

THE TRANSIT ELEVATOR-ESCALATOR TRAINING CONSORTIUM:

A MODEL FOR SUCCESSFUL TRAINING DEVELOPMENT



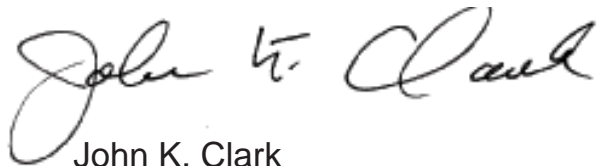
LETTER FROM THE DIRECTOR

When the Transportation Learning Center began its work in 2000, the initial vision involved deep engagement of labor and management partners at the local level to address skill needs. Fairly quickly, it became obvious that skills needed to maintain public transportation equipment in Philadelphia were the same skills needed in New York, San Francisco, Atlanta, etc. This led to development of nationally recognized training standards which could enhance local efforts in four maintenance areas: bus, rail car, signals and traction power systems and transit elevators and escalators.

When that work was finished, the elevator and escalator maintenance committee approached the Center to say that training standards were good but not sufficient. They needed classroom-ready courses but did not have the capacity to produce them alone. This and the subsequent consortia were built on the idea that if locations banded together and shared resources, they could develop what they needed. A lot needed to happen for that to come together, and it did.

It is harder to capture the spirit, dedication and sense of common mission that united the subject matter expert team with which the Center worked to accomplish this daunting task. The group felt deeply that this work represented a legacy they were leaving for future generations. I agree.

Thanks are due to all who pioneered this effort,



John K. Clark
Executive Director, Transportation Learning Center



ACKNOWLEDGEMENTS

Federal Transit Administration

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Elevator and Escalator Manufacturers For Permission to Use Manual Contents in Consortium Material	
Adams Elevator Equipment Company	KONE
Allen Bradley	Maxton Valve
Bob Desnoyers Elevator & Escalator Inspections, Inc.	Mid-American Elevator Company
ECCO	Otis
EHC Global, Inc.	Schindler
Fujitec	Southern Elevator & Electric Supply Inc.
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OVERVIEW

The Transit Elevator-Escalator Training Consortium (the Consortium) is the first in an ongoing series of industry-wide collaborative programs to develop integrated systems of training for key frontline occupations in public transportation. Building on national training standards developed by industry Subject Matter Experts (SMEs) from 2006 to 2010 and then adopted by the American Public Transportation Association (APTA), the Consortium has achieved unprecedented success by bringing together the knowledge of experienced frontline technicians, managers and trainers with the Transportation Learning Center’s (the Center’s) expert team of instructional system designers (ISDs).

The Need

Transit elevators and escalators (Ei-Es) provide an essential service to rail systems. For aging or disabled riders with limited mobility, broken Ei-Es systems mean that transportation is literally inaccessible. Yet, before the Ei-Es Partnership, the percentage availability of elevators and escalators in many transit systems was below 85 percent. Better maintenance skills were recognized as necessary to achieve needed levels of equipment availability and service to the public. The challenge of more reliable equipment is compounded by the wave of retirements sweeping through the industry and the overall economy.

Over the next ten years the industry will have to hire the equivalent 126 percent of today’s total workforce. Few, if any, transit systems have sufficient training capacity to meet that need.

History

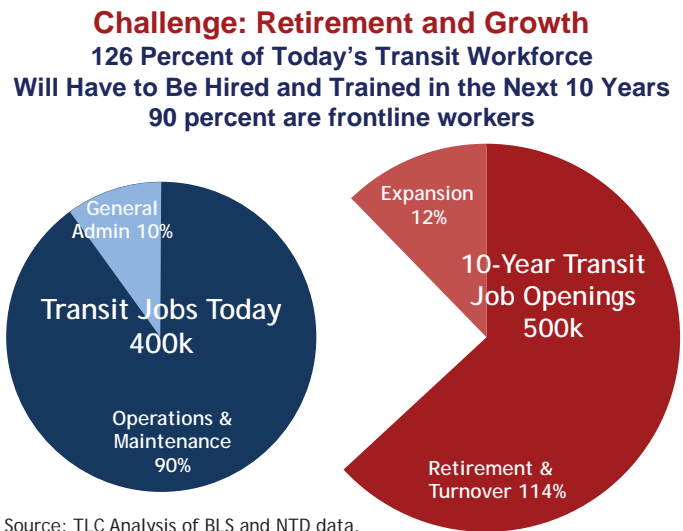
A very sensible approach to this problem is for agencies and their unions to come together to share the costs of developing excellent training and apprenticeship programs. This is the process that originally developed transit’s national training standards, and is the basis of this and subsequent training Consortium efforts. As with the initial development of training standards starting ten years ago, the the Center convenes the SME work groups and provides needed technical assistance through ISD experts. Subsequent industry-wide efforts have been launched for signals, transit bus and rail car maintenance technicians.

