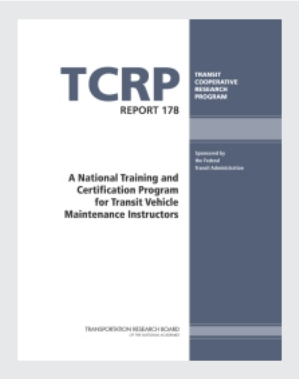

A National Training and Certification Program for Transit Vehicle Maintenance Instructors

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TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP REPORT 178

A National Training and Certification Program for Transit Vehicle Maintenance Instructors

TRANSPORTATION LEARNING CENTER
Silver Spring, MD

WITH

EDUCATIONAL DATA SYSTEMS, INC.
Dearborn, MI

Subject Areas
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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), Transportation 2000, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

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The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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It is important to recognize the contributions to this project from a number of industry leaders. The members of Panel F-19 are listed in this report. The project team is led by principal investigator Dr. Chuck Hodell, Senior Program Director of Instructional Design of the Transportation Learning Center and Associate Director of Graduate Program in Instructional Systems Development, University of Maryland, Baltimore County. Center staff who contributed to this effort includes Xinge Wang, John Schiavone, Robin Gillespie, and Brian J. Turner. Contributors from Educational Data Systems, Inc. (EDSI) included Brian Lester and Ken Mall. Melissa Huber, Principal of Huber & Associates, also contributed to the program design and development. The industry-wide organizations contributing to this effort included American Public Transportation Association and the national transit unions, Amalgamated Transit Union (ATU) and Transport Workers Union (TWU), and the various subject matter experts groups from those organizations that provided valuable feedback.

FOREWORD

By Gwen Chisholm-Smith
Staff Officer
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TCRP Report 178: A National Training and Certification Program for Transit Vehicle Maintenance Instructors provides a proposed national program structure and plan for training and certifying transit bus and rail maintenance instructors. The report also provides best practices used in the public and private sectors to prepare and certify technical instructors, as well as the attributes and instructional delivery methods found most effective for maintenance instructors. The report is intended for use by maintenance operations managers, vehicle maintenance instructors, organized labor, and learning professionals.

The public transportation industry has made significant progress in establishing a national training and certification program for transit bus maintenance technicians. An apprenticeship program for bus maintenance technicians has been developed. In addition, a transit bus maintenance technician certification testing program has been developed through the National Institute for Automotive Service Excellence (ASE). In support of this testing certification program, standards for training curricula have been developed through the American Public Transportation Association's (APTA) Bus Standards Program. Similar work has also been conducted for a training and certification program for rail transit maintenance technicians.

In addition to these efforts, there is a need to define and establish credentials for a national certification for transit vehicle maintenance instructors.

The Transportation Learning Center prepared this report under TCRP Project F-19. The objective of this research was to develop a plan for potential implementation of a vehicle maintenance instructor training and certification program. To accomplish this objective, a feasibility study to determine the viability of a national certification system for a vehicle maintenance instructor training and certification program was conducted. A series of online surveys and interviews with subject matter experts were conducted to provide the foundation for the Training and Certification Program Plan and the roadmap for implementation.

CONTENTS

SUMMARY

A National Training and Certification Program for Transit Vehicle Maintenance Instructors

Creating a world-class and credentialed cadre of professional transit vehicle maintenance instructors was the single, unwavering objective for TCRP Project F-19, "A National Training and Certification Program for Transit Vehicle Maintenance Instructors." In a complex transit environment where safety requirements, economic constraints, and daily advancements in technical and system sophistication require cost-effective and reliable training solutions, the demands on transit vehicle maintenance instructors have never been more critical. Coupled with the onslaught of retirements within the ranks of both technicians and instructors, the necessity for nationally recognized standards and a comprehensive model for instructor training and certification has become a priority among most transit agencies. In stark contrast to this critical need, there presently exists no national system or standard for the training and certification of these transit vehicle maintenance instructors. It is within this vacuum of national standards and certification that this project evolved and has now developed a program that ensures that vehicle maintenance instructors will have the established courses, demanding skill evaluation and professional certification that meets or exceeds anything else existing today.

A suite of instructor skills courses designed specifically for the needs of this population of instructors will provide the framework for a certification process that includes both cognitive and applied skills requirements. Together with a business plan that addresses the specific and detailed issues of budget, operational process and organizational structure, the work done through this project delivers a roadmap that an organization can use for implementing a modern, professional, and cost-effective training and certification program for transit vehicle maintenance instructors. This new program will be credible because it is based on the rigorous work performed in Project F-19 and it provides a suite of tools for the evaluation and accreditation of mastery for instructors. It will be more efficient since it is a national approach eliminating the need for each agency to develop redundant and unnecessary programs, courses, and qualifications. Finally, it will insure a new generation of instructional professionals since the courses and process of certification will assure that any instructor granted certification will have the documented skills to be the best in transit vehicle maintenance instruction.

Defining and Addressing the Training and Certification Challenge in Transit Vehicle Maintenance

While there is almost universal agreement that upgrading and credentialing the teaching skills of transit vehicle maintenance instructors is a priority, the daunting task of actually creating the program proves to be no small endeavor. Years of dispersed, agency-specific traditional training approaches, lack of momentum for change, and scarce resources have left the transit vehicle maintenance training organizational landscape essentially unchanged

for decades. Concurrently, visibility and scrutiny by political, governmental, regulatory, and public interests engendered an expectation of seemingly perfect transit vehicle maintenance.

As if all of these issues weren't enough, the existing generation of top maintenance technicians, who for years were the primary source of maintenance instructors, were now retiring in larger numbers. This exodus left agencies with the dual challenge of not only hiring and training new technicians, but also replacing and training the new corps of instructors.

With all of these converging influences, the environment was conducive and receptive to finally addressing the question of better training and national certification for transit vehicle maintenance instructors. TCRP provided the leadership and foresight to direct this project, assembling a panel of industry professionals representing all facets of transit to mentor the project process and specifics based on decades of transit and subject matter expertise.

The Process for Developing a National System of Training and Certification

In order to determine the best approach to the training and certification of transit vehicle maintenance instructors, a rigorous and detailed process was followed that involved a comprehensive plan of action, thorough data collection and research by the Project Team and participation by a multidimensional representation of transit and training professionals. Included were representatives from transit agency leadership, transit vehicle maintenance instructors, labor representatives, certification program leadership, and instructional designers, all serving as subject matter experts (SMEs). Utilizing this diverse, yet complementary group of experts provided invaluable insights into specific program content elements as well as adding general best practice data and program structure options from successful similar certification programs.

The Project Team implemented four key elements of research including the following specific deliverables:

- Feasibility study;
- Best practices report;
- Training and certification program plan; and
- Business plan.

Each of these four critical elements of Project F-19 reflects the process and specific recommendations for achieving the goal of a national transit vehicle maintenance instructor training and certification program.

The Feasibility Study

Early determination of the usefulness and eventual support and viability of this program within the targeted organizations was the primary role of the feasibility study. Without this information and the guidance it provided, the remaining project elements might essentially be developed with little in the way of knowledge of the potential participants, size and structure of existing agencies and training staff, willingness and ability of agencies to participate, and population data on the vehicle maintenance instructor population.

First, the Project Team designed and implemented a SME survey with the assistance of the Project F-19 panel that was distributed to three primary groups: the American Public Transportation Association (APTA) National Bus Maintenance Training Committee, the TCRP National Transit Rail Vehicle Technician Training Committee and the TRB Transit Fleet Maintenance Committee ListServ.

Following the distribution of the survey, the Project Team participated in discussions with SMEs and stakeholders at several national meetings including the National Bus Maintenance Training Committee in Phoenix, Arizona; the National Rail Vehicle Technician Training Committee in Silver Spring, Maryland; and several other venues.

The data compiled by this effort provided the foundation for both the Training and Certification Program Plan and the Business Plan. Among its many findings was the fact that more than 52,000 vehicle maintenance employees are being taught by approximately 600 full- and part-time instructors with an average age of 46 years old.

It has long been the hope of many professionals in the bus and rail vehicle maintenance training community that a national program for establishing and certifying instructor competencies be established. With an estimated initial population of more than 600 in-house instructors and multiples of this population existing in other associated areas, the scope of interested and supportive organizations and individuals builds support and credence to the concept of establishing this national framework for instructor certification.

More details and findings from this element of the project are contained in Chapter 2 of this report.

Best Practices Report

In order to establish a credible starting point for the training and certification plan, it was necessary to conduct thorough background research in best practices within both transit and other industries that implement instructor certification programs. This data touches every aspect of program elements including existing agency programs, effective transit training approaches, expected prerequisites for instructors, course offerings, competency expectations, evaluation of content mastery, certification, and organizational structure of sponsoring entities.

The strength of this information lies in the breadth and quality of the data collection landscape and the fact that transit organizations, vendors, and numerous successful instructor certification programs outside of the transit environment provided their experiences to the Project Team. It was then possible for the most productive and successful program elements to be highlighted for discussion and possible replication within the project.

One extremely useful outcome of this reporting process was the creation of a data pool that, among other things, ranks the importance of seven distinct maintenance instructor attributes. Interestingly, good communication skills and good work habits have a higher priority than good technical knowledge.

The lessons learned component of the best practice effort informs the discussion leading to program choices in the core competencies, mastery of content and certification process presented within this report.

The complete details of the findings by the Project Team best practices report can be found in Chapter 3.

Training and Certification Program Plan

The Project Team and panel established that three critical program elements need to exist to provide a legitimate path to transit vehicle maintenance instructor certification: technical and non-technical prerequisites, required courseware, and rigorous capstone certification requirements. While the prerequisites for individual certificate candidates are left to participating agencies to determine, the project has established guidelines to assist in that effort. For certification, each instructor must complete a required number of courses (or approved

4 A National Training and Certification Program for Transit Vehicle Maintenance Instructors

substitutes), as well as complete the capstone experience requirements, each at a specific, predetermined level of mastery. The program plan, while detailed and comprehensive, will require the future AO (administrating organization) to finalize the program based on actual participation levels, available resources, and program oversight.

Prerequisites

Suggested prerequisites for instructors participating in the program include a series of technical and basic non-technical skills. Technical prerequisites might include certifications, professional affiliations, and minimum number of years in relevant technical field or independent skill evaluations. Non-technical entrance competencies expected include more subjectively evaluated personal skills including basic computer familiarity, writing, presentation, and social or people skills.

From the program's perspective, only qualified technicians will be participating in the certification process. However, these prerequisites are to be established by each participating agency to match their expectations and requirements for instructors based on their specific and individual needs. The program does, however, offer recommendations for best-fit prerequisites to match entry competencies for the courses required for certification.

Required Program and Certification Courses

Courses required for certification shown in Figure S-1 as part of the overall competency model reflect the range of skills needed to be an effective vehicle maintenance instructor including the three most important elements of program design, instructional design, and

Figure S-1. Transit vehicle maintenance instructor competency model.

training delivery. This time-proven mix of professional instructional tools reflects both best practice and benchmarked criteria for training professionals across a wide range of content areas.

Within these three general categories of courses, specific offerings reflect a core curriculum designed to build an instructor's skills well beyond the basics of technical content delivery into a professional, well-rounded facilitator, course designer and program manager. This approach reflects the reality that content knowledge is but one of many skills necessary to design, deliver and manage vehicle maintenance technical training. There is also a separate mentoring and coaching certificate available to technicians interested in taking only that one course as a way to improve their mentoring skills and to use it as a pathway to achieving full instructor certification in the future.

Specific courses and suggested implementation time are represented in Table S-1.

To provide flexibility, candidates also can choose from a series of approved alternative courses that met program requirements.

The Capstone Requirement

Completing the required courses for certification is augmented by a capstone process that adds a vital dimension to the certification process. It is in this final segment of the program that students are required to go beyond taking and successfully completing certificate courses and actually validate their skills in a three element final process. Each student must pass all three elements to qualify for certification. This is the program equivalent to graduation requirements in an academic program and this approach is almost always part of similar instructor certification programs in other organizations.

These final three elements start with a summative comprehensive exam linked to the content for each required course. The exams will be reviewed and scored by a panel of SMEs and final score of 70 percent or better is required for certification.

Second is a reflective paper linking specific course objectives from each required course to the worksite. A student is required to write a minimum of 250 words on how they will apply the course content in their work as an instructor. As in the comprehensive exam, the reflective paper will be reviewed and scored by a panel of SMEs and assigned a pass or fail grade.

Table S-1. Program courses and suggested implementation time.

Courses	Hours
Mentoring and Coaching	4 – 8
Communication: Oral and Written	4 – 8
Delivering Instruction: Classroom & Hands-On	8
Adult Learning	8
Lesson Plan Design	8
Assessment and Process Analysis	4 – 8
Instructional Material Development	8
Instructional Technology	8
Standards-Based Training	8 – 16
Program Management & Evaluation	4 – 8
Curriculum Development	8
Capstone - Putting it all Together	8 – 16

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The final capstone element is a case study assignment to validate application of program objectives in the context of a real-world transit vehicle maintenance environment. A real-world problem within the transit vehicle maintenance training environment will be presented and a student will be required to write a minimum of 500 words on how they would address the problem and provide a solution. As before, a panel of SMEs will review and score the case study responses and render a pass or fail grade.

More specific details on the Training and Certification Program Plan are contained in Chapter 4.

Business Plan for Implementation of the Certificate Program

Every successful program must have a clear and concise business plan to have any likelihood of reaching its goals. Implementation of the transit vehicle maintenance instructor's certification program relies on a structure that includes two primary organizational elements: a national steering committee and an AO.

The national steering committee will be the governing body of the program and may evolve from the Project F-19 panel or be organized as a nonprofit, an APTA subcommittee or other suitable structure. This group will be responsible for the request for proposal (RFP) process and associated selection of an AO, overview and governance of the AO, and general responsibility for the credibility of the certificate.

The AO will be selected by the national steering committee and be responsible for the entirety of the day-to-day administration of the program as well as the process of course implementation, credentialing management, record keeping and issuance of each certificate. Specific organizational requirements for the AO are included in the business plan.

Issues of budget (including projected launch costs, and ongoing costs and revenues), organizational approach, projected participation, and other business plan details are also covered in Chapter 5.

Next Steps

This project may be seen as a turning point in the standardization and professionalization of the ranks of transit vehicle maintenance instructors. This project has shown that interest and support within the transit vehicle maintenance community exists and that further work to inform and involve this group will provide added support and participation.

There now exists the operational framework, project specifics, and business plan to move this concept to reality. The next steps are the creation of a national steering committee and selection of an administrative organization. In a relatively short period of time, the first cohort of instructors could be entering the program and working toward certification and the recognition they deserve.

CHAPTER 1

Introduction and Research Approach

Introduction

As the complexity of transit vehicle technology advances at a quickened pace, experienced baby-boomer technicians retire in droves, and fewer younger workers entering the workforce are interested in pursuing mechanical jobs, finding qualified maintenance employees has become increasingly difficult. The diminishing pool of skilled workers dictates that the transit industry as a whole develop the training capacity needed to grow its own transit vehicle maintenance technicians. Along with having quality training materials developed in accordance with industry standards, the preparation and certification of technical instructors is absolutely crucial to enhancing the quality of training provided to those who maintain and repair bus and rail vehicle equipment. Absent the ability to effectively enhance technical knowledge and skills, transit technicians will be ill prepared to keep transit equipment operating safely and efficiently, resulting in inconvenienced passengers, unnecessary costs, and reduced taxpayer confidence in public transit.

The majority of transit technical instructors come from the maintenance ranks with little or no formal training. While they may have superior technical skills related to their craft, they are seldom if ever provided with training related to the skills required to become an effective technical instructor. Additionally, no standard mechanism exists in transit to evaluate instructor skills, qualifications, and performance.

The question then becomes: How best to prepare and qualify transit vehicle maintenance instructors for the tasks that they are responsible for? TCRP Project F-19, "A National Training and Certification Program for Transit Vehicle Maintenance Instructors," squarely addresses this question by establishing the competency levels and necessary skills required for individuals to qualify to be transit vehicle maintenance instructors so transit agencies do not have to develop programs on their own. Project deliverables include (1) a feasibility study, (2) a best practices report, (3) a training and certification program plan, and (4) a business plan for implementation of a vehicle maintenance instructor training and certification program.

Developed through a stakeholder-driven process, this program will be extremely valuable and directly applicable to enhancing the capacity and quality of technical training in public transit. The research products provide a road map for implementing a national instructor training and certification program. The contractor ultimately selected to run the program, while having the ability to shape certain aspects of it, will greatly benefit from the core structural elements developed through this work. Included are various best practices and lessons learned from similar applications, comprehensive learning objectives from which to develop program curriculum, a fully defined set of courses to be delivered through the program, an assessment process to confirm instructor ability, a detailed organizational structure, and an operating budget based on various participation level scenarios. For individual transit agencies the benefit is straightforward—a national program gives them a ready-made structure in which to have their instructors properly

trained and certified. All of this will improve the quality of transit vehicle maintenance instructors, which in turn will elevate the skill and knowledge levels of the technicians they teach.

Understanding that instructors have other responsibilities and time constraints, the program is designed to give candidates great flexibility in achieving certification. Through distance-based methods, transit agencies will be the primary location where most instructor training delivery will take place. Conferences, workshops, and local community colleges will also serve as essential venues. Candidate instructors will be given further flexibility in achieving certification by being allowed to receive credits for previously taken courses, and to take alternative courses through approved sources.

The process to develop a system of training and certification for transit technical instructors established through this project leveraged the larger system of learning that has been emerging in the transit industry for over 10 years. The development of industry-wide technical training standards and systems in transit has been significantly advanced through the work of several joint national technical committees. These have included Bus Training Standards and Rail Car Training Standards Committees and similar Training Standards Committees for Transit Signals, Traction Power and Elevator-Escalator Maintenance Training. A full system of transit training—including apprenticeship frameworks, skill gap analysis systems, guidelines for mentoring, developing new courseware to fill existing gaps, written and hands-on tests and certifications as well as train-the-trainer programs—has been built on the foundation of these industry-wide technical training standards. This project to develop a national system of instructor training and certification incorporated essential elements of this broader body of work, and made good use of the extensive network of transit training SMEs already engaged in these industry-wide efforts and research projects supported by TCRP, the FTA, and the U.S. Department of Labor (DOL). The result is an instructor training and certification framework that is integrated with an ongoing system of frontline worker training and development.

The need to carry this work forward and establish a nationally recognized training and certification program for technical trainers in transit cannot be overstated. The ability to attract and retain a younger workforce will require instructors to engage students using modern techniques. No longer acceptable or effective are traditional delivery methods where instructors simply lecture or deliver PowerPoint presentations and hope that students will then somehow be capable of performing manual tasks. Interactive computer-based programs combined with classroom instruction, hands-on activities, and on-the-job training are proven instructional methods that instructors will learn through this program. If transit does not develop instructors with the ability to effectively train technicians, it will lose this important workforce to the myriad of other transportation sectors desperately seeking the same limited pool of workers and offering more modern and appealing training techniques.

Research proves (and our own personal experiences confirm) that when it comes to learning, teachers do make a difference. Several best practice examples found in Chapter 3 substantiate that student achievement in the workplace is directly related to instructor ability. In one automotive industry example, a study showed that 79 percent of technical instructors reported their teaching performance had been enhanced by an instructor development program. Despite the activities taking place in other trades, research conducted for this project clearly shows that the overwhelming majority of transit agencies do not have programs in place to adequately prepare instructors for their jobs. This project fills that void by creating a detailed structure that a future contractor could use to more adequately prepare transit maintenance instructors and issue certifications as recognition of their abilities. Given the minimum level of technical training investment made by transit, it is imperative that what little training is provided to technicians is in fact useful and effective.

Overall Research Approach

To adequately address the complex matrix of issues associated with the training and certification of transit vehicle maintenance instructors, the Project Team deemed it necessary to honestly represent the present range of practices in this industry and elsewhere. Based on the best practices, the team then set off to propose a series of options that are most likely to be implemented by transit agencies, and ultimately would be successful in reaching the objective of quality training and meaningful certification of transit trainers.

The research process was guided by both practical analysis conducted within the context of the instructional systems development process and generally accepted academic research practices. This practitioner-based approach assures the best combination of reality of practice and professional standards. The Project F-19 panel members, practitioners with rich experience from transit and related industries, provided excellent guidance to the overall direction of the project and highlighted for the Project Team considerations for extra research sensitivity. Throughout this project, the Project Team worked in close coordination with the experts on the Project F-19 panel to ensure that the results are as effective as possible in the industry.

To assure the highest degree of success, this project engaged transit maintenance personnel and instructors through multiple SME working groups. To utilize existing resources, the SME Working Group meetings were held in conjunction with Bus Maintenance and Rail Car Training Standards Committee meetings, as well as the 2014 APTA Bus and Rail Conferences. Ongoing interaction with the SME Working Group assured immediate and effective integration of industry expertise and provides consistency with existing National Training Standards.

This research process began with the identification of the environmental factors in the transit industry that influence the ultimate implementation and success of any technical training for instructors. These non-technical factors included the existing population of various groups of instructors, a wide range of current industry practices, as well as the level of interest from industry stakeholders to implement a national instructor training and certification program. Research findings from these earlier tasks of Project F-19 provided a foundation for the Project Team to proceed with the design of the program and business plan development in later stages of the project.

Research in this specific field of inquiry was guided by a long and rich history of similar programs in numerous apprenticeships and related training programs for frontline technical workers over many generations of workers in transit and other industries. While the transit industry has many unique features that relate to the economic, regulatory, collective bargaining, and technical nature of the enterprise, the maturation of training, especially technical training and the training and certification of instructors has evolved within a context of consistent application of standards-based best practice independent of industry-specific content. Identifying and codifying key points of best practice in existing apprenticeships and other similar instructor certification programs allowed for valid integration into transit-specific content and practice.

The complex issue of instructor qualifications was researched in a way that allows a multi-dimensional perspective based on a variety of factors. A rubric of skills developed from existing populations and expected future instructors provided data necessary to design both a process of certification for resident qualified instructors and a valid path to certification for others.

An essential aspect of this approach is that all program elements were designed with the intent to allow review of each course and all associated program elements for college credit. This includes, at a minimum, course rigor, implementation time, evaluation processes and other associated procedural and content–specific elements needed to satisfy academic requirements

for either articulation with an existing academic institution or review by a credit recommendation service.

Finally, this research expanded beyond the traditional analog classroom as a technical learning standard and embraced the new generation of technical learning options available today. Within this research element the relationship between technical integration in the workplace and similar technical integration within the learning environment has been explored.

Major Tasks and Organization of the Final Report

Based on the overall research design, this research effort is divided into six major tasks as listed below, with the respective chapters included in parentheses. In each chapter of the report, an overview of the chapter content is immediately followed by a review of the data collection process. Findings from the research task are then presented. A brief conclusion is provided at the end of each chapter, with an overall conclusion of the report in Chapter 6.

Task 1: Feasibility Study

Conduct a feasibility study of a proposed national certification system for a vehicle maintenance instructor training and certification program (Chapter 2). The feasibility study will include, at a minimum:

- An estimate of the number of transit agencies and participants likely to participate each year,
- Identification of organizations capable of developing a vehicle maintenance instructor training and certification program, and
- Identification of organizations willing to offer the program.

Task 2: Best Practices Report

Produce a report on best practices used in both the public and private sectors to train and certify instructors. The report will focus on what lessons can be most usefully adapted for a national transit vehicle maintenance instructor training and certification program (Chapter 3). The report will also include a comparison of best practices for training and certification delivery and appropriate case studies.

Task 3: Interim Report

Prepare an interim report for review by the panel summarizing the results of early tasks and providing a detailed outline and description of the proposed training and certification program and business plan.

Task 4: Training and Certification Plan

Prepare a training and certification program plan to include recommendations for curriculum design, development and implementation (Chapter 4). The plan will explain in detail the recommendations for:

- Core competencies that lead to becoming a certified transit vehicle maintenance instructor,
- Curriculum objectives and specific subject areas for certification,
- Methodology for validating attainment, and
- Qualifications for transit vehicle maintenance instructors to apply and enter the program.

Task 5: Business Plan

Prepare a business plan for implementation that is institutionally sound for the long term (Chapter 5). The business plan will include, at a minimum:

- An organizational structure for the program,
- Project management details to initiate and maintain the training and certification program, and
- A budget to implement and operate the training and certification program.

Task 6: Final Report

Prepare a final report that documents the results of this research and provide background materials used in preparation of the final deliverables.

CHAPTER 2

Feasibility Study

Overview

A feasible training and certification program is one that meets its original goals, is financially sustainable, withstands the risks it encounters, and adapts to changing needs and conditions. Chapter 2 summarizes the activities and findings of Task 1 Preliminary Feasibility Study, analyzing how a national training and certification program for transit vehicle maintenance instructors would be received and supported.

More specifically, this chapter provides an estimated number of available vehicle maintenance instructors nationally, including in-house instructors (full-time and part-time), in-house mentors, contract instructors and other external instructors such as original equipment manufacturer (OEM) and community colleges. It assesses the interest and support among transit agencies in certifying vehicle maintenance instructors, and identifies barriers that may hinder agency participation. Understanding the population and industry needs enabled the Project Team to design targeted program and business plans later in the project that are not only feasible but also sustainable in the long run. A preliminary list was also developed in Task 1 with potential organizations capable to develop and deliver components of the vehicle maintenance instructor certification program. This list later became the starting point in the Project Team's effort to provide examples of alternative training programs.

Data Collection

The Project Team utilized a targeted SME survey supplemented by face-to-face SME and stakeholder group discussions to assess the need for and interest in a national vehicle maintenance instructor training and certification program. The Task 1 surveys and discussions were not intended to include all agencies but only a representative sampling of industry SMEs. Data from existing sources such as the National Transit Database (NTD), TCRP reports, and APTA's Public Transportation Fact Book were also collected to help generate the estimated number of instructors.

SME Survey

A brief survey was designed by the Project Team to probe research questions from both Tasks 1 and 2 with SMEs who have participated in previous national activities related to vehicle maintenance training standards and technician qualification program development. The survey questionnaire was reviewed by the project panel, revised based on panel comments, and transferred to an online survey engine. After internal testing of the survey, the Project Team moved the quantitative questions toward the end of the survey to maximize the participation rate.

The survey was emailed to three SME groups, who also received follow-up emails:

- National Bus Maintenance Training (BMT) Committee sponsored by APTA, including bus maintenance training managers, trainers, frontline technicians and union training representatives.
- National Transit Rail Vehicle Technician Training Committee sponsored by TCRP, including rail vehicle maintenance training managers, trainers, frontline technicians and union training representatives.
- BFM-General (bus fleet maintenance) listserv for TRB Transit Fleet Maintenance Committee and friends, hosted by the Center for Urban Transportation Research at the University of South Florida [CUTR (Center for Urban Transportation Research) listserv]. This listserv includes bus fleet maintenance managers and training personnel, and is used to reach out to both large and small to medium, rural and paratransit agencies.

The survey provided data to estimate the number of transit vehicle maintenance instructors across the industry, including those employed at transit agencies, trainers associated with OEMs, trainers who work on an as-needed contract basis, and employees whose duties may include training in addition to other responsibilities, including peer mentors. The survey asked respondents how likely their agencies were to participate in a national instructor certification program. A list of organizations that might be able to implement a certification program was also solicited from the respondents.

SME and Stakeholder Group Discussions

In addition to the survey, the Project Team facilitated discussions with the SMEs at the 2013 and 2014 National BMT Committee meetings and the National Rail Vehicle Technician Training Committee in Silver Spring, MD on May 29, 2013. Questions probed were similar to those in the SME survey. The 2013 APTA Annual Meeting, and 2013 and 2014 APTA Bus and Rail Conferences were used as additional venues to gauge the interest from the industry. Information collected from various SME and stakeholder group discussions is incorporated into the feasibility study.

Responses

Complete survey responses were received from 49 respondents in an electronic or paper format. Not all respondents answered all questions. After the Project Team combined six additional BMT Committee member responses from the SME group discussion, 55 individual responses served as the basis for analysis in the database (Figure 2.1).

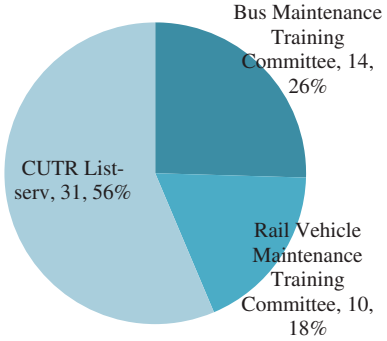

Figure 2.1. Respondents by source.

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Source Distribution

Figure 2.1 shows the distribution for survey respondents according to the source.

Bus Maintenance Training Committee. Eleven members of the BMT Committee participated in the SME group discussion at the January meeting in Phoenix and answered a significant number of the survey questions. When the survey was distributed to the BMT Committee via email later, the Project Team received five responses from members who had already provided input in the SME group and an additional three new responses. Combining these two sources, data was obtained from 14 individual members. When duplicate responses were received from the same individual, the electronic response containing the latest data was used for analysis.

Rail Vehicle Technician Training Committee. Following the SME discussion at the Rail Vehicle Technician Training Committee meeting, rail committee members were provided with a paper copy of the survey in addition to the email they received earlier. Ten out of 15 active members of the National Rail Vehicle Maintenance Committee responded to the electronic or paper survey, a response rate of 67 percent.

CUTR BFM Listserv. The CUTR listserv survey distribution generated 31 responses from an estimated membership of 350, generating a response rate of about 9 percent. However, active subscription to the listserv may be much lower given that some email addresses may be outdated and participants may have stopped monitoring listserv updates. The actual response rate may be higher.

Respondent Characteristics, Agency Size and Mode

Transit agency employees made up 93 percent of all respondents, representing 33 individual transit agencies. The remaining seven percent were primarily representatives from OEMs and transit consulting companies. One out of five respondents identified themselves as affiliated with a local union.

Fixed-route bus service is provided by 45 (88 percent) of the respondents who identified their agency's operating modes in the survey, 24 (47 percent) of the respondents operate heavy or light rail, and 23 (45 percent) paratransit. Of the responding agencies, 33 agencies or 65 percent operate multiple modes. About one in three of the agencies that provide fixed-route bus service are small to medium-sized, defined as operating fewer than 250 vehicles.

Instructor Population

One of the main objectives of the feasibility study was to estimate the vehicle maintenance instructor population and those likely to participate in an industry program for training and certifying instructors. These instructors or trainers can be categorized into five groups, with in-house instructors being the primary focus of this project:

- In-house full-time or part-time vehicle maintenance instructors (employees of transit agencies),
- In-house vehicle maintenance mentors (employees of transit agencies),
- Instructors associated with OEMs,
- Instructors associated with community colleges and technical/vocational schools,
- Other instructors who work on an as-needed contract basis, such as retirees and consultants.

In-house Vehicle Maintenance Instructors

For many skilled technicians in transit maintenance occupations, training is delivered at their workplace by in-house trainers employed by the same agency as the technicians. Typically, these

transit maintenance trainers are former technicians who have been promoted. The SME survey collected detailed data on the number of vehicles in each transit mode and the number of full-time and part-time vehicle maintenance instructors employed by their agencies. Using these data points and the total fleet size of all U.S. agencies from the APTA 2012 Public Transportation Fact Book (American Public Transportation Association 2012), the Project Team estimated the number of full-time and part-time instructors for all transit agencies, as illustrated in Table 2.1. Approximately 557 full-time and 47 part-time instructors are employed by transit agencies across bus, heavy and light rail, and paratransit, a national total of 604 instructors. With 52,929 vehicle maintenance employees working in these four modes (commuter rail, trolleybus, and other modes are not included), this represents an employee–instructor ratio of 88:1.

The Project Team utilized data from the 2010 Transit Training Survey (Transportation Learning Center 2010a) (covering 55 percent of the transit workforce) to validate estimates generated from the survey. Agencies responding to the Transit Training Survey employed roughly one full-time equivalent (FTE) instructor for every 125 employees. With 52,929 vehicle maintenance employees working in bus, heavy/light rail and paratransit, this generates 423 vehicle maintenance instructors. This estimate may be conservative, as the Transit Training Survey included operations, vehicle, and non-vehicle maintenance, as well as general administration employees. The actual instructor/vehicle maintainer ratio may be lower.

Respondents to the survey reported an average maintenance instructor age of 46 across all four modes, with fixed-route bus maintenance having the most senior instructors—an average age of 49. Given that most transit maintenance workers are eligible to retire with 25 to 30 years of service, it is foreseeable that a large number of these instructors will meet this eligibility requirement in the next five to 10 years. This substantiates the increasing need to recruit, train, and qualify new instructors, either from existing transit mechanic ranks or from other industries.

Table 2.1. In-house instructor estimates.

	Fixed-Route Bus	Heavy Rail	Light Rail	Paratransit	Total/*Average*
Average Fleet Size–Project F-19 Survey	635	136	92	124	
Total Fleet Size for All Agencies	66,239	11,510	2,104	68,621	
Total # of Vehicle Maintenance Employees for All Agencies	**33,276**	**9,408**	**2,214**	**8,031**	**52,929**
Full-time (FT) In-house Vehicle Maintenance Instructors–Project F-19 Survey estimated average	3.1	1.4	1.7	0.1	-
Estimated # of Vehicles/FT Instructor	202.9	97.7	54.7	929.2	-
Estimated # of FT Instructors for All Agencies	**327**	**118**	**38**	**74**	**557**
Part-time (PT) In-house Vehicle Maintenance Instructors–Project F-19 Survey estimated average	0.4	0.0	0.4	0.0	-
Estimated # of Vehicles/PT Instructor	1,733	-	230	-	-
Estimated # of PT Instructors for All Agencies	**38**	**0**	**9**	**0**	**47**
Total Estimated FT & PT Instructors for All Agencies	**365**	**118**	**48**	**74**	**604**
Estimated # of Vehicle Maintenance Employees/Instructor	**91**	**80**	**47**	**109**	***88***
Estimated Instructor Average Age	**49**	**44**	**46**	**45**	***46***

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Mentors

In all transit work environments, on-the-job learning constitutes the major means of developing and perfecting new skills. This is especially the case at smaller agencies with no formal training programs. Ideally, a trained mentor works with a less experienced colleague with an organized check list to assist the trainee in practicing the new skill to the point of mastery, known as formal mentoring. On the shop floor, mentors reinforce the training and instruction delivered in the classroom as a coordinated effort. Informal mentoring, which is far more prevalent, has inexperienced mechanics seeking assistance from anyone in the shop willing to help. Based on the SME survey, it is estimated that a national total of 3,300 maintenance employees fulfill a formal or informal mentoring role within a total vehicle maintenance cohort of 52,929 across these four modes, roughly 16 employees per mentor (Table 2.2).

Contract Instructors

Non-agency personnel can also provide training, through OEMs, technical schools and community colleges, or training firms with specific technology expertise. In fact, respondents to Metro Magazine's 2014 Bus Maintenance Survey indicate that the vast majority of bus technicians receive their training from OEMs and vendors. (http://www.metro-magazine.com/resources/images/maintenancesurvey2014.pdf.) Using the number of instructors contracted by transit agencies, as reported by the survey respondents, the Project Team estimated a national total of 392 vehicle maintenance instructors associated with OEMs, 24 with community colleges or technical schools, and an additional 157 for-hire instructors that do not fall into any of the categories above. Detailed breakdown by mode is provided in Table 2.3.

The actual number of contractors spending at least some time providing vehicle maintenance training in transit may be significantly greater than these estimates. For example, an OEM instructor who spends most of the time providing training to trucking companies and only a few days annually to transit technicians may not have been reported by the agency respondents. To obtain a more accurate estimate of these contractor instructors, additional information needs to be collected from transit OEMs and other vendors directly.

Types of Instructors to Include

When asked about the types of trainers/instructors the national training and certification program should cover, 94 percent of the F-19 survey respondents selected agency instructors (Figure 2.2). A little over half felt that in-house mentors should be covered. Forty-seven percent also selected instructors associated with OEM and community colleges. Seventeen percent of the respondents also listed retirees and consultants as other groups to be covered by the program.

Table 2.2. Mentor estimates.

(See Table 2.1 for Average Fleet Size, Total Fleet Size, and number of vehicle maintenance employees)	Fixed-Route Bus	Heavy Rail	Light Rail	Paratransit	Total/*Average*
Mentors for Vehicle Maintenance Trainees–Project F-19 Survey estimated average	12.5	8.1	4.8	2.1	-
Estimated # of Vehicles/Mentor	51.0	16.8	19.3	58.3	-
Estimated # of Mentors for all Agencies	**1,300**	**687**	**109**	**1,177**	**3,272**
Estimated # of Vehicle Maintenance Employees/Mentor	**26**	**14**	**20**	**7**	***16***

Table 2.3. Contract and other external instructor estimates.

(See Table 2.1 for Average Fleet Size, Total Fleet Size, and number of vehicle maintenance employees)	Fixed-Route Bus	Heavy Rail	Light Rail	Paratransit	Total/*Average*
# of OEM Vehicle Maintenance Instructors–Project F-19 Survey estimated per agency	1.7	0.2	0.4	0.3	-
Estimated # of Vehicles/OEM Instructors	367.1	678.7	220.8	371.7	-
Estimated # of OEM Instructors for all Agencies	**180**	**17**	**10**	**185**	**392**
# of Community College Vehicle Maintenance Instructors–Project F-19 Survey estimated per agency	0.1	0.0	0.2	0.0	-
Estimated # of Vehicles/Community College Instructors	4057.4	-	273.5	-	-
Estimated # of Community College Instructors for all Agencies	**16**	**0**	**8**	**0**	**24**
Other Vehicle Maintenance Instructors (independent consultants, retirees, etc.)–Project F-19 Survey estimated per agency	0.9	0.0	1.1	0.1	-
Estimated # of Vehicles/Other Instructors	670.6	-	82.8	2106.2	-
Estimated # of Other Instructors for all Agencies	**99**	**0**	**25**	**33**	**157**

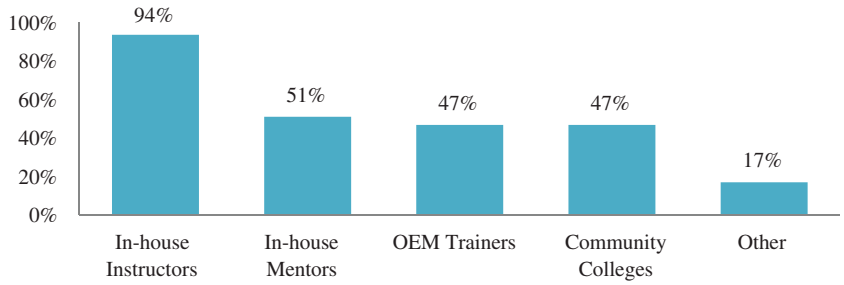

Figure 2.2. Types of instructors to include in a national program.

Industry Interest and Support

Interest in National Program

Transit agencies potentially interested in a national transit vehicle maintenance instructor certification program would include all major bus and light, heavy, and commuter rail operations, a total of over 1,000 agencies. Some paratransit providers may also choose to participate.

To gauge the level of interest among industry stakeholders at the early stage of program development, the Project Team asked SME survey participants "If a national training and certification program is to be implemented for transit vehicle maintenance instructors, how likely is your agency to participate?" Overall, nearly three out of four respondents are highly or somewhat likely to participate in the program (72 percent, Figure 2.3). At 73 percent, small to medium-sized bus agencies have a lower rate of likely participation than large bus agencies (81 percent).

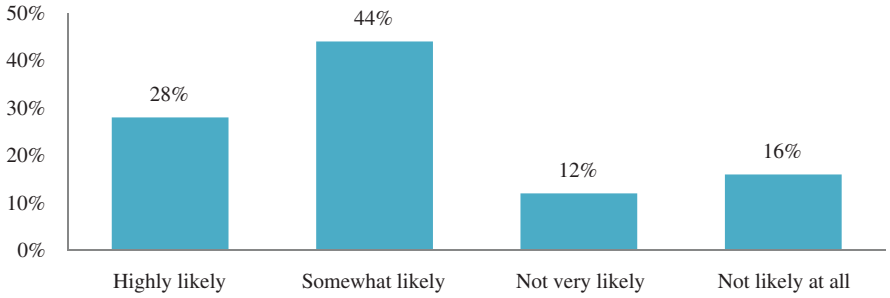

Figure 2.3. Likelihood of agencies to participate in a national program.

Of those indicating that their agencies are unlikely to participate, respondents cited a range of reasons including:

- Lack of national program details, for example, level of agency time commitment, program format, delivery methods, content and requirements;
- Funding issues;
- No in-house instructor to certify; and
- Agency isolation from participating in national programs in general.

At the APTA Workforce Development Subcommittee meeting held at the 2013 APTA Annual Meeting, there was strong interest in the possibility of upgrading the capabilities of technical trainers. The idea of a multi-agency Train-the-Trainer Consortium effort bringing together a group of agencies was discussed with interest among senior managers of several agencies. All the agency attendees agreed that they had issues with under-prepared trainers who had been promoted from the ranks of technicians without adequate further training in the arts of instruction.

SME feedback at discussion sessions at the APTA Bus Maintenance Committee Meetings and National Transit Institute (NTI) Transit Trainers' Workshop, as well as audience response following presentations on Project F-19 at the 2014 APTA Bus and Rail Conferences continued to corroborate the industry's need for a national program for instructors. Comments from participants included broadening the scope to include other instructor groups in transit and related industries, such as commuter rail and Amtrak. Participants reasoned that most of the instructor skills needed (adult learning, communication and facilitation, mentoring, material development, etc.) are similar whether one is teaching a group of mechanics, operators, or first responders. Participants also noted that offering the program to others would make it more financially sustainable given the relatively low number of agency maintenance instructors. Other participants asked that limited travel budgets be considered and suggested extensive use of online and local course delivery to make the program more appealing.

Conclusion

Members of the national committees on bus and rail vehicle maintenance training have long articulated the need for improved instructor training programs and consistent national guidelines for validating instructor skills. During the SME group discussions conducted for the Project F-19 and the APTA Workforce Development Subcommittee meeting, themes such as aging of the instructor workforce and need for replacements over a short period of time resonated among participants. Throughout the Task 1 discussions and survey, participants expressed strong support for a national program to standardize instructor training and skills assessments. The idea of a national Train-the-Trainer Consortium was brought up by senior managers attending

the Workforce Development Subcommittee and should be further explored. Enthusiasm for a national program was also high among survey respondents on the CUTR email list.

At a minimum a national program will benefit the industry's existing 500 to 600 in-house vehicle maintenance instructors. The benefits can be extended to a much larger group of in-house mentors and contracting instructors affiliated with OEMs, colleges and technical schools, and other organizations providing transit technical training. During the program plan development phase of Project F-19, the Project Team examined the differences in the competency requirements of these several groups of trainers and designed scalable training and skills validation programs to fit their differing needs.

CHAPTER 3

Best Practices from Transit and Related Industries

This chapter reviews best practices used in the public and private sectors to prepare and certify technical instructors, as well as the attributes and instructional delivery methods found most effective for maintenance instructors. This chapter concludes with lessons that can be most usefully adapted from those practices.

Data Collection

Data used to identify and collect best practices examples were drawn from several sources. To begin with, the Project Team used the results of the stratified data collection methods as described in Chapter 2 where a targeted SME survey supplemented by face-to-face SME group discussions were used to reveal how training and certification programs are structured, the process used to train and certify instructors, cost and fee structures where applicable, how performance is measured, and other structural elements used in the various instructor programs identified. In conducting the SME surveys and group discussions, several best practice examples were also identified and pursued for additional information.

In addition to obtaining data directly from transit agencies, the research team investigated relevant programs at APTA, the NTI at Rutgers, the Southern California Regional Transit Training Consortium (SCRTTC), and the Transportation Learning Center (the Center). The search for best practice examples from outside transit included various automotive examples, the Society of Automotive Engineers (SAE), and occupational trades including masonry, plumbing and pipefitting, laborers, and airlines.

The collective investigations define best practice examples of how various technical crafts prepare instructors for their jobs as teachers, certification programs used to confirm instructors have the appropriate attributes to become effective teachers, and the role third-party institutions and vendors can play in establishing a national transit maintenance instructor training and certification program. Many of the best practices have been incorporated into the program plan; all should be considered by the eventual AO when implementing the final program.

Transit Best Practices

Agency Instructor Development Programs

Data gathered from the SME surveys and in-depth discussions held with transit agencies that included Metropolitan Atlanta Rapid Transit Authority (MARTA), Chicago Transit Authority (CTA), Southeastern Pennsylvania Transit Authority (SEPTA), and King County Metro in Seattle revealed that about 25 percent of agencies provide a formal training program for their vehicle

maintenance instructors, and even fewer (about 6 percent) have a certification or qualification program for these instructors. The findings, which are not surprising, validate the need for a national program to ensure instructors are adequately prepared. Although none of the transit agencies surveyed issue formal certifications to their instructors, each program contains elements that can be helpful to developing a national program.

Best practice elements of interest from transit agencies include:

- To qualify its existing technicians to become instructors, MARTA's program begins with having instructor candidates attend in-house courses the agency already offers to prepare its managers for promotion. There they receive soft skills training in subjects that include interpersonal communication, writing, and other subjects useful to instructor development.
- Because MARTA purchases many support vehicles from General Motors (GM) and Ford, the agency sends candidate instructors to attend technical courses they offer. Although the automotive subject matter may not be relevant to larger buses, transit instructors are exposed to the highly developed training delivery methods perfected over the years by these very capable automakers.
- MARTA's instructor preparation program is presented in two duration formats: six months and two years. The accelerated six-month program requires existing technician candidates to have extensive mechanical experience and Automotive Service Excellence (ASE) certifications. Courses focus on improving communication and teaching skill. The two-year program requires no prerequisites; candidate instructors use the additional time to learn technical subjects in addition to the soft skills training.
- Like MARTA and other agencies, rail instructors at CTA are hired from technician ranks because the agency believes they should have the first-hand ability to perform the jobs they are providing instruction on.
- Newly hired instructors at CTA first observe more seasoned instructors deliver introductory-level courses. The seasoned instructors serve as mentors, coaching new hires before, during, and after classes. In time, new instructors assume increasing teaching responsibilities. Before being accepted as a qualified instructor, the novice must deliver at least three classes in basic rail subjects and receive approval by the training department.
- While large agencies like CTA have qualified instructors at the agency to provide the mentoring and training needed for novice instructors to progress and become qualified, many agencies lack such mentors. An alternative that could be applied to a national program would involve a peer review group or committee consisting of seasoned training professionals from around the country using national criteria for instructor preparation and qualification to observe, coach, and approve instructors for certification. This concept could be enhanced by remote mentoring using video equipment as presented below for SEPTA.
- The process used at SEPTA to select and qualify instructors involves taking a competency test to determine if candidate instructors first have technical proficiency. After passing the technical test, candidates are asked to provide a 5–10 minute presentation instructing the SEPTA evaluation team on any topic of their choice that they know well and are most comfortable delivering, technical or non-technical. If the evaluation team is satisfied with the applicant's training skills, the person is hired.
- One interesting procedure used by SEPTA involves the use of video cameras where novice instructors can watch their own presentation, observe traits they may not be aware of, and learn from them as experienced trainers also review the tapes and provide valuable feedback. The application has significant implications for this project to prepare and qualify instructors. Instructor candidates could tape their presentations and send them to a national peer review team for evaluation and to receive certification.
- As part of the selection process at King County Metro in Seattle, candidates are asked to write a technical presentation describing a solution to a basic service problem, and are then asked

to present their work in the form of instruction to a review committee consisting of experienced instructors. The committee assesses the written material and how well the candidate presents it, paying particular attention to how well he/she was able to engage the audience in the learning process. Following the presentation several interview questions are asked to get a sense of how the candidate would perform as an instructor, and to make a final determination regarding selection.

Effective Transit Training Techniques

The best practices research revealed several examples of effective instructor methods. One such example was found at the Washington Metropolitan Area Transit Authority (WMATA) where an extremely capable instructor uses a well designed and appropriate blend of instructor-led classroom and computer-based training activities to teach electrical troubleshooting techniques. The instructor uses a series of exercises to assess the background and skill level of each student to ensure that everyone is adequately prepared for the computer simulations. The course focuses on using computer simulations as the primary instructional method with supplemental classroom activities.

The interactive approach used by the WMATA instructor is an innovative and effective way to teach a subject like troubleshooting where faultfinding requires technicians to apply many skills to be effective. A traditional classroom approach where "the instructor talks and the students listen" would not be nearly as effective at developing the deductive skills needed by students where the underlying cause of a fault is not readily apparent.

Los Angeles County Metropolitan Transportation Authority (LACMTA) uses several interactive activities to engage students to learn. One is an extensive use of mock-up equipment such as a brake board where all system components are mounted to a display. The interactive nature of working with the mock-ups engages the students to learn and gets them accustomed to performing tasks they will be responsible for after they return to work.

Another interactive learning technique used by LACMTA, SEPTA, and others in the classroom to break up lecture and get students engaged is to have the students work with tangible objects. In one example, after learning about different size fasteners, a mix of actual fasteners are placed in a bag and students must "blindly" identify them by size. Interactive exercises like this help students accomplish real-world tasks in a way that classroom lecture could never achieve.

A training course observed at SEPTA has the rail instructor conduct "classroom" training inside a train, teaching electrical schematics in an engaging way by showing students where the various wires, relays and electrical components shown on paper schematics are located on the rail car. Doing so is far more effective in that students, who will need to troubleshoot and repair electrical equipment, will not only understand how power travels through circuits from one component to another but will be able to locate those components on the vehicle.

Vendor Programs

New Flyer

New Flyer is a leading manufacturer of heavy-duty buses in the United States and Canada, with locations in both countries. The New Flyer Institute is a term that encompasses the company's training program, a blend of web-based, hands-on, and classroom instruction. In seeking new instructor candidates, the company points out that nearly all come from outside firms. They look for candidates with strong technical backgrounds and transit experience; a transit instructor is ideal. Newly hired instructors first receive factory training, attending the same classes as transit agency personnel. The next step is to be paired with a veteran instructor and begin to take on

more training responsibility while being coached by the mentor. This process typically takes about 3 months until the new instructor can deliver training classes without supervision.

All New Flyer instructors meet two to three times per year for one week. Vendor trainers (engine OEMs, etc.) are also invited to provide updated training on their components. The meeting is used to update trainers on New Flyer product developments and exchange training ideas. The company admits that they do not provide their trainers with much if any in the way of outside training on adult learning or other more advanced training topics. New Flyer does, however, recommend that their instructors provide a ratio of 50/50 hands-on to classroom training.

According to New Flyer, an effective instructor is one that:

- Communicates well and gets the message across;
- Has strong technical knowledge; and
- Is honest with students and will tell them if they do not know something.

In addition to conventional classroom training, New Flyer has added an e-Learning component to its training program. The computer-based platform features 3D animations, voice-over narrations, photos, video, quizzes, and simulations to engage students and facilitate learning. Students can go back to review materials and work at their own pace. Student progress and certification are tracked within the system. New Flyer's e-Learning system is turn-key and can be implemented very quickly. It is delivered through a cloud-based learning management system and is integrated with an agency's existing IT infrastructure. All data is hosted on an external, fully secured server with 24/7 access. In addition to training mechanics, New Flyer's e-Learning courses are available for maintenance and reliability training, operator training, supply chain training, and leadership development. According to New Flyer, the e-Learning platform is well suited for introductory training and refresher training, leaving instructors free to focus more on advanced and hands-on training.

Thermo King

Thermo King (TK) is a leading manufacturer of heating, ventilation, and air conditioning (HVAC) systems for trucks, trailers, buses, rail cars and shipboard containers. Since 1938 the company realized the importance of providing technicians with training as a way of offering its customers high quality service support. Today, TK maintains an Education Center at its corporate headquarters in Minneapolis, Minnesota, offering courses to enhance technicians':

- Technical knowledge of the units and the industry;
- Critical thinking skills for diagnostic and service procedures; and
- Skill and expertise in service, maintenance and repair.

The TK Education Center uses a combination of classrooms and labs to provide a variety of class venues, teaching styles, and course levels on its entire line of HVAC products. The company uses and makes available to other trainers a TK Bus Air Conditioning Maintenance Training Simulator. The fully operational and functioning air conditioning system comes complete with a rear-mount air conditioning unit, compressor and clutch assembly driven by an electric motor. This is all mounted on a moveable stand for use by transit agency maintenance training departments for their bus air conditioning maintenance training purposes.

Regarding its instructors, TK has been hiring recently retired U.S. Navy military personnel with shipboard HVAC equipment and training experience. Veteran TK instructors then work with the new hires to get them familiar with the company's commercial vehicle HVAC systems and TK's teaching protocols. TK also uses Langevin Learning Services (http://www.langevin.com) to help prepare its newly hired instructors. Langevin Learning Services is a provider of workshops and products for trainers. Their workshops communicate effective teaching skills

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based on proven adult learning principles and give attendees multiple opportunities to practice those skills during individual and group exercises. Feedback is provided by the instructor as well as peers attending the workshop. A comprehensive course manual is provided with the workshop for future reference.

After attending TK's own training program along with training provided by Langevin, novice instructors observe veteran instructors provide courses. As is the case with other instructor preparation approaches, including examples given for transit, novice instructors progressively assume more training responsibility until they are ready to teach an entire course. The veteran instructor serves as a mentor throughout the transition, providing instructional guidance as needed.

Surprisingly, not many instructors have come from the TK ranks. In addition to retired U.S. Navy instructors, TK has also hired from bus companies, those with prior training and HVAC experience. About 25 percent of TK's transit training program is directed at teaching basic HVAC fundamentals. The remainder is split between troubleshooting and providing instruction on electronic control systems. Classes use a blend of classroom and hands-on instruction, with TK's Training Simulator module playing a major role in all aspects of its hands-on training program.

Cummins Engine Company

Cummins is the leading, and currently the only, supplier of heavy duty diesel engines for full-size U.S. transit buses. Worldwide, Cummins earned $1.66 billion on sales of $17.3 billion in 2012. Service support comes from an extensive series of distributors and dealers located throughout the country. To maintain control over its warranty work, mechanics are not allowed to make warranty repairs unless they are trained and certified by Cummins to do so. With few exceptions, the focus of Cummins' certified training is on distributor and dealer personnel, who almost exclusively are the only ones authorized by Cummins to make warranty repairs. The reasoning is that Cummins can control work done under warranty, making determinations as to what caused the problem, and preventing any collateral damage done as the result of improper warranty work. As a result, training directed to agency personnel focuses on routine engine maintenance, making repairs and conducting overhauls after the warranty has expired when Cummins is not responsible for providing parts and labor reimbursements.

At the foundation of Cummins' training, regardless of whether it is directed to certifying its own dealers or agency mechanics, is its virtual college program. The web-based program is intended to ensure that mechanics first have rudimentary, foundational understandings of engine theory and operation before turning over those students to instructor-led training. Doing so allows the instructors to focus more on critical repair, troubleshooting and rebuilding instruction where hands-on training plays a larger role, leaving the online approach to provide the basic training.

Cummins instructor candidates first undergo a screening process where the company first looks for a minimum of five years Cummins engine experience, existing qualifications on five Cummins engine models, and an interview process where candidates go through the same training as dealership personnel to first become certified at a level of technical proficiency. This consists of the online virtual college program followed by instructor-led training that involves classroom and hands-on training at about a 50/50 ratio. Newly hired instructors are then paired with a seasoned veteran before assuming some responsibility for delivering instruction. The novice instructor assumes increasing responsibility for training delivery until the mentor feels he/she is ready to deliver a class on their own.

Cummins has about 20 certified instructors. Again, instructors are certified based on technical proficiency; there is no formal certification for training proficiency. All trainers meet annually to exchange training ideas, learn new techniques, and receive updated technical training.

Other Transit Programs

Significant programs and materials of value related to instructor training and certification were also identified from transit organizations such as APTA, NTI, the Transportation Learning Center, and others.

APTA

APTA's Subcommittee on Instructor Development, composed of representatives from both labor and management with assistance provided by the Transportation Learning Center, has produced two documents of interest to this project. The first is a *Discussion Draft for Instructor Development*; its purpose is to help increase the training capacity of transit agency maintenance departments by providing a career path for technicians to become qualified instructors, and to increase the pool of instructor candidates. The second APTA resource is the *Recommended Practice (RP) for Transit Vehicle Maintenance Instructor Training and Certification*, which recommends the skill sets needed to become an effective technical instructor.

Discussion Draft for Instructor Development. APTA's *Discussion Draft for Instructor Development* recognizes the need to improve the teaching skills of transit maintenance instructors and urges labor and management to work together to create an environment that supports this goal. The document is accessible at http://www.aptastandards.com/portals/0/Bus%20Maint/Final%20Draft%203-27-07%20Instructor%20Development.pdf and sets forth guidelines in four areas:

- Increasing the instructor candidate pool;
- Selection criteria;
- Training curriculum; and
- Support and mentoring.

The APTA draft concludes with two useful appendices. Appendix A of that document consists of a comprehensive process for selecting instructor candidates. It includes suggestions for:

- Obtaining writing samples;
- Arranging group presentation demonstration;
- Having the candidate pose a scenario (a potential problem or need) and address it with a training response; and
- Conducting a panel interview where the candidate outlines their technical experience and focus on personal and interpersonal competencies.

Appendix B lists transit training resources from organizations such as NTI, EDSI, the Transportation Learning Center, and others.

APTA Recommended Practice for Transit Vehicle Maintenance Instructor Training and Certification. The second APTA resource document with direct applicability to this project is the *RP for Transit Vehicle Maintenance Instructor Training and Certification.* APTA RPs are voluntary, industry-developed, and consensus-based. This particular RP recommends a set of skills needed to achieve the level of proficiency for transit vehicle maintenance instructors that includes:

- Administrative knowledge and skills;
- Technical skills;
- Interpersonal skills;
- Training and presentation aids; and
- Required training documentation.

The RP also addresses federal and state regulations, agency policies, labor contracts, and safety and security. Materials contained in both APTA documents are extremely useful for establishing a broader system of instructor training and certification for transit.

NTI

NTI, at Rutgers, the State University of New Jersey, was established to develop, promote, and deliver training and education programs for the public transit industry. Training courses are offered in a variety of subjects ranging from advanced technologies, management development, workplace safety and security, and others. As was suggested in APTA's *Discussion Draft for Instructor Development*, several courses offered by NTI could be extremely useful for preparing technical instructors for certification. Although course offerings change over time, examples of NTI courses that could assist instructors include:

- Training and Coaching Skills for Maintenance Instructors;
- Introduction to Training and Coaching Skills;
- Adult Learning Principles;
- Communicating and Working with Diverse Personalities;
- Assessment and Feedback;
- How to Write Policies and Procedures; and
- Changing to Supervision.

Also of interest from NTI is its Transit Trainers' Workshop, a national event that focuses exclusively on transit training and includes a variety of training and networking opportunities. The goal of the workshop is to offer skills, strategies, and techniques that build the professionalism of transit trainers, enable trainers to become proactive partners in their organizations, and facilitate the sharing of information and resources in the industry.

As noted in other best practice examples, a dedicated workshop series established exclusively for trainers provides an excellent opportunity to enhance instructor skills, have them network with other instructors, and learn from each other's experiences.

Southern California Regional Transit Training Consortium

SCRTTC is a nonprofit organization created in response to the industry's need for a trained technical workforce. It includes a coalition of 43 transit agencies, community colleges, and other educational institutions based in California and Colorado. SCRTTC has developed and delivered curriculum designed to meet present and future technological needs of transit agencies. To date, the SCRTTC has trained over 3,500 transit employee participants and delivered over 50,000 hours of training.

Standard Operating Procedures. A standard operating procedure (SOP) developed by SCRTTC ensures that courseware and instructors meet established validation, certification, and accreditation standards. Course topics come from a committee made up of the transit industry and educational members based on the immediate training needs of its membership. Once the core topic is selected, a subset of committee members begins content development designed to fit within one of the four training tracks developed for the program: Basic, General, Advanced and Specialty.

Training Courses. All SCRTTC courses developed, validated and delivered are evaluated by students taking the courses on a 4-point scale where 1 is poor and 4 excellent. There is also one survey question pertaining to the instructor. Courses are typically delivered by community college instructors, some of whom are also SMEs in the particular subject being taught. In other cases transit agency instructors teach the courses. Agency instructors first attend community

college courses that provide soft skills training needed to become effective instructors. In all cases, SCRTTC notes that the community college is teaching "our course," that is a course developed and approved by the consortium. About 60 percent of the training is conducted at transit agency facilities depending on the course being offered. Much of the instruction is hands-on where students learn by doing.

SCRTTC has several essential program elements that warrant consideration for this project. They include defining of courses by those who need it, existence of a professional training structure, curriculum developed by a community college, a course validation process, and instructor evaluation by students. Certifying the entire training program, common in the non-transit best practices explored later, can ensure that qualification extends beyond the instructor to include curriculum, course and other training elements. The Transportation Learning Center, APTA, NTI and other transit organizations already have in place many of the elements needed to certify entire training programs; work undertaken by this project should serve as a building block to establishing such a future national program.

Transportation Learning Center

The Transportation Learning Center is a partnership of national transit leaders that develops industry-wide solutions and provides support for local and statewide partnerships in areas of common labor–management interest, such as workforce development and safety. The Center has produced several documents and programs that can be applied to this project.

Training Standards. The Center has worked with APTA on a joint labor–management basis to develop training standards for both bus and rail maintenance, which can be used in establishing a national instructor certification program as a basis for defining trainer effectiveness.

Courseware Development and Sharing. In 2009 the Center established the Transit Elevator/Escalator Training Consortium (the EL/ES Consortium) for developing standards-based training courseware and related materials. A new Consortium for Signals Training is also underway with broad interest expressed in follow-on consortium work in rail vehicle maintenance and traction power. Initial courseware development work has also been completed under the TCRP Project E-7.

In addition to courseware development, the Transportation Learning Center has built an online platform to facilitate sharing of transit technical training materials from several sources across agencies at Transit Training Network (TTN) (www.transittraining.net). The courseware development and sharing initiatives could be applied to bring quality training materials and resources based on national standards to transit instructors across large and small agencies.

Learn By Doing. How people learn is a complex subject and numerous theories abound. Aware of those complexities, the Center has produced two papers that explore the benefits of hands-on learning in great detail. Information contained in these papers could be incorporated in a training program to assist instructors move from traditional classroom lecture to more effective hands-on methods that engage students to learn.

Mentoring. A Mentoring Guidebook produced by Center provides an effective training opportunity by linking an experienced person (mentor) with a less experienced trainee to help foster the trainee's abilities, career development, and professional growth. The instructional methods presented in this publication could be useful to an instructor development and certification program by helping instructors incorporate mentoring as an instructional method and assessing their abilities to effectively do so.

Elements of Effective Training. The Center's paper, *Establishing Guidelines for Quality Training: Elements of Effective Training Programs*, examines all aspects of a training program with several sections of particular value to this project including:

- Creating a national system of transit industry apprenticeship programs;
- Transitioning toward a system that can provide college credits for transit technical skills training tied to industry training standards; and
- Responsible implementation of technician testing and certification.

The program is available at: http://www.transportcenter.org/images/uploads/publications/Establishing_Guidelines_for_Quality_Training.pdf.

Train-the-Trainer Activities. The Center has developed quality train-the-trainer programs, alongside national development of courseware to provide high quality classroom-ready training materials. In particular, the Transit Elevator/Escalator Training Consortium has tackled the pressing need to prepare SMEs to become trainers.

In partnership with the Center, EDSI has also developed and delivered train-the-trainer programs to transit agencies across the country as part of the local transit career ladder partnership training programs. Sample train-the-trainer PowerPoint and Instructor's Guide are provided in Appendixes G and H. Materials contained in this program are directly applicable to a national program to help prepare instructors for certification.

Credential Management System. As part of the National Rail Vehicle Technician Qualification Program, the Center has developed an online credentialing management system that is currently piloted to track technician training, written and hands-on assessment results and qualification progress. This system could potentially be used for national training and certification of vehicle maintenance instructors and other instructors for transit technical training.

American Public Transit Exam Institute

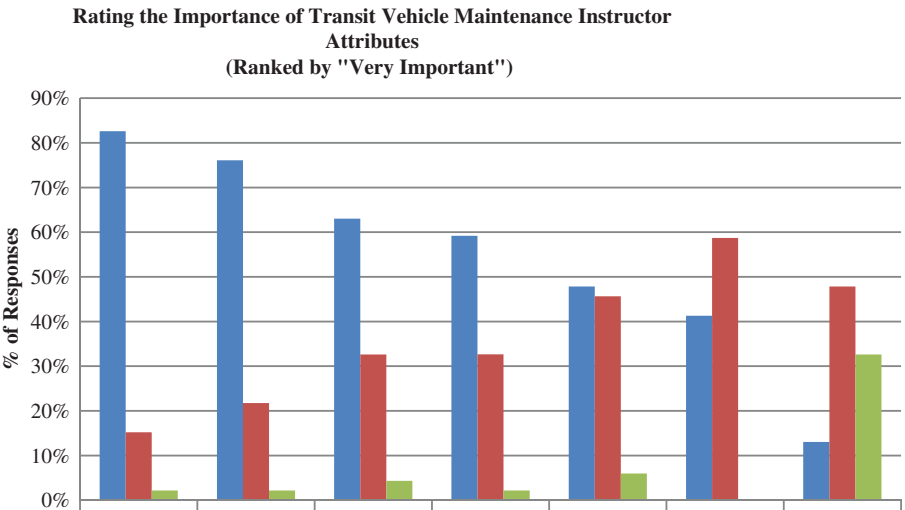
The American Public Transit Exam Institute (APTREX) claims to be the only accredited professional certification institute in public transit. It focuses on the continuous improvement of managers, supervisors, and executives. The mission is to provide the transportation industry with a certification process that encourages industry development.

APTREX was founded in 1993 as an examination center for the public transportation industry. Its certification process is governed by the International Transit Certification Review Board (ITCRB), a professional body composed of senior executives and educators. The APTREX Certification Program was developed as a result of feedback from hundreds of transit authorities and in concert with NTI.

Although APTREX currently does not offer a program for maintenance instructors, the tenets of the certification program, which is similar to professional certification programs found in other industries (e.g., real estate, accounting and healthcare, etc.), have relevance to this project and should be considered.

Instructor Attributes and Prerequisites

The Project Team also examined the prerequisites that agencies require of their instructors and the attributes they feel are most essential. The two are interrelated in that the more desirable attributes a candidate already possesses, the less preparation and training is needed to make instructors productive and effective.



	Good communication skills	Good work habits/ethics	Good technical knowledge	A desire to be a trainer/ Passion	Patience	Trust and respect for the ability of others	A sense of humor
Very Important	83%	76%	63%	59%	48%	41%	13%
Moderately Important	15%	22%	33%	33%	46%	59%	48%
Of Little Importance	2%	2%	4%	2%	6%	0%	33%

Figure 3.1. Rating the importance of instructor attributes.

The research, summarized in Figure 3.1, revealed that good communication skills, good work habits or ethics, good technical knowledge, and a desire or passion to be a trainer ranked highest among desired attributes.

When asked to list prerequisites for their trainers, the vast majority of survey responders cite technical experience. The ideal candidate described by one agency comes to the job with technical experience, college training in teaching methods, extensive work experience, and a training background. Finding a transit instructor with these existing qualifications, however, can be extremely difficult.

Some agencies require instructors to first have one year of supervisory or lead experience (preferred); five years as a journey-level mechanic, or five years of teaching diesel engine, transit bus maintenance, electronics or mechanical skill areas; and ASE certification (preferred). Others require a two-year degree and five years of transit vehicles maintenance, while other agencies send their instructors to train-the-trainer programs offered by OEMs and NTI. One agency without in-house instructors sums up their situation: "We only use OEM instructors. Some are very good while others are a waste of everyone's time and money."

When asked for specific examples of effective technical training many survey respondents, including instructors and union technicians, mentioned activities that engage students. King County Metro strongly favors interactive, web-based learning offered by engine and transmission OEMs. These courses provide technicians with essential background knowledge, allowing agency instructors to focus on more advanced training.

VIA (San Antonio) describes an effective instructor who frequently uses tests to gauge student comprehension. VIA is a strong proponent of task-based training where SOPs are developed for carrying out common jobs. The SOPs ensure that all workers perform jobs in a consistent manner, and they serve as the basis for instruction where students perform the jobs first in hands-on

training settings that they will later carry out on the shop floor. This approach is also used by CTA and several other agencies.

At LYNX in Orlando, a highly effective instructor is cited for applying interactive and hands-on teaching approaches that students find very helpful. New York City Transit (NYCT) cites an instructor who spends extra time mentoring new students, follows up once the person has graduated the course, and tracks the success of the students over time. Strong technical understanding, work experience, interactive training technicians, and dedication to teaching and seeing students succeed are desirable attributes described in the survey responses.

Lessons Learned from Transit Best Practices

The transit industry investigation produced several significant practices and approaches with relevance to this project. Many of the elements identified through this work have been applied to the program structure; others are left for the eventual AO to consider as it finalizes the program for future implementation.

Few Programs Exist for Instructor Training: It was made clear from the research that because most agencies do not have programs in place that adequately prepare instructors for their jobs, a national program is needed.

Essential Instructor Attributes Identified: Survey responses and follow-up research provide a consistent description of essential trainer attributes that a national training and certification program should focus on. The top four attributes identified are strong technical knowledge, good communication skills, good work habits and ethics, and a desire (or even passion) to share information and skills with others. Although stated in a variety of ways, the prerequisite qualifications noted by survey responses mirror these attributes.

Transit Elements Have Merit in Establishing a National Program: Although few in numbers, much can be gleaned from the best practices found at transit agencies with programs in place to train and prepare instructors for their jobs. Elements of qualification/certification, though not formalized, are in place as part of processes used by these agencies to determine if candidates are capable to serve as instructors. These elements can be used as a starting point for establishing a more formal national program, understanding that more robust up-front preparation and other essential elements will be needed to adequately prepare instructors for certification.

As shown by MARTA and King County Metro, taking advantage of in-house and local training sources makes sense. The concept could be made part of a national program where applicable training to prepare instructors (that already exists) could be identified and assembled into a training resources directory and shared with other agencies.

Processes used by CTA, SEPTA, King County Metro, and others whereby newly hired instructors work alongside seasoned instructors in a mentoring relationship to learn their craft also have merit. Work from the Transportation Learning Center and others on mentoring should be applied. The concept could be extended to smaller agencies where their instructors would travel and receive mentor training from larger agencies with the resources to accommodate them.

The concept of using a team of seasoned instructors also has value in establishing guidance for a national instructor certification program. A peer committee or team could be established for the purposes of evaluating instructor performance to determine qualification. The team could travel to evaluate instructors and offer guidance or certification as appropriate. As a more efficient and cost-effective alternative, video presentations could be made of the instructors as was suggested by SEPTA's best practice and sent to the national peer committee/team for review, evaluation, and to make recommendations.

National standards would need to be developed for instructor training and qualification in the same fashion they were done for technicians to ensure the training is appropriