance Report, the ELES approved FY 2012 capital budget was $8.1 million; actual expenditures were $5.2 million; FY 2013 capital budget was $6.9 million and actual expenditures were $7.6 million.

The ELES approved FY 2012 operating budget was $28.1 million; actual expenditures were $33.4 million; FY 2013 operating budget was $40 million and actual expenditure was $37.3 million. Operating funds are used for preventive and corrective maintenance.

We provided a draft of this performance evaluation to the DGMO on November 21, 2014. We received a response from the Assistant General Manager Transit Infrastructure and Engineering Services (AGM/TIES) on December 15, 2014. The AGM/TIES concurred with our findings and recommendations. The complete text is included as Attachment 1 to this report.

EVALUATION RESULTS

The ELES rehab, replacement, and maintenance program met its CY 2012 and CY 2013 targets in most areas and produced results that are consistent with the program's objective. OIG reviewed the ELES program business plan targets to determine whether the program is successful.

OIG found:

1. ELES met the performance target for escalator availability system-wide.
2. ELES met the performance target for escalator preventive maintenance inspections compliance.
3. ELES met the rehab and replacement annual target.
4. ELES met the target of responding promptly to customer complaints.
5. ELES generally met the Mean Time to Repair (MTTR) target in 2012 and significantly improved the MTTR in 2013. (Mean Time is the same as average).
6. ELES did not meet their performance for Mean Time Between Failure (MTBF) in 2012, but they significantly improved in 2013.

In addition to reviewing ELES *CY 2012-2014 Business Plan* performance targets, we performed additional analyses as follows:

- Comparison of performance between ELES and [redacted]
- Comparison of covered and uncovered metro rail station escalators
- Comparison of escalator manufacturers
- Comparisons with other transit agencies
- Dupont Circle ridership analysis during escalator replacement

Exhibit 2 is a summary of ELES' system-wide measurements and actual achievements in CYs 2012 and 2013.

EXHIBIT 2 - SUMMARY OF SYSTEM-WIDE PERFORMANCE

	2012 & 2013 Target	2012 Actual	Difference	2013 Actual	Difference
1. System Escalator Availability (above 89% target is favorable)	≥89%	89.74%	0.74%	93.31%	4.31%
2. Scheduled Maintenance Compliance (above 85% target is favorable)	≥85%	94.92%	9.92%	99.75%	14.75%
3. Escalator Rehab & Replacement (above 28 escalators target is favorable)	≥28 esc.	37	9	31	3
4. Days to Resolve Customer Complaints (below 7 days target is favorable)	≤7 days	5.95	1.05	2.9	4.10
5. System Mean Time To Repair (below 10 hours target is favorable)	≤10 hrs.	10.10	-0.10	6.69	3.31
6. System Mean Time Between Failure (above 160 hours target is favorable)	≥160 hrs.	154.19	-5.81	160.18	0.18

System availability is a measure of escalators in a "state of good repair," which includes mean time to repair, and mean time between failures. System availability[8] is based on when escalators are operating during revenue hours.[9] Operating hours,[10] hours achieved,[11] scheduled out of service hours, and unscheduled out of service hours are used to calculate availability. MTTR is the time involved to correct unscheduled outages from the time it is notified until it is resolved. MTBF measures available average operating time from one unscheduled outage to another. ELES escalator targets are affected by a number of factors, including age, last renovation, emergencies, and weather conditions.

We provided a draft of this report to the DGMO on November 21, 2014. We received a response from the Assistant General Manager Transit Infrastructure and Engineering Services (AGM/TIES) on December 15, 2014. Management generally concurred with our findings and recommendations and provided suggested changes to the report. We made revisions to the report, where appropriate. The complete text is included as Attachment 1 to this report.

1. ELES MET THE PERFORMANCE TARGET FOR ESCALATOR AVAILABILITY SYSTEM-WIDE

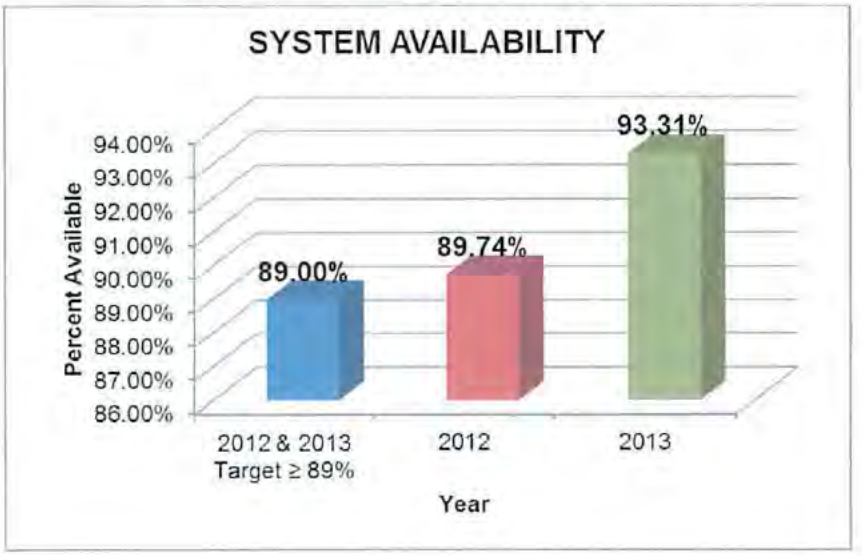
The system availability for all existing escalators for calendar periods 2012 and 2013 exceeded the targets. This represents all 588 escalators that existed in the two calendar periods. However, availability differs from station to station based upon age, ridership, and last renovation date. In 2012, the lowest availability was 72.0 percent at Georgia Avenue Station and the highest availability was 98.8 percent at Twinbrook Station. In 2013, the lowest availability was 72.5 percent at Ronald Reagan Washington National Airport and the highest availability was 99.6 percent at East Falls Church.

[8] System availability equals hours achieved divided by operating hours.
[9] Revenue hours are the following:
- Monday thru Thursday, 5 am to midnight, (19 hours a day)
- Friday, 5 am to 3 am, (22 hours)
- Saturday, 7 am to 3 am (20 hours)
- Sunday, 7 am to midnight, (17 hours)

[10] Operating hours equal revenue hours times the number of assets
[11] Hours achieved equals operating hours minus unscheduled out of service hours plus scheduled out of service hours

ELES improved system-wide availability by 3.6 percentage points from 2012 to 2013. The targets for both years were exceeded. Exhibit 3 shows the actual availability for 2012 and 2013.

EXHIBIT 3 - SYSTEM AVAILABILITY



According to ELES management, system availability improved as a result of an increase in staffing. From January 2012 to December 2013, ELES management increased the number of technicians from 144 to 179. In addition, the number of supervisors increased from 16 to 20, and inspectors from 5 to 7.

ELES management increased maintenance regions from one to four. As a result of the reorganization, technicians were given more ownership, accountability and responsibility for their assigned regions. Another factor in improving availability is ELES provided more comprehensive PMIs. PMIs helped technicians identify escalator components (parts) that needed adjustments and/or replacements, which reduced outages. These changes resulted in overall maintenance improvements.

According to the *CY 2012-2014 Business Plan,* dated August 13, 2012, the overall system availability target remained the same in 2014. On February 4, 2014, the General Manager announced the WMATA Board had agreed to revise the CY 2014 target to 90 percent. The ELES *CY 2015-2017 ELES Business Plan* availability goal is 91 percent.

2. *ELES MET THE PERFORMANCE TARGET FOR ESCALATOR* PREVENTIVE MAINTENANCE INSPECTIONS (PMIs) COMPLIANCE

PMIs are performed on escalators to resolve any identifiable concerns to avoid future mechanical failures and outages. The total number of PMIs changes from year to year because of scheduled repairs, such as modernization, rehabilitation, or replacement during the normal PMI schedule. Most escalators are given a PMI each month, with a more detailed inspection annually, excluding those being rehabbed/replaced. Complying with the scheduled inspection intervals is important in meeting ELES targets.

Our analysis showed PMIs exceeded the target for 2012 and 2013. The PMIs exceeded the 85.0 percent target by 9.9 percentage points in 2012 and by 14.8 percentage points in 2013. In 2012, there were 6,420 PMIs scheduled and 6,094 were completed. In 2013, there were 6,348 scheduled PMIs and 6,332 were completed. Exhibit 4 shows the actual percentage analysis of compliance to PMIs.

EXHIBIT 4 - PMI COMPLIANCE[12]

According to ELES management, the improvement was due to reorganization of maintenance sectors, which provided more efficiency, additional staffing, and improved scheduling and monitoring of PMIs.

According to the *CY 2012-2014 Business Plan,* dated August 13, 2012, the percent compliance target with PMIs remained the same in 2014. According to ELES *CY 2014-2016 Business Plan,* dated July 2013, targets for PMIs were revised to 95 percent.

[12] PMI Compliance is meeting the preventive maintenance scheduled intervals.

3. ELES MET THE REHAB AND REPLACEMENT ANNUAL TARGET

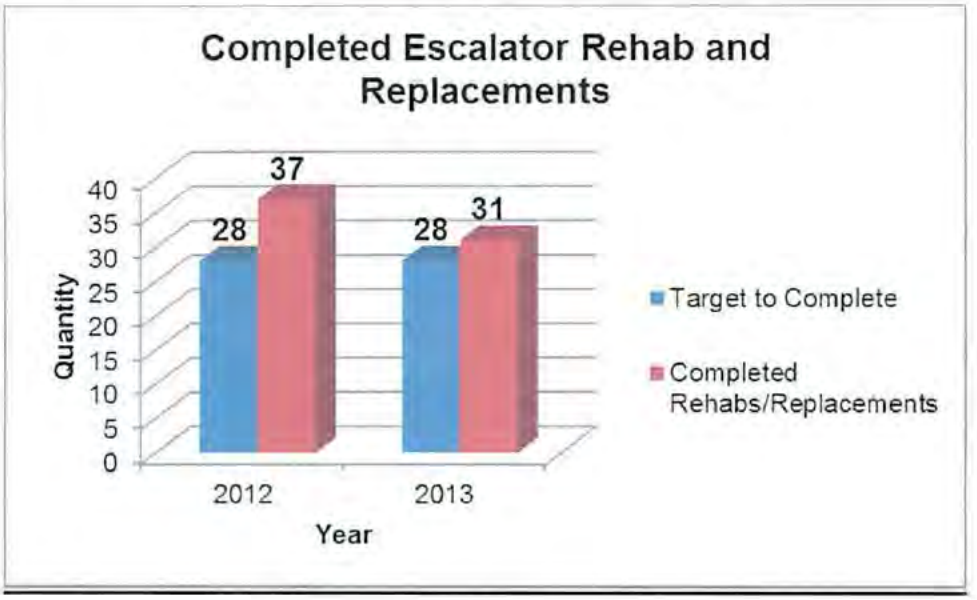
All rehabs and replacements were done by contractors in 2012 and 2013. This accounted for a greater number of rehabbed and replaced escalators completed in 2012. In 2013, two of these contracts were near completion, which resulted in fewer rehabilitation and replacement of escalators.

Escalators are expected to be rehabbed every 15 years; however, the expected useful life is affected by factors such as, but not limited to, weather, use, location, foundation, age, maintenance records, vandalism, approval authorities, and structural issues. Attachment 2 provides a listing of factors that affect service and availability.

ELES rehabbed/replaced nine more escalators than their target in 2012 and three more than their target in 2013. Exhibit 5 shows the actual numbers rehabbed/replaced.

According to the *CY 2012-2014 Business Plan,* dated August 13, 2012, the number of units to rehab/replace remained the same in 2014. ELES *CY 2014-2016 Business Plan,* dated July 2013, did not include a measurement for the number of rehabs and replacements. Instead, the Business Plan included as a measure the percentage of capital funds invested, with a target of 95 percent.

EXHIBIT 5 - REHABS AND REPLACEMENTS TABLE[13]



[13] Rehabs and replacement table includes all completed during 2012 and 2013

4. ELES MET THE TARGET OF RESPONDING PROMPTLY TO CUSTOMER COMPLAINTS

Customer complaints are managed by the Office of Customer Service. In 2012 and 2013, there were 626 and 368 escalator complaints, respectively. The average days to resolve escalator complaints in 2012 and 2013 were six and three days, respectively. After reviewing escalator complaints, it was determined common complaints were related to escalator outages. Scheduled outages account for approximately 40 percent of total outages.

EXHIBIT 6 - AVERAGE DAYS TO RESOLVE CUSTOMER COMPLAINTS[14]

According to ELES management, the reduction of days to resolve complaints was the result of a more streamlined system to process customer complaints. ELES consolidated the people who received the complaints from customer service to one. That person could then delegate complaints to staff for response. This allowed for better tracking and accountability. Staff was also reminded of the importance of responding as a way of sharing information with our customers.

According to the *CY 2012-2014 Business Plan,* dated August 13, 2012, the average number of days target to resolve customer complaints remained the same in 2014. The *CY 2014-2016 Business Plan,* dated July 2013 revised the days target to resolve customer complaints from 7 days to 5 days.

[14] This table shows the number of days from receipt involved in resolving a customer complaint.

5. ELES GENERALLY MET THE MEAN TIME TO REPAIR (MTTR) TARGET IN 2012 AND SIGNIFICANTLY IMPROVED IN 2013

MTTR is the average time involved to correct unscheduled outages from the time it is notified until it is resolved. Unscheduled outages may occur due to a variety of factors such as, customer incidents, weather, component failure, and escalator safety shut offs. Escalator safety shut offs can be activated by an emergency stop switch and safety triggers. A safety trigger can cause an escalator to power off from debris, weather, or passenger error.

The least amount of time to repair escalators is more favorable. ELES was only six minutes away from meeting their target in 2012 and exceeded the target by three hours and 19 minutes in 2013. Exhibit 7 is a chart showing the MTTR in hours for 2012 and 2013.

EXHIBIT 7 - MTTR HOURS[15]

(.10 equates to 6 minutes, and .69 equates to 41 minutes, 24 seconds)

According to ELES, contributing factors for improvement were the replacement and rehabilitation of escalators that had numerous repairs, maintenance improvements, and the reorganization of staffing.

According to the *CY 2012-2014 Business Plan,* dated August 13, 2012, the MTTR number of hours target remained the same in 2014. The ELES *CY 2014-2016 Business Plan,* dated July 2013, showed the target also remained the same.

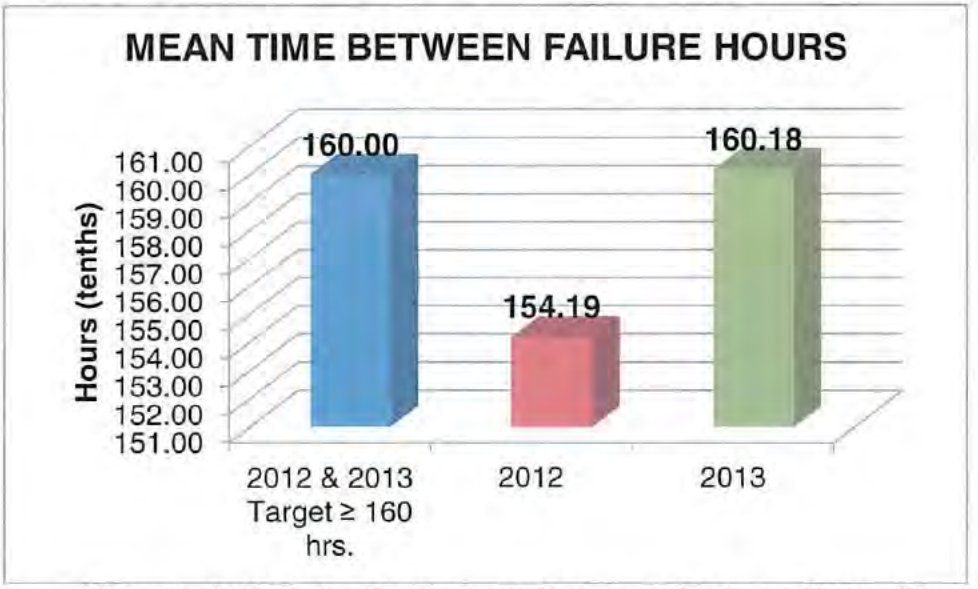
[15] MTTR is calculated as followed, Unscheduled Hours out of Service divided by Unscheduled Escalators out of Service. Unscheduled Hours out of Service equals the number of Unscheduled Hours for all escalators. Unscheduled Escalators out of Service equals the number of Unscheduled Escalator Outages.

6. ELES ALSO GENERALLY MET SYSTEM-WIDE PERFORMANCE FOR MEAN TIME BETWEEN FAILURE (MTBF) IN CY 2012 AND SIGNIFICANTLY IMPROVED IN CY 2013

MTBF measures available average operating time from one unscheduled outage to another. It is the continuous operating time until it is out of service. The greater time between outages the better the performance. Our analysis showed the MTBF in 2012 was below the target by almost six hours. Significant improvement was made between 2012 and 2013 by six hours, which was slightly above target. In 2012, there were a total of 25,264 unscheduled escalator outages. In 2013, there were a total of 24,804 unscheduled escalator outages.

Exhibit 8 shows actual MTBF hours for 2012 and 2013.

EXHIBIT 8 - MEAN TIME BETWEEN FAILURE HOURS[16]



(.19 equates to 11 minutes, 24 seconds and .18 equates to 10 minutes, 48 seconds)

According to ELES management, contributing factors for the improvement of MTBF were the result of recent rehabs/replacements, and PMIs identifying and eliminating the repair issue needed to improve escalator reliability and performance. In 2012, a greater number of escalators were rehabbed/replaced. These escalators performed significantly better in 2013 resulting in an increase between failures.

According to the *CY 2012-2014 Business Plan,* dated August 13, 2012, the MTBF hours target remained the same in 2014. The ELES *CY 2014-2016 Business Plan,* dated July 2013, showed the MTBF target remained the same.

[16] MTBF is calculated as follows, (Operating Hours minus Unscheduled Hours out of Service) divided by the number of Unscheduled Assets out of Service.

7. ADDITIONAL PERFORMANCE EVALUATIONS

In addition to reviewing ELES *CY 2012-2014 Business Plan* performance targets, we performed additional analyses as follows:

- Comparison of performance between ELES and [redacted]
- Comparison of covered and uncovered metro rail station escalators
- Comparison of escalator manufacturers
- Comparisons with other transit agencies
- Dupont Circle ridership analysis during escalator replacement

A. Comparison of Performance Between ELES and KONE

During 2011, ELES was understaffed and it was difficult to meet the demands to maintain escalators. ELES management made a strategic decision to have a contractor augment the workload to maintain some escalators. [redacted] was awarded the contract for the [redacted] between [redacted] which allowed ELES to devote attention to the remaining escalators.

The rail line between [redacted], was identified because it was easily segmented, which would be conducive for bids. This segment of the rail line included 9 stations and 59 covered escalators manufactured by [redacted] Between 2001 and 2011, 55 of the 59 escalators were rehabbed prior to the contract award date. The remaining 4 of the 59 were rehabbed during 2012 and 2013. Two escalators were removed from [redacted] in October 2013.

We compared 59 covered escalators maintained by [redacted] to 59 covered escalators maintained by ELES. The ELES escalators selected were from the entire rail system having similar attributes as the escalators maintained by [redacted] The attributes included the number of drives, escalator models, similar handrails, platforms, and entrance locations.

Total ridership during CYs 2012 and 2013 for the escalators maintained by [redacted] at nine stations was 85,958,000. In contrast, escalators used in the comparison maintained by ELES are located at 20 stations throughout the Metro rail system with total ridership of 271,681,000 during the same period.

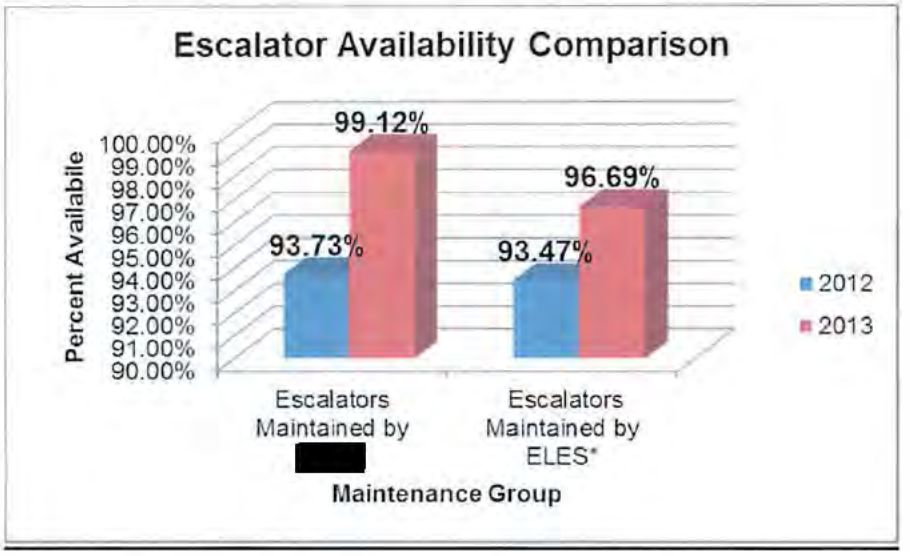
Our analysis showed that in 2012, [redacted] availability rate for escalators was less than one percent greater than ELES. In 2013, [redacted] availability rate for escalators was two percent greater than ELES.

A memorandum on *Escalator Contracted Maintenance*, dated June 28, 2013, reported the impact of contracting escalator and elevator maintenance at nine stations and how the work supported WMATA's maintenance approach to "get it right the first time." The memorandum indicated the nine [redacted] stations contracted were 3 percent more available in January 2012 – June 2012 than the system-wide average of 90 percent. The memorandum also indicated the WMATA average monthly maintenance cost/unit was $4,403 and [redacted] was $4,808 cost/unit for FY 2013.

We attempted to show only escalator maintenance cost data for ELES and [redacted] during 2013, but this information was not readily available at the end of our field work.

Exhibit 9 shows the availability rate comparisons between [redacted] and ELES.

EXHIBIT 9 - ESCALATOR AVAILABILITY COMPARISON



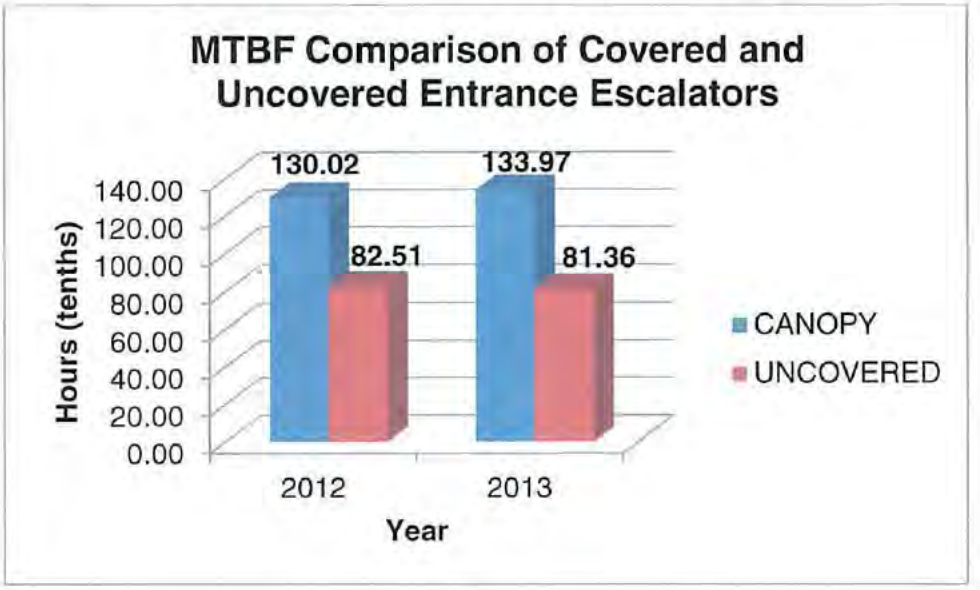
B. Comparison of Mean Time Between Failure for Covered and Uncovered Entrance Escalators

OIG analyzed the mean time between failures at stations with similar entrances that were covered by canopies compared to those completely uncovered for performance. Our analysis included 43 selected covered escalators. We compared them with all 43 uncovered escalators.

The more hours an escalator is in service, the better the performance. Our analysis showed canopy covered escalators performed better than uncovered. In 2012, canopy covered escalators' MTBF was 47.5 hours greater than uncovered escalators' MTBF. The canopy covered MTBF was 52.6 hours greater than uncovered escalators' MTBF in 2013.

Exhibit 10.1 shows the comparison of covered and uncovered MTBF between 2012 and 2013.

EXHIBIT 10.1 - MEAN TIME BETWEEN FAILURE FOR COVERED AND UNCOVERED ENTRANCE ESCALATORS



(.51 equates to 31 minutes and .36 equates to 22 minutes)

The American National Standards Institute (ANSI) provides standards for the escalator (and elevator) industry. These standards apply to new and existing escalators. The standard is for new and existing escalators to be covered. WMATA has chosen canopies to cover escalators.

Although ANSI regulations require escalators to be covered, the U.S. Department of Interior and some jurisdictions will not allow canopies on their properties. The primary reason for non-approval of canopy installations relate to aesthetic issues raised by approving authorities. The concern is to maintain an iconic view of some areas, such as the National Mall, which extends from the Washington Monument to the U.S. Capitol.

A canopy covered escalator offers overhead element protection for both the passenger and escalator. Uncovered escalators are exposed to all types of weather conditions. As a result of not being covered, escalators become corroded; require additional lubricants; and have additional wear from the snow and rain. The slippery surfaces cause additional safety hazards and accidents.

Exhibit 10.2 are photos of a canopy covered and uncovered escalators.

EXHIBIT 10.2 - CANOPY COVERED AND UNCOVERED ESCALATORS

Medical Center Canopy Covered

Shady Grove Uncovered Escalator

Covered escalators normally require less maintenance; however, unanticipated circumstances may cause problems. The Bethesda Rail Station has a fountain located above the escalator that leaks. The water from the leaks can freeze as shown in Exhibit 10.3.

EXHIBIT 10.3 - ICICLES ABOVE STATION

Photo of Icicles Above Bethesda Rail Station Escalator

The property above the Bethesda Rail Station is not owned by WMATA. A dispute between WMATA and the property owners concerning the source of the leak has delayed resolution of the problem.

C. Comparison of Manufacturers

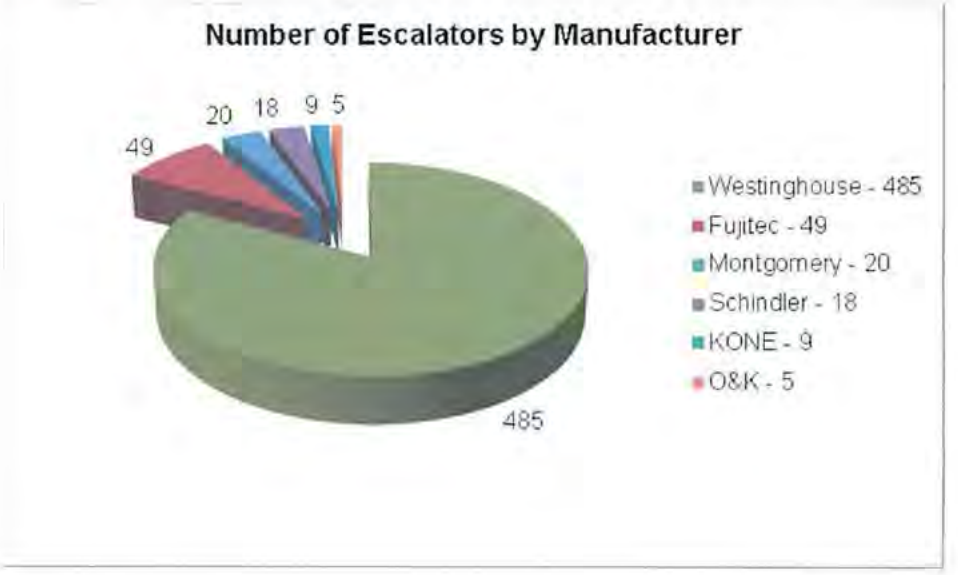
We could not conduct a meaningful analysis of escalator performance between manufacturers because of the wide disparity between the number of Schindler/Westinghouse escalators and other manufacturers.

WMATA has a total of 503 (86 percent) Schindler/Westinghouse escalators. Of the 503, 18 were manufactured by Schindler and 485 by Westinghouse. One hundred ninety-six (196) Westinghouse escalators originally installed between 1976 and 1993 have never been rehabbed or replaced. (Westinghouse no longer manufactures escalators).

Fujitec installed a total of 49 escalators (8 percent) between 1998 and 2003. Twenty-eight of the original Fujitec escalators originally installed have never been rehabbed or replaced. The Fujitec escalators are maintained by ELES.

KONE (including 5 O&K and 20 Montgomery) has a total of 34 escalators at WMATA. This equates to 6 percent of the overall escalator population. Nine KONE escalators were installed between 2004 and 2014, and all are still in operation (as of May 2014). Exhibit 11 shows the number and percentage of escalators by manufacturers (not including the Silver Line).

EXHIBIT 11 - NUMBER OF ESCALATORS BY MANUFACTURER



We calculated the mean, median and mode ages of the escalators. The computed mean age of escalators was 14.37 years which includes dates from last rehab and installation. Attachment 3 shows a listing of the manufacturers and mean age of the escalators by brand.

D. Comparison with other Transit Agencies

We contacted four major transit agencies - NYCT, Los Angeles County Metropolitan Transportation Authority (LACMTA), MARTA, and the Bay Area Rapid Transit (BART) to determine if we could compare escalator performance in several critical areas.

We were unable to make an equivalent comparison of escalator performance for the agencies contacted, as these agencies do not use the same KPIs/metrics to assess their performance. ELES benchmark their escalator performance against their previous year's performance.

ELES' key performance metrics included system-wide escalator availability, scheduled maintenance compliance, escalator rehabilitation and replacement, days to resolve customer complaints, system mean time to repair escalators and system mean time between failures.

NYCT monitors escalator performance by measuring 24 hours availability; AM rush hour service availability, PM rush hour service availability, mean time between failures and the number of scheduled versus unscheduled outages.

LACMTA utilizes a contractor to conduct all escalator maintenance. The agency measures the number of escalators that are cleaned and maintained annually. Other metrics include the number of escalator steps that are cleaned annually, escalator brake test report, and the number of repeat callbacks that are repaired.

Both BART and MARTA measure the success of their escalator program by the percentage of service hours during which escalators are available to their customers.

We noted that ELES and the other transit agencies use availability to assess if an escalator is in a "state of good repair." For example, WMATA escalator availability is affected by scheduled preventive maintenance, corrective maintenance, inspections, and capital projects such as rehabilitation and replacement. If a customer is unable to use an escalator, the unit is included on ELES outage report.

NYCT includes preventive maintenance scheduled repairs, cleaning and inspection, in the calculation of escalator availability. However, capital replacement projects are not included in the calculation of availability. For example, if the station where the capital replacement work is taking place is closed to customers for three to six months, the out of service escalators at the station are not counted against NYCT availability.

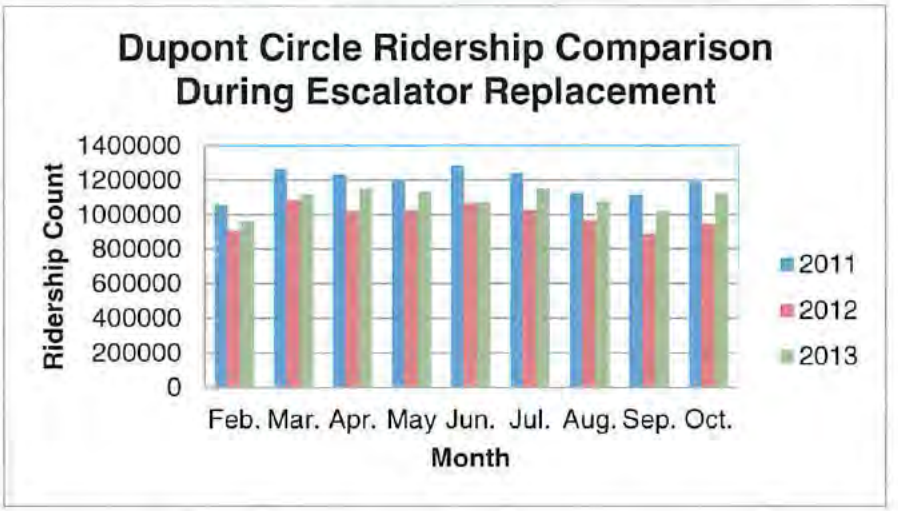
Both BART and MARTA include scheduled preventive maintenance, corrective maintenance, major repairs, modernization and replacement of escalators, in the calculation of escalator availability to their customers.

LACMTA uses two different methods for calculating availability. In the first method, all unplanned outages (for example vandalism, power outages, weather issues or equipment problems) and scheduled outages (for example: preventive maintenance, repairs and construction) are used to calculate the percentage time that escalators are available to the public. In the second method, only unplanned outages are used to calculate the percentage time an escalator is available to the public.

E. Dupont Circle Ridership Analysis during Escalator Replacement

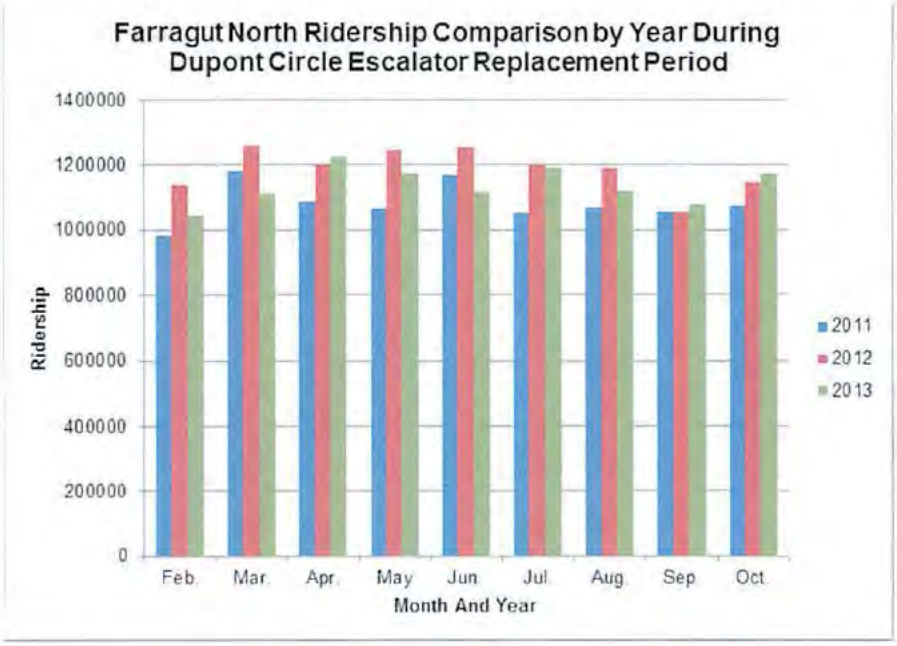
An analysis was conducted to determine the effect on ridership at the Dupont Circle Rail Station from February 2012 to October 2012, (nine months) when the Dupont Circle South entrance was closed due to escalator replacement. We compared ridership for the same time period, in calendar years 2011 and 2013. The analysis indicated the ridership was down during the replacement period compared to the year before and year after as shown in Exhibit 12.1.

EXHIBIT 12.1 - DUPONT CIRCLE RIDERSHIP COMPARISON DURING ESCALATOR REPLACEMENT



Consideration was made that passengers would use Farragut North as an alternative during the Dupont Circle Station escalator replacement. Farragut North Rail Station was selected due to its proximity to the Dupont Circle Station. Analysis for the same nine months of the Dupont Circle Station replacement indicated Farragut North Station ridership increased during that time period as shown in Exhibit 12.2.

EXHIBIT 12.2 - FARRAGUT NORTH RIDERSHIP COMPARISON BY YEAR DURING DUPONT CIRCLE ESCALATOR REPLACEMENT PERIOD



The Department of Information Technology (IT) is responsible for ridership trend analysis. Based on discussions with IT management, ridership trends cannot be directly associated with escalator outages. Ridership is affected by a variety of factors, including weather, athletic events, government holidays, congressional shut-downs, historical events, etc., not necessarily the availability of escalators.

Exhibit 12.3 is a photo of the Dupont Circle Station escalator during replacement.

EXHIBIT 12.3 - DUPONT CIRCLE ESCALATOR DURING REPLACEMENT

8. ELES CHALLENGES

Some of the challenges ELES personnel have to overcome are outside of their control. OIG's evaluation identified two such challenges - customer perception concerning performance, and various escalator inspection codes in multiple jurisdictions. These are discussed in the sections below.

A. Customer Perception Challenge

According to ELES personnel we interviewed, customers are less concerned about the availability of escalators system-wide, only that the escalators are not working for them. The public's perception is that escalators are frequently malfunctioning and unavailable. Some customers could have a negative perception of escalators based upon escalators not working at the station they frequently use, rather than system-wide performance.

ELES differs from BUS and RAIL as far as service standards and expectations. When a bus or rail car has outages, it can be substituted, and service is resumed.

Some of these unexpected and unscheduled outages include customer incidents, power outages, fire alarms, and weather conditions. In addition, scheduled PMIs and repairs increase the number of unavailable escalators, which drives customers' negative perception.

Based on ELES' *CY 2012-2014 Business Plan*, the escalator system-wide availability target is 89 percent. This means the actual availability percentage can fluctuate throughout the calendar year. Given this scenario, 11 percent of the escalators could be unavailable throughout the year, and ELES would still meet their target.

ELES sets a system-wide target for escalator availability; it does not have targets for escalators at individual rail stations. For example, L'Enfant Plaza did not meet the system-wide target in CY 2012 and CY 2013 because scheduled repairs affected escalator availability. As a result, customers that use L'Enfant Plaza may have a negative perception. Other stations like Dupont Circle in CYs 2012 and 2013 and Ronald Reagan Washington National Airport in CY 2013, experienced the same availability issues due to major scheduled rehabs or replacements.

Exhibit 13 shows the availability at highly populated Metro Stations. Availability may have been negatively affected at six of the eight stations, highlighted in yellow, because escalators were rehabbed or replaced. However, in 2012, Columbia Heights and Smithsonian both experienced a large number of unscheduled out of service (OOS) hours requiring major repairs and re-inspections, which caused them to have low availability percentages. The repairs were addressed and resulted in improved availability in 2013.

EXHIBIT 13 - Availability at Highly Populated Metro Stations

Exhibit 13 - Scheduled and Unscheduled Hours Out of Service (OOS) and Availability at Highly Populated Metro Stations									
Locations	# of Esca	2012 Sched Hrs. OOS	2012 Unsched Hrs. OOS	2012 Available	2013 Sched Hrs. OOS	2013 Unsched Hrs. OOS	2013 Available	2012 Rehab or Replacement	2013 Rehab or Replacement
Archives	5	351.90	2924.81	90.72%	120.66	2699.26	91.99%	None	None
Ballston	12	777.45	3067.96	95.46%	156.77	398.94	99.34%	None	None
Columbia Heights	7	775.19	7875.78	**82.49%**	142.90	3928.78	**91.74%**	**None**	**None**
Dupont Circle	14	19304.78	3087.95	**77.34%**	10371.43	4370.91	**85.04%**	**5**	**3**
East Falls Church	3	56.75	525.97	97.25%	21.19	59.62	99.62%	None	None
Fort Totten	6	332.65	2505.88	94.27%	127.80	1204.64	96.96%	None	None
Friendship Heights	11	1189.19	2185.59	95.65%	339.81	2524.94	96.30%	None	None
Gallery Place*	30	14761.11	13042.03	**86.41%**	2484.37	5809.83	**96.02%**	**3**	**1**
L'Enfant Plaza*	31	10927.26	16572.14	**87.62%**	16059.84	8516.89	**88.84%**	**3**	**7**
Metro Center*	25	19686.88	18594.64	**77.98%**	5407.26	11615.23	**90.22%**	**6**	**1**
New Carrollton	3	86.63	1354.06	93.2%	75.74	405.57	97.72%	None	None
Pentagon City	10	5238.42	1971.41	89.79%	5420.91	1119.24	90.71%	3	3
Ronald Reagan National	8	272.00	2333.3	**95.39%**	14334.37	1140.66	**72.52%**	**None**	**2**
Rosslyn	10	13753.45	1905.57	**77.82%**	504.77	984.06	**97.88%**	**3**	**1**
Silver Spring	5	231.81	1704.58	94.51%	119.21	1336.24	95.86%	None	None
Smithsonian	14	1197.18	13393.31	**85.24%**	360.2	8209.79	**91.30%**	**None**	**None**
U-Street Cardozo	8	1022.78	4897.33	89.52%	275.93	2781.97	94.57%	None	None
Union Station	9	1616.78	2789.63	93.06%	142.79	2589.55	95.69%	None	None
West Falls Church	6	80.55	670.46	98.23%	43.21	259.51	99.28%	None	None
Woodley Park	8	705.41	4698.15	90.43%	290.53	3569.50	93.15%	None	None

(*Major transfer hubs - Yellow highlighted stations reflect those that did not meet 89 percent system-wide availability, set by OIG for the analysis.)

In an effort to prepare the public about what is involved in a rehab or replacement project, we noted WMATA's effort to alert riders of an upcoming project. Specifically, three entrance escalators at the Bethesda Station were scheduled for replacement to begin on October 6, 2014. Hand-outs were provided to riders to inform them each escalator will take about 42 weeks, nearly 2½ years for completion of the entire project. The hand-outs also included travel options, in an effort to prepare the public about what is involved as part of improving service and customer perception. Attachment 4 is a copy of the hand-out.

B. Jurisdictional Inspection Code Challenge

WMATA operates escalators in several jurisdictions, and each Authority Having Jurisdiction has its own inspection codes and requirements. Inspections of escalators are conducted to ensure escalator units are maintained in accordance with WMATA's safety codes, state and county jurisdictional codes, the American Society of Mechanical Engineers A17.2, Guide for Inspections of Elevators regulations, and American National Standards Institute A17.1, Safety Code for Elevators and Escalators.

ELES employees have challenges meeting inspection code requirements in the various Metro rail station jurisdictions. For example, the Friendship Heights Rail Station is on the border of Washington, DC and Maryland and has escalators in the two jurisdictions.

ELES personnel, who are responsible for inspection of escalators, have to ensure that WMATA is in compliance with each jurisdiction. The jurisdictions include: the District of Columbia (DC); Maryland (Md.); Arlington County, Va.; Fairfax County, Va.; and the City of Alexandria, Va.; the Commonwealth of Virginia and the Metropolitan Washington Airports Authority. Attachment 5 is a listing of the jurisdictions including their responsibilities.

ELES personnel are responsible for conducting preventive maintenance, corrective maintenance inspections, annual inspections of units, accident inspections and re-inspections of escalator units after deficiencies have been addressed. ELES provides a qualified maintenance team to support each ELES inspector and any third party inspector during the inspection of escalator units.

RECOMMENDATIONS

We recommend the DGMO:

1. Develop new performance targets for the ELES rehab, replacement, and maintenance program taking into consideration past performance.

2. Develop a process to capture escalator and elevator maintenance costs separately for work performed by ELES personnel and contractor personnel. This type of information can be used along with performance data in making management decisions on whether to out-source, maintain in-house, or have a combination of both.

EVALUATION OBJECTIVE, SCOPE, AND METHODOLOGY

The objective of the performance evaluation was to determine whether WMATA's Escalator Rehabilitation Replacement and Maintenance Program is producing results that are consistent with the program's objective.

The scope of the performance evaluation was CY 2012 through CY 2013. WMATA had a total of 588 escalators. Two escalators were removed at Rosslyn for a total of 586. (This analysis did not include the Silver Line).

To accomplish our performance evaluation objective, OIG auditors gathered and analyzed data on availability/performances, preventive maintenance inspections compliance, reviewed customer complaints, mean time to repair, and mean time between failures.

We conducted analyses, comparing the performance between contractor and ELES technicians, covered and uncovered Metro rail station escalators, escalator manufacturers, and other transit agencies. We also compared the ridership at Dupont Circle and Farragut North stations while Dupont Circle Station was undergoing escalator replacements.

We interviewed ELES management, supervisors, technicians, and Metrorail station managers. WMATA performance and maintenance records for escalators were reviewed to determine the accuracy, reliability, validity and methodology used to make judgments on escalator availability/performance. We interviewed WMATA Office of Performance employees, and the Manager, Office of Customer Service.

We also observed escalator technicians work activities at several Metro rail stations listed below:

Bethesda	Glenmont	L'Enfant Plaza	Shaw-Howard U
Brookland	Greenbelt	Metro Center	Union Station
Dupont Circle	Judiciary Square	Mt. Vernon Square	U-Street Cardozo
Gallery Place	Landover	Navy Yard	Van Ness-UDC

We toured the escalator/elevator training lab at the Carmen Turner Facility and received a demonstration of the training escalator. We also examined WMATA policies and procedures; organizational charts; and the following prior reports:

- Vertical Transportation Excellence (VTX) *Assessment of Elevator and Escalator Maintenance and Repair Program Final Elevator Audit Submission,* November 15, 2010
- *Escalator Performance Update*, February 10, 2011
- OIG Report IT 11-002, *Review of Washington Metropolitan Area Transit Authority's (WMATA) MAXIMO Work Orders Module,* dated March 28, 2011
- *Escalator Performance Report*, September 8, 2011
- *Escalator Contracted Maintenance* Memorandum, dated June 30, 2013
- OIG *Investigations Complaint/Case No. 13-0025-1,* dated December 5, 2013

We reviewed Maximo work orders which include a history of escalator rehabs, replacements, and maintenance. We also reviewed regulatory industry and code standard requirements. We contacted transit agencies to obtain how they defined availability and gathered metrics specific to their agencies. We also interviewed project managers, and contractors who performed rehabs and replacements.

We conducted this performance evaluation in accordance with Council of the Inspectors General on Integrity and Efficiency "*Quality Standards for Inspection and Evaluation*" (January 2012) as appropriate to the scope of the performance evaluation. We believe that the evidence obtained provides a reasonable basis for our evaluation results and conclusion based on our evaluation objectives. OIG held an exit meeting on September 19, 2014, to discuss the preliminary results with WMATA management.

ADMINISTRATIVE MATTERS

Corrective actions proposed (resolution phase) and implemented (closure phase) by the affected Departments/Offices will be monitored and tracked through the Office of Inspector General's Audit Accountability and Resolution Tracking System. Department policy requires that you develop a final corrective action plan (CAP) for our review in the automated system within 30 days of issuance of this report. The CAP should set forth the specific action items and targeted completion dates necessary to implement final corrective actions on the findings and recommendations contained in this report.

We appreciate the cooperation and assistance extended by your staff during the performance evaluation. Should you or your staff have any questions concerning the draft report, please contact Andrew Clemmons, Assistant Inspector General for Audit, on (202) 962-1014, or me on (202) 962-2515.

Attachments

cc: GM/CEO – R. Sarles
TIES – R. Bitar
ELES – [redacted]
COUN – K. Pett
CPO – A. Burnside
CHOS – B. Richardson

Attachment 1

M E M O R A N D U M

SUBJECT: Response to Performance Evaluation; Review of WMATA's Escalator Rehabilitation, Replacement and Maintenance Program by OIG

DATE: December 10, 2014

FROM: ELES – [redacted]

THRU: AGM/TIES – Rodrigo Bitar

TO: OIG – Helen Lew

RECEIVED 12-15-14 ASC

Helen Lew,

I concur with the findings of the Performance Evaluation; Review of WMATA's Escalator Rehabilitation, Replacement and Maintenance Program.

The Office of Elevator and Escalator Services (ELES) and the Office of Performance (CPO) noted eight (8) errors or inaccuracies. The comments are listed below and shown on the draft report, attached. Please note that the CPO may have other comments that were forwarded to you or to the Office of Inspector General (OIG).

- Comment #1: Background, page 2, paragraph 7. ELES technicians are responsible for maintaining escalators. *ELES technicians must have National Association of Elevator Safety Authorities (NAESA) certification. WMATA has a four year apprenticeship program for technicians to qualify for NAESA certification.* ELES comment: All technicians are certified but not only by NAESA. Technicians are certified by any of the following: CET (Certified Elevator Technician), IBEW (International Brotherhood of Electrical Workers), IUEC (International Union of Elevator Constructors) and NAESA.

- Comment #2: Background, page 3, paragraph 1. *Contract personnel augment ELES' workforce rehabilitation, replacement, and maintenance of escalators. Contractors also are required to have NAESA certification or are in an apprenticeship program.* ELES Comment: Contractors are required to be certified but not exclusively by NAESA.

- Comment #3; Exhibit 2 – Summary of System-wide Performance, page 6, paragraph 1. *Mean time between failures is a measurement of available hours (time) between the time an escalator is out of service and returned to service.*

Washington Metropolitan Area Transit Authority

ELES Comment: The definition of MTBF on page 11 of the report is accurate. MTBF measures available average operating time from one unscheduled outage to another.

- Comment #4: 2. ELES Met the Performance Target for Escalator Preventive Maintenance Inspections (PMIs) Compliance, page 7, paragraph 2. *In 2012, there were 6,094 scheduled PMIs and 6,420 were completed. In 2013, there were 6,332 scheduled PMIs and 6,348 were completed.* CPO Comment: scheduled and completed numbers are reversed. Should read "In 2012, there were 6,420 PMIs scheduled and 6,094 were completed. In 2013, there were 6,348 scheduled PMIs and 6,332 were completed."

- Comment #5: B. Jurisdictional Inspection Code Challenge, page 22, paragraph 3. *"...Metropolitan Washington Airport Authority."* ELES Comment: Metropolitan Washington Airports Authority.

- Comment #6: Appendix 4, item #4. *"All inspections go through county personnel and its authorized third party agent."* ELES Comment: All inspections go through city personnel and its authorized third party agent.

- Comment #7: Background, page 2, paragraph 2. "*Only three of the manufacturers...*" CPO Comment: "Three of the manufacturers..."

- Comment #8: Background, page 2, paragraph 5. "*The CPO prepares a Vital Signs Report, which is a monthly analysis...*" CPO Comment: the Vital Signs Report is produced quarterly.

I suggest that paragraph 4 on page 2 of the report be aligned with the language used in the Departmental Business Plans—namely "goals", "measures", and "targets." Business Plans are a management tool to help the organization deliver on its mission. All Business Plans are organized around the four Strategic Goals endorsed by WMATA's Board of Directors[1]. These goals provide direction for the organization to attain its mission. The plans include measures, which track progress toward achieving strategic goals, and targets, which set the end point or direction for measures.

There are two types of measures included in the ELES Business Plan reviewed by the OIG. Escalator availability is a WMATA Key Performance Indicator (KPI), with targets set by the Executive Leadership Team (ELT) on an annual basis. KPIs are the means by which the organization demonstrates accountability to the public and the Board of Directors. Escalator availability is included in the GM/CEO Business Plan and monitored on a quarterly basis by the Board of Directors via the Vital Signs report. The remaining measures and targets discussed in the draft report (Mean Time to Repair,

Mean Time Between Failure, scheduled maintenance compliance, rehab & replacement, and days to resolve customer complaints) are selected by ELES in conjunction with the TIES Director. They are used by the Department to manage work, and do not rise up to the KPI level of review. These targets are set based on resources, service requirements, past performance, and other external factors.

While business plans focus on a three calendar year time frame, they are refreshed on an annual basis. Targets and measures can be added and dropped across business plans as the needs and focus of a Department evolves. Thus, the targets generally refer only to the first year of the three year period. As noted in the report, the ELES CY12-14 Business Plan was developed in August 2012 and includes measures and targets that guided work for the remainder of calendar year 2012 and all of calendar year 2013. In September 2013, ELES refreshed its CY12-14 Business Plan for the CY14-16 period.2 This process involved reviewing the measures to identify those that remained most useful to manage departmental work, and setting new targets for the CY14 period. While many of the targets remain the same for CY12-14 and CY14-16, two changed: preventative maintenance compliance and response to customer complaints. In addition, the number of units rehabbed or replaced was dropped as a measure. As a result, we suggest the following edits:

- Pg 7: The ELT held the target for Escalator Availability constant at 90% for 2014.
- Pg 8: According to the CY 2014-2016 Business Plan, the target for PMI compliance rose to 95% in 2014 from 85% in 2012 and 2013.
- Pg 8: The number of escalator units rehabbed and/or replaced was not included as a measure in the CY 2014 -2016 Business Plan, and consequently there was no target for 2014. Instead, the CY 2014 -2016 Business Plan included as a measure the percentage of capital funds invested, with a target of 95%.
- Pg 9: According to the CY 2014-2016 Business Plan, the target for the average number of days to resolve customer complaints dropped to 5 days in 2014, from 7 days in 2012 and 2013.
- Pg 10: According to the CY 2014-2016 Business Plan, the target for MTTR remained the same in 2014.

Pg 11: According to the CY 2014-2016 Business Plan, the target for MTBF remained the same in 2014

Two recommendations were generated as part of the performance evaluation. The first recommendation was to develop new performance targets for the ELES

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2 A copy of the plan can be found on the intranet at:
http://metroweb/departments/cpo/CY20142016%20Business%20Plans/ELES%20CY14_16%20Business%20Plan_POST.pdf

rehabilitation, replacement and maintenance program taking into consideration past performance.

On November 13, as part of the General Manager's directive to review Key Performance Indicators (KPIs), ELES sponsored, the ELT recommended and GM approved an increase to the escalator availability metric from 90 to 91%.

The second recommendation was to develop a process to capture escalator and elevator maintenance costs separately for work performed by ELES personnel and contractor personnel. In May 2014, ELES initiated the process to create budget centers in order to capture the cost to maintain each asset. Both labor and material charges can be applied to the budget centers. Each asset and all ELES personnel are captured in the budget centers. OMBS anticipates divvying the ELES operating budget into the budget centers in January 2015.

Attachment, OIG Draft Performance Evaluation

cc: DGMO – A. Robert Troup

ATTACHMENT 2

Factors That Affect Service

Preventive Maintenance Inspections are regular scheduled maintenance to proactively identify and address maintenance problems early to prevent major repairs.

1. Modernization

   a. Rehabilitation: Major component removal and replacement of all existing escalator components, installation of code upgrades with the exception of the truss and truss pan. A rehab can take from 10 to 20 weeks to complete, and extend the escalator life 10 to15 years. The average cost to rehab is approximately $450,000.

   b. Replacement: Installation of new escalators in the existing well-ways under applicable codes. Replacements can normally take up to 10 to 42 weeks depending on the rise (escalator height). The replacement expected life is 25 to 30 years. Replacement costs can range from $607,000 to $2,870,000.

   Escalator rehabs and replacements are scheduled based upon:

   - Frequency of Failures
   - Availability
   - Failure Analysis
   - Costs to Maintain

2. Walker: When one escalator is out of service for repair (typically, for a modernization that takes many weeks to complete) the adjacent escalator must be turned off so that customers may either walk up or down the remaining escalator.

3. Service Call: When an elevator/escalator is observed out of service unexpectedly by a station manager.

4. Scheduled Support: Elevators/escalators are occasionally taken out of service to support other maintenance activity in a station.

5. Safety Inspection: Building codes require that elevators/escalators be inspected on a regular basis to ensure units are operating safely.

6. Preventive Maintenance Inspections: Are conducted to ensure repairs conform to maintenance standards.

7. Customer Incident: Keeping elevators/escalators safe is Metro's top priority. If an incident/accident does take place in/on an elevator/escalator, the unit is shut down so it can be inspected to ensure the unit is safe.

8. Power Outage: When severe weather causes power outages, elevators/ escalators can go out of service for several hours until power is restored by the utility company.

9. Fire Alarm: If a sprinkler system is activated in a station due to a fire alarm, elevators and escalators are designed to shut off.

10. Weather Conditions: Mechanical and/or electrical damage may occur the day of a heavy rain event for elevators/escalators exposed to the elements as water cascades down the units, particularly entrance elevators and escalators.

11. Water Intrusion: An elevator/escalator may go out of service many weeks after a rain event as water seeps into the ground and collects at the bottom of the unit, causing damage to the equipment.

ATTACHMENT 3

2A. Comparisons of Manufacturer Brands

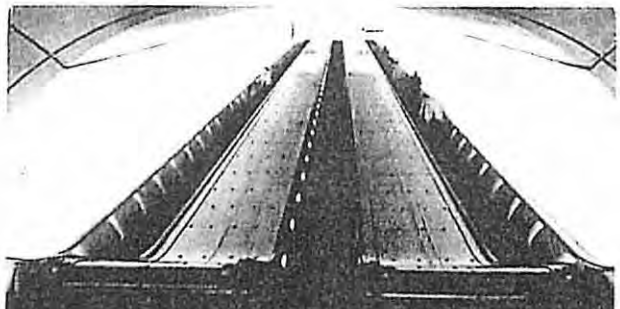
Manufacturer	Units	% of Total Units
Schindler	18	
Westinghouse 100	426	
Westinghouse 250	59	
Subtotal	503	85.84%
Fujitec	49	
Subtotal	49	8.36%
KONE	9	
Montgomery	20	
O&K	5	
Subtotal	34	5.80%
	Total 586	**100.00%**

2B. Mean Age of Escalator by Manufacturers

Manufacturer	# of Esc.	% of Total	Mean Age
Westinghouse 100	426.00	72.70%	15.17
Westinghouse 250	59.00	10.07%	18.81
Fujitec	49.00	8.36%	10.17
Montgomery	20.00	3.41%	4.00
Schindler	18.00	3.07%	6.46
KONE	9.00	1.54%	7.29
O&K	5.00	0.85%	17.43
Total	**586.00**	**100.00%**	**14.37**

ATTACHMENT 4

Bethesda Station Escalator Hand-Out



Coming to Bethesda Station:
New escalators.
One escalator at a time.

Good news, Bethesda. After over 30 years of service, the Bethesda Station escalators are being completely replaced. Not repaired, not rehabbed. Replaced.

To keep the station open, we'll replace the escalators one at a time. So only two escalators will be available during the project: One going up and one going down. We realize this could still cause some hassles for you, but it's the best solution for a project that's large, important and necessary.

The work will begin around October 6. It will take about 42 weeks to replace each unit due to the complexity of removing and installing the escalator support structures. For safety, most work will be done overnight, while all units are turned off. We apologize for the inconvenience and thank you for riding Metrorail. **For more information, call 202-637-7000 or visit wmata.com/bethesda.**

If Bethesda Station ever closes for safety reasons:

If there's a service disruption that causes crowding, the station must close. Free shuttle bus service will operate between Bethesda and Medical Center stations. But it's good to have other back-up plans, so familiarize yourself with local Metrobus and RideOn bus service. Or consider walking to/from Medical Center Station (north about a mile) or Friendship Heights Station (south about two miles). Remember: The better you're prepared, the easier it will be to go to Plan B.

metro

ATTACHMENT 5

Jurisdiction Responsibilities

1. District of Columbia - ELES has "Third Party Agreement" with the Department of Consumer and Regulatory Affairs in the District of Columbia which allows ELES to perform annual and accident inspections within the authority only on WMATA vertical transportation equipment. All inspection documentation is secured for ELES by the manager of inspections.

   ELES Maintenance Coordinators are authorized to conduct:
   a. Annual Inspections
   b. Accident Inspections
   c. Re-inspections

2. Maryland - A Memorandum of Understanding between WMATA and Department of Labor Licensing and Regulations in Maryland allows ELES Qualified Elevator Inspector to inspect elevator and escalators units annually and when accidents occur. All inspection documentation is secured for ELES by the manager of inspections.

   ELES Maintenance Coordinators are authorized to conduct:
   a. Annual Inspections
   b. Accident Inspections
   c. Re-inspections

3. Arlington County, Va. - ELES acts as the Authority Having Jurisdiction for WMATA vertical transportation equipment operating in this county. All inspection documentation is secured for ELES by the manager of inspections.

   ELES Maintenance Coordinators are authorized to inspect:
   a. Annual Inspections
   b. Accident Inspections
   c. Re-inspections

4. City of Alexandria, Va. - ELES does not inspect units in this county. The City of Alexandria has contracted with an outside agency to inspect Metro units operating in its jurisdiction. All inspections go through city personnel and its authorized third party agent.

5. Fairfax County, Va. - ELES does not actively inspect units in this county. Fairfax County has contracted with an outside agency to inspect Metro units operating in its jurisdiction. All inspections go through county personnel and its authorized third party agent.