Partners

Membership of the Consortium consists of transit systems that maintain their vertical transportation equipment in-house, rather than relying on outside contractors. The initial members of the group include:

Bay Area Rapid Transit (BART)	Service Employees Union Local 1021
New York City Transit, MTA (NYCT)	Transport Workers Union, Local 100
SE Pennsylvania Transit Authority (SEPTA)	Transport Workers Union Local 234
Washington Metro (WMATA)	Amalgamated Transit Union Local 6
Metropolitan Atlanta Rapid Transit Authority (MARTA)	Amalgamated Transit Union Local 732

Other agencies and their union partners may join in the future. National sponsoring organizations were APTA and international unions representing frontline workers. Ei-Es original equipment manufacturers contributed access to their technical drawings and manuals to enrich the courseware. Program costs were evenly split between member transit agencies and innovative workforce grants from the Federal Transit Administration.



RESULTS: IMPROVED SKILL, GREATER SYSTEM RELIABILITY AND REDUCED COSTS

The immediate product of the Consortium is a comprehensive set of courseware within a full system of technical apprenticeship training. This greatly improved training system has produced greater skill. The collaborative process of jointly designing and then implementing this training has led to a more productive workplace culture where everyone is focused on working together to do the work in the best possible ways. For the riding public, this means greater system reliability and availability of functioning escalators and elevators – a critical requirement for high volume systems that can serve all transit customers. For area residents and governments, better skill in diagnosis, maintenance and repair translates into big cost savings – savings that far exceed the reduced costs incurred by participating agencies in working collaboratively to develop the most effective training solutions.

Training Courseware

The core product of the Consortium is detailed curriculum and customizable instruction-ready courseware, built to convey the complete set of skills and knowledge needed for expert technicians. There are over 40 courses, most with an instructor's guide, student guide, supporting PowerPoint presentations and assessments. Courses 302 and 303, OEM Specific Elevators and Escalators respectively, provide internet hyperlinks to the relevant pages of the maintenance manuals for Original Manufacturer Equipment (OEM) specific maintenance manuals. These links can be used to customize classroom instruction and/or used by maintainers in the field at each location. A collection of short "how to" videos is also included to provide hands-on demonstrations of diagnosis and repair techniques.

Integrated System of Training. These multiple modules make up the integrated system of training developed by the industry and the Center. The capstone of this system is registered apprenticeship training – the gold standard for frontline workforce training around the world. The Consortium developed a national framework for Transit Elevator-Escalator Technicians that has been reviewed and approved by the US Department of Labor. Apprenticeship training can provide the basis for granting college credit for learning on the job. With bipartisan support from Congress and the administration, it provides preferred access to public workforce funding for work-based learning. Registered apprenticeship also underscores that the transit industry has developed a shared approach to quality training – one that is applicable throughout the industry.

Reliability and Cost Savings - A Huge Return on Investment.

Dramatic improvements in equipment availability and major cost savings have already resulted from the initial implementation of this new apprenticeship training. All Consortium member agencies have already raised the availability of their elevators and escalators from the mid-80 percent range up to 94 percent and higher; more gains are expected. The agencies are saving tens of millions of dollars by doing this maintenance work with qualified in-house technicians rather than relying on outside contractors who are more costly and less responsive than in-house expertise. By joining in the Consortium's sharing of expertise across the industry, member agencies have saved millions of dollars while improving customer service.

ELEVATOR-ESCALATOR

National Apprenticeship
(and College Credit)

National Skill Validation
(Hands-on & Written)

National Credential
Management System

National Mentor
Training

National Framework for
On-the-Job Learning

National
Train-the-Trainer

Standards-Based National
Courseware

National Training
Consortium

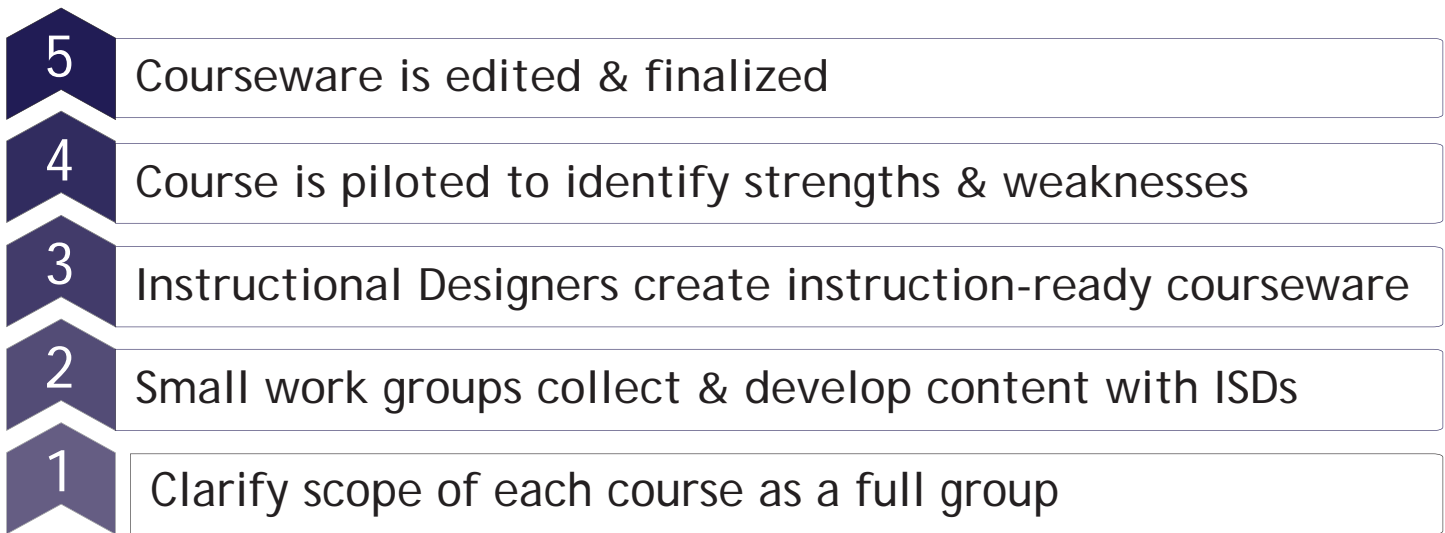
National Training Standards/
Curriculum (200-2006)

National Training
Committee

STANDARDS-BASED TRAINING COURSEWARE – WHAT WAS DEVELOPED AND HOW

The Courseware Development Process

The Consortium's largest project has been developing detailed courseware needed to develop the knowledge and skills identified in the industry-approved training standards for elevator-escalator maintenance. These training standards are made up of a series of learning objectives which are grouped into modules and then learning objectives. Five sets of transit maintenance standards were initially developed by national joint labor-management SME committees between 2006 and 2009: transit elevator/escalator, rail vehicle, bus, signals and traction power. They were adopted by APTA in 2010. As shown in the graphic below depicting the Center's proven model for courseware development, these standards are the foundation of all standards-based courseware development.



Foundation: Industry Approved Training Standards

The Consortium members developed the courseware and other components of the training systems through a collaborative partnership between industry SMEs from the agencies and their unions, and skilled ISDs from the Center - a joint labor-management project of the national industry. As shown above, the first step is to work as a full group to clarify the scope of each course. This is important not only to make sure the courses fit together and flow in a way that enhance learning but also to address any technology changes since the training standards were adopted. Once the full group agrees to the direction for the course(s), small groups of SME (in this case usually three to five) work with an ISD to identify resources which will cover address each learning objective. In some cases, location had material which was developed and could be augmented for this purpose. In other cases, ISDs would ask key questions to glean the knowledge from the SMEs and then draft new content.



SME Team working with Instructional Designer

Small group work was done at live meetings, via webinars and during site visits where ISDs would go to a certain transit property and collect information, photographs, schematics, etc. Once all content was collected, the ISDs used proven principles of adult learning to organize and present the content in a way for optimal understanding and retention. Note that all Center created courseware follows proven instructional design theories and models such as of Gagne’s Nine Events of Instruction.

To ensure quality, each course was evaluated through a pilot at a partner agency. Feedback collected from each pilot (pre/post tests, surveys, instructor interviews) was used to make any needed edits and then deem the courseware “final”. The process of piloting and related outcomes will be covered in depth later in this report.

“Too often, training materials for front-line workers are developed by people who may know the technology but don’t know what the work environment is really like. The Consortium for Transit Elevator-Escalator Maintenance does courseware development the right way. Experienced instructors and front-line supervisors sit side-by-side with mechanics who repair this equipment every day. The shared perspective produces training materials that address changing technology and real-life working conditions. I am convinced that the great experience in developing courseware for Elevator-Escalator can be adapted for a very broad range of technical transit skills.”
 - Hector Ramirez, Former Director, Training and Upgrade Fund, NYC Transit TWU Local 100

INCREASING LEVELS OF LEARNING

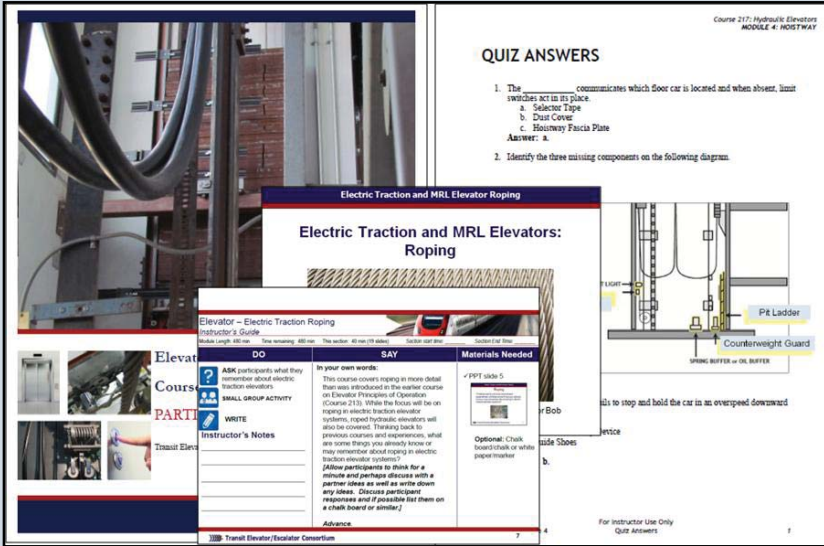
The courseware was organized in four levels, starting with the simplest and leading to the most complex – following the proven model of Bloom’s Taxonomy where each step in learning builds on the other. Sequentially these steps go from knowledge acquisition to comprehension to application and finally to analysis. The graphic below shows how the courses developed for the Consortium align to this proven ISD model.

Level of Bloom’s Taxonomy	Consortium Application
KNOWLEDGE – recalling or recognizing specific information. Remembering an idea or a fact in a similar form in which it was learned.	100 level - basic fundamentals of safety, math and science, hydraulics and pneumatics, hand tools, etc.
COMPREHENSION – Understanding information given. Communicating an idea or thing in a new or different way. Qualifying ideas in relation to one’s own experiences.	Early 200 Series - Principles of transit elevator and escalator systems, sub-systems and operations
APPLICATION – using concepts in new situations. Using what is known from a variety of areas to find solutions to problems.	Late 200 Series – Inspection and Maintenance
ANALYZE – draw connections among ideas. Take information apart and explore relationships.	300 level - advanced diagnostics and repair 400 level - most advanced topics and master-technician preparatory courses

Because the Consortium courseware was developed by a joint labor-management-trainer group, the learning objectives and their reflective content align specifically and directly to the required skills for front-line elevator-escalator technicians and consequently directly support industry needs. The Consortium also developed components of training that extend beyond courseware: Train the Trainer courses for instructors and on-the-job mentors, model questions and answers for topical quizzes, and finally a national framework for apprenticeship training submitted to and approved by the US Department of Labor.

THE PRODUCTS

Instruction-Ready Courseware



It was the goal of the Consortium to create courses that were “instruction-ready” – meaning that the courseware could be taken off the shelf and as is used for instruction by any frontline worker with a vast knowledge of the system. While it is preferable that instructors have some sort of training (more on this in the next section), everything that a would-be instructor would need is included in these instruction-ready packages:

- Coursebook/Participant Guide
- PowerPoint Presentation
- Detailed Instructor Guide
- Assessments and Evaluations

Course previews can be found on Transit Training Network: http://www.transittraining.net/courseware/facilities_maintenance/category/elevator-escalator-maintenance

Apprenticeship

A complete and Department of Labor-approved apprenticeship program is now in place as a result of Consortium work. Additionally, the Center worked with BART to help them put together a Joint Training and Apprenticeship committee. Those members have been selected, have met and a training schedule has been developed in accordance with the apprenticeship laid out by the Consortium. On January 16, 2014, the US Department of Labor officially approved the Center’s proposed transit elevator-escalator apprenticeship program. Transit Elevator-Escalator thus becomes the third national transit apprenticeship approved by DOL’s Office of Apprenticeship, joining the Bus Maintenance Technician and Rail Car Maintenance Technician programs. This new apprenticeship program is based on the industry-developed standards for training, and it incorporates the detailed courseware developed by the Consortium for Transit Elevator-Escalator Maintenance Training. The Center continued to work with locations to develop joint apprenticeship and training committees. BART successfully registered their apprenticeship with the federal and state Department of Labor. WMATA’s apprenticeship program is registered with the DC Office of Apprenticeship. The Center continues to work with SEPTA to register their apprenticeship with their state apprenticeship agency. NYCT has declined to develop an apprenticeship program.

Train-the-Trainer

Train-the-Trainer is a course designed to support trainers in the transit elevator-escalator field. The week-long course built around the Consortium-developed courses was not only piloted generally for Consortium members, but has also been held by two individual agencies in conjunction with the Center for facilitation. SEPTA, as one agency who contracted with the Center to run the course, included trainers from other departments. While the course is designed for the Elevator-Escalator material, successful adjustments were made to meet the needs in variation of all participants in the course. In all cases, the course received rave reviews from participants including incumbent instructors who have been teaching for years and indicated new growth and learning.



Train-the-Trainer Session at BART

INTRODUCTION TO THE LEVELS OF EVALUATION

To help evaluate the new training program, the Consortium has utilized the well-known and widely-accepted 4-level model of evaluation developed by the late Donald Kirkpatrick. In this model, evaluation begins with a measurement of reaction to the learning experience and then proceeds through three more levels for a comprehensive look at training results.



Kirkpatrick Levels of Evaluation (Source: dartmouth.edu)

Level 1 – Reaction: At this level, a measurement is taken to determine participant reaction to the delivered training. Provided at the end of the course, this evaluation is typically collected via surveys, questionnaires, and feedback forms.

Level 2 – Learning: In order to determine what learning has taken place, a second level of evaluation is also completed. Often, this learning evaluation is conducted through a pre and post-test and should reflect in nature and scope the learning objectives outlined in the course.

Level 3 – Behavior: The third level is a measurement of on-the-job application and use of what was learned in the course. Evaluation in this instance is collected by observation and/or interviews and again should reflect the learning objectives. In many cases, this evaluation must be completed in cooperation with workplace partners.

Level 4 – Results: The final level of evaluation is the final determination of the full impact of training in terms of agency gains or losses. This level is addressed by looking at variables and indicators such as growth, return on investment, quality ratings, etc. Identifying, measuring and relating the trainees direct input and results in business outcomes can sometimes be challenging at this level, and external factors affecting business performance must also be considered.

PILOT FINDINGS

Level I Reaction: Survey Findings from Pilot Delivery

This level one assessment was conducted through surveys completed by participants and instructor(s). Both surveys were designed to capture the reaction of the students and instructor(s) to the usefulness of the course and the effectiveness of the provided materials. The surveys also asked for participants and instructors to make suggestions for future courses if needed. Both surveys are comprised of a combination of likert items and open ended questions. On a scale of 1 – 10 with 10 being most helpful, an average of 8 out every 10 participants rated the learning objectives and reflective content as a 9 or 10. Open-ended questions provided valuable participant perspective feedback on what worked well and possible needs for future course adjustments and Consortium work.

Responses from Participant Surveys What elements did you find most helpful?

Diagrams and drawings helped out a lot.
Images on the slides with arrows.
Hands on.
Course 209: Escalator Control Systems book used actual diagrams for the job.
The course binders. They made it simple to understand.
Yes (course visuals were clear)! Hands-on practice is excellent.

What recommendations or suggestions would you make for improving this course?

More hands on activities.
Make course longer.

Level II Learning: Assessment Findings



NYCT Pilot of Course 250: Troubleshooting Theory

The first stage of assessment happens informally throughout the course for the student's and instructor's direct benefit by means of a pre-course knowledge assessment, knowledge checks throughout the module, and post module quizzes.

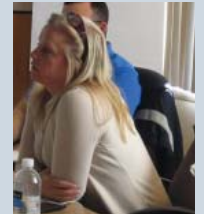
The second stage of assessment is a formal evaluation with a pre and post course test. The pre and post tests reflect the course learning objectives. This formal evaluation provides an official measurement of knowledge gain in terms of content delivered. Formal assessments conducted in these course pilots showed average pre test scores in the 50% range and average post test scores in the 90% range. An average increase of knowledge of 80 percent!

Level III: Behavior

As described earlier, the third level is a measurement of on-job application and use of what was learned in the course. To measure improvement of behavior, the Center spoke with contact people at each location. Improvements were shown, as illustrated by the quotes below from key employees at SEPTA. Evaluation continues to be on-going as more agencies complete apprenticeships.

"The apprentices have been doing well! The addition of task lists aligned with Consortium-developed courseware provide support and direction to mentors, incumbents and apprentices. Consequently, Elevator-Escalator employees have mastered technical skills with greater success and confidence."

- Colleen May, Chief Technical Instructor, SEPTA



"The aligned task lists are very important as they help the instructor, mentors, trainees, and apprentices track what level of training has been completed; where the training took place such as in the field or in the lab; the name of the instructor; the length of training in terms of hours, days or weeks; and, the apprentice scores for various tasks. The task list is considered a very important tool in the application and on-the-job portion of our SEPTA Elevator-Escalator Apprenticeship program!"

- Jerome Moore, Elevator/Escalator Specialist at SEPTA/TWU 234

Level IV: Results - System Reliability and Cost Savings

Currently, the Center is measuring this level of evaluation through agency feedback via management, supervisors and instructors. Thus far, Indications have shown that Consortium course material, through both development of material via Consortium meetings and implementation through pilots and apprenticeship, has had wide-reaching impacts including increased system reliability and cost savings.

Cultivating in-house expertise through training helps agencies save on Elevator-Escalator repair costs, while producing higher quality work that are less prone to repeat failures. Data was collected from two consortium agencies. Assuming a two-person crew for a typical repair job and an average of 20 full time Elevator-Escalator technicians on staff, in-house work results in savings of between \$4 to \$8 million dollars on an annual basis.

System Reliability is Up

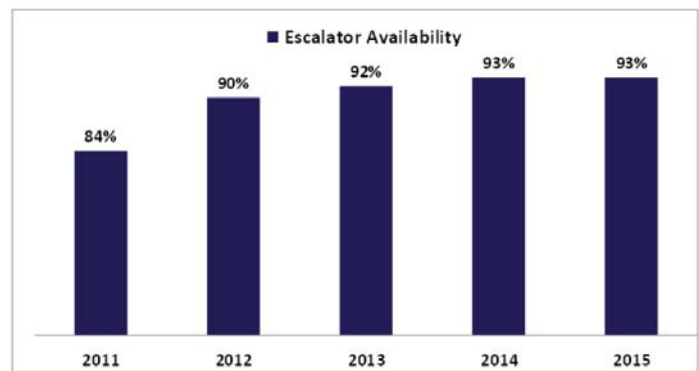
As Consortium-developed material was developed and implemented through courses and apprenticeship, participating agencies saw increases in reliability.

PARTNER HIGHLIGHTS

Washington Metro/ATU 1300

Since participation in the consortium, WMATA's escalator availability has improved tremendously, from 84 percent in 2011 to 93.2 percent in Q3 2015. Hiring of additional El/Es mechanics and beefing up the preventive maintenance program has also contributed to this improvement. 97 percent of preventive maintenance was completed on time in the second quarter of 2014, as compared to 90 percent in Q2-2012 and 40 percent in Q2-2011.

WMATA Increases Escalator Availability over Five Years



Source: WMATA Escalator Status Report

New York City Transit/TWU 100

In 2014, NYCT achieved 95 percent escalator availability and 96 percent for elevator. The agency reached its availability goals for 10 straight quarters by the summer. As a member of the Elevator-Escalator Training Consortium, NYCT has significantly improved Elevator-Escalator training relative to where it was in 2008. Improved training, along with significant changes to the planning and organization of maintenance work and strong operational leadership has made the record high availability possible.

Increased Revenue through Enhanced Maintenance Capacity



SEPTA is now being contracted to manage and service the maintenance and inspection of elevator and escalator systems in neighboring PATCO. Since participation in the El/Es Consortium, SEPTA's improved El/Es maintenance capacity has not only resulted in more reliable equipment in its own stations, but also enabled it to help out other transportation agencies in the area. SEPTA crews have been hired for five years to maintain PATCO's balky escalators and elevators for \$3.9 million. Initially, SEPTA staff was hired on an

emergency basis to assist in resolving elevators-escalators problems. PATCO and SEPTA agreed to continue the maintenance of fourteen escalators and thirteen elevators by SEPTA employees. SEPTA added five elevator-escalator repair workers to help fulfill the PATCO contract as well as maintain its own escalators and elevators. SEPTA is an active member in the Elevator-Escalator Consortium, which is currently completing development of the National Transit Elevator-Escalator Maintenance Technician Apprenticeship Program.

Savings on Repair Costs

Cultivating in-house expertise through training helps agencies save on elevator-escalator repair costs, while producing higher quality work that are less prone to repeat failures. The table below shows the labor cost comparisons between using an external contractor, versus in-house crew for Elevator-Escalator maintenance. Data was collected from two consortium agencies. Assuming a two person crew for a typical repair job and an average of 20 full time Elevator-Escalator technicians on staff, in-house work results in savings of between \$4 to \$8 millions on an annual basis.

El/Es Maintenance Labor Cost Comparisons External vs. In-house for 2-Technician Crews					
	Estimate	External Contractors (2 person crew)	In-house Specialists (2 person crew)	Hourly Savings (2 person crew)	Annual Savings (based on 20 F/T technicians)
Agency A	Low	\$380	\$136	\$217	\$4,336,000
	High	\$558	\$163	\$422	\$8,440,000
Agency B	Low	\$400	\$130	\$270	\$5,400,000
	High	\$550	\$130	\$420	\$8,400,000

Source: Transportation Learning Center preliminary analysis based on raw data from two consortium member organizations.

Other Value Added For the Industry

While the original scope of this project focused on creating standardized, quality training; instructor training and a nationally recognized apprenticeship program, there are many other benefits that were seen by location and SME participation in the courseware development process.

Shared Training Best Practices

The Consortium has provided a platform for agencies to share training knowledge and resources. As a result, Elevator-Escalator training departments in all agencies have continued to add to their training programs, practices, equipment and labs. They have shared their training methods and resources to further bolster their participant performance both in the classroom, during hands-on activities, and later in the field as technicians. In addition, the Center facilitated instructional design lessons on topics like – drafting quality learning objectives, evaluating outcomes and applying Gagne’s nine events of instruction to learning.

Shared Maintenance Best Practices

Other notable impacts from Consortium work includes improvements through agencies sharing best practices in maintenance, repair and management along with sharing their knowledge of OEM equipment and new technologies. For example, as part of course development, SMEs regularly shared knowledge regarding various components, equipment, systems and manufacturers. Some course development required integration with other departments which resulted in opportunities to further bridge or observe bridging between interagency groups.

PARTNERSHIP HIGHLIGHTS



Consortium meeting at BART

In January 2015, SEPTA added a training elevator and escalator to their training center. This equipment was re-designed by SEPTA instructional staff to simulate real problems which allows training participants the opportunity for easier and better-targeted hands-on learning including troubleshooting of problems and completing various maintenance tasks. The combination of the training program courseware with the hands-on instruction continues to result in highly knowledgeable and skilled transit elevator-escalator maintenance technicians.

At Consortium meetings held at BART and NYCT in 2015, trainers and SMEs used formal instruction system design tools to develop hands-on lesson plans for supplementing Consortium-developed curriculum and participant guides.

As part of Course 402’s development, a Consortium meeting in NYCT included a tour and observation of the agency command center and computer software system which manage all inspection, testing, maintenance, and repair tasks.



SME Phillip Newton Shows Consortium Members Command Center at NYCT

At a course development meeting in Oakland, CA, BART shared with other Consortium agencies an array of training techniques and maintenance solutions used in their agency. Since the transit environment consists of unique conditions separate from many other vertical transit applications, identification of components and equipment which may not be working as expected is an important skill for transit elevator and escalator technicians. As part of their presentation, BART demonstrated how they not only utilize damaged equipment for training purposes, but also shared how techniques they use to successfully engage with their engineering department and OEM partners to find important cost-saving solutions to these address these issues.

LOOKING FORWARD - NEXT STEPS IN CONSORTIUM WORK

Pilot Training helped identify a range of additional industry needs and opportunities for growth including:

- Additional hands-on learning lessons
- A comprehensive bank of test questions and means for “testing out”
- Short “how to” videos for instruction and later job aids
- Adjustment of apprenticeship application
- Additional instructional support for initial basic technical courses
- On-going opportunities for trainer, front-line worker, and management collaboration and support



Consortium Members get hands-on exposure to photovoltaic mock-ups at NYCT

More hands-on learning: As indicated in surveys by both participants and instructors, the importance of hands-on learning is critical to the learners and for the nature of the work ahead. While the initial work completed by the Consortium focused on the development of curriculum, course books and some hands-on learning, there is a need for more hands-on instructional strategies as well as continued on-going trainer collaboration and training for continued professional development and support.

More Assessment: Instructors and agencies also indicated a need for the means for participants to be able to “test out” of the program. “Testing out” will help target training to participant needs while helping to reduce training costs. Additionally, instructors indicated the need for a test bank which could be used for “testing out” and also used to provide fair and more accurate testing throughout the program.

Videos and other instructional technologies: In response to advancing technologies, the inclusion of additional supporting videos using the latest video technology to capture intricate details and angles of the technical work will also be addressed in future consortium work.

Apprenticeship and course hour modification: Variation in required hours varied in pilots. Some courses were completed in shorter time period than anticipated while others required more time. Sometimes, the variations were a result of differences in training supports from agency to agency, such as the availability of in-house training labs vs. actual field trips for hands-on learning opportunities. Review and consideration for hours required, adjustments in agency equipment, etc. must be conducted to fine-tune the apprenticeship program and course ware.



EL-ES Training Consortium at BART Meeting

Early course instructional support: The piloting of early courses at the 100 and 200 level indicated a need for further development through additional instructor support.

Professional development and partnerships: As earlier indicated, a positive result of Consortium work and pilot findings was the benefit of collaboration within and across the three groups present: front-line workers, managers, and trainers. Continued and regular opportunities to meet will enable the continuation of professional partnerships and development that not only strengthen employees, but also agencies both on an individual level as well as a collective group.

APPENDIX: RELATED INDUSTRY PROJECTS - TRAINING CONSORTIA. IMPLEMENTING APPRENTICESHIP AND MORE

Elevator-Escalator was the first national training consortium in the public transportation industry and led the way for two similarly modeled consortia.

The Signals Training Consortium

Transit and Rail Properties	Unions
Bay Area Rapid Transit	SEIU Local 1021
Charlotte Area Transit System	N/A
CMTA (Austin, TX)	N/A
Dallas Area Rapid Transit	ATU Local 1338
Denver RTD	ATU Local 1001
Greater Cleveland RTA	ATU Local 268
Hampton Roads	ATU Local 1177
Keolis Commuter Service (Boston)	BRS
Long Island Rail Road	BRS
Los Angeles MTA	ATU Local 1277
Maryland MTA	ATU Local 1300
MBTA (Boston)	IBEW Local 103 (Full Member)
Metra (Chicago)	BRS
Metro North	BRS
Metro Transit (Minneapolis)	ATU 1005
NFTA (Buffalo, NY)	ATU Local 1342
SacRTD (Sacramento)	IBEW Local 1245
San Diego MTS	IBEW Local 465
San Jose VTA	SEIU Local 521
SEPTA (Philadelphia)	TWU Local 234
TriMet (Portland)	ATU Local 757

The Signals Training Consortium was formed by the Center at the request of the public transportation industry in 2013. Signals maintenance is a highly technical operation requiring the highest quality training. The industry consensus was that current training was lacking and that signal maintainers were being sent into the field without adequate training. Members of the Signals Training Consortium as of Fall 2016 include those in the table.

During the past three years the Consortium has grown from 16 members to 22 including IBEW Local 103 which intends to incorporate the training materials into their basic electrician's apprenticeship program. The Consortium has been producing high quality courseware for training signal maintenance personnel. Many of the courses have been completed in draft form for review by the committee and include

student textbooks, instructor guides, power point presentation, original videos and photos and assessments.

The consortium is currently developing materials to assist agencies in recruiting and interviewing veterans as well as a toolkit for attracting, hiring and retaining more women in signal maintenance. Other products to follow are a registered apprenticeship program (hybrid), mentoring resources and a train-the-trainer course. Participants have expressed a level of enthusiasm and satisfaction that has been phenomenal.

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Signals Consortium Members Lead a Panel Discussion at SmartRail 2014 in conjunction with the Signals Consortium Meeting in Charlotte, NC

Rail Car Training Consortium

Following the successful Elevator-Escalator and Signals Training Consortia, the National Rail Car Training Consortium was formed in 2015. It brings together twelve public transportation agencies and their unions from across the country (listed below) to create a standardized training program for rail vehicle maintainers.

Building on the framework established under Transit Cooperative Research Program (TCRP) project E-7, Establishing a National Transit Industry Rail Vehicle Technician Qualification Program, the Rail Car Consortium will move forward from entry-level training to the highest level of technical qualification through the development of detailed courseware. Participating agencies and unions are also exploring the prospect of implementing Registered Apprenticeship for rail car technicians in their locations and improving rail car training beyond the standardized courseware. The first batch of instruction-ready training materials is scheduled to be available for agency piloting in the summer of 2016. Train-the-Trainer and mentor training will also be provided to member agencies to help build internal training capacity.

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4Rail Car Training Consortium SMEs Brainstorm the Correct Order of Instruction for the Courses Which Will be Developed

Rail Car Training Consortium Members Current & Pending* September 2016	
Transit and Rail Properties	Unions
Bay Area Rapid Transit	SEIU Local 1021
San Francisco MTA (MUNI)	IBEW Local 6
Maryland MTA	ATU Local 1300
MBTA (Boston)	ATU Local 589
SEPTA (Philadelphia)	TWU Local 234
Los Angeles MTA*	ATU Local 1277*
Dallas Area Rapid Transit	ATU Local 1338
Denver RTD	ATU Local 1001
San Diego MTS	IBEW Local 465
NFTA (Buffalo, NY)	ATU Local 1342
Greater Cleveland RTA	ATU Local 268
CATS (Charlotte, NC)	N/A
PATCO (New Jersey)	IBT 676

DOL American Apprenticeship Initiative

While the Elevator-Escalator Consortium has provided the framework for successful transit elevator-escalator training, the work of the Consortium does not stop with the development of the courseware. As a component of the Center's American Apprenticeship Initiative project, the Center will continue to work with the elevator-escalator consortium members to enhance and improve the transit elevator-escalator technician apprenticeship.

This future work will include:

- Modification of National Transit Elevator-Escalator Maintenance Technician Apprenticeship framework - revise required hours to make it a "true" hybrid apprenticeship model. The revised national framework will be submitted to the National Office of Apprenticeship for approval.
- Development of Apprenticeship Resources - including refinement of "100 level" curriculum materials as per pilot recommendations and development and validation of a bank of assessment questions.
- Implementation and Registration of Local Apprenticeships - work with agencies and the Department of Labor to register elevator-escalator apprenticeship and assist locations with the implementation of their apprenticeship program. This will include assistance with the development of joint apprenticeship committees, assistance with the implementation of the training program, mentor training, train the trainer, etc.

The American Apprenticeship Initiative project will last until September 2020. The continuation of the Transit Elevator-Escalator Training Consortium (now called the transit elevator-escalator apprenticeship committee) will not only provide the opportunity to advance additional goals and priorities for elevator-escalator technicians, it will also provide the opportunity for a review and update of the courseware materials before the end of the project. This update will ensure that the consortium materials that were already developed stay up to date with any changes in technology that may happen in the next 3 to 5 years.

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Transit Core Competencies



This Transit Core Competencies Curriculum (TC3) program's goal is to connect public transportation agencies' need for well-prepared workers with the community's need for good jobs. In the context of a primary focus on frontline technical positions, the TC3 program helps to inform program participants broadly about the industry and available job opportunities, while providing background knowledge and understanding that will help them to be successful job applicants and new employees, ready to learn and advance.

Specifically, this Transit Core Competencies Curriculum (TC3) will cover these ten modules: Public Transportation Industry Overview; Workplace Relations; Safety and Security; Public Transportation Technology Overview; Basic Mechanical Theory and Application; Electrical Theory and Application; Public Transportation Maintenance Overview; Tools and Material Handling; Public Transportation Vehicle Maintenance; and Facilities and Support Equipment Maintenance.

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Train-the-Trainer

Too often in the transportation industry, workers come up through the ranks and into training positions without any knowledge of training or adult learning principles. It is assumed that if you can perform a task, you can teach others to perform this task. This is simply just not the case.

The Center's Train-the-trainer course was built specifically to help a proficient frontline maintainer into a successful trainer. Additionally, this course is performed on the properties site by the Center's Instructional Design team, eliminating costly travel for agency employees. Topics include:

- Adult learner characteristics
- Qualities of an effective instructor
- Gagne's 9 events of instruction
- The pros and cons of different teaching techniques
- Using consortium developed training materials
- Evaluation techniques

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BART Employees Identify Strengths and Weaknesses of Different Teaching Techniques at Train-the-Trainer Session

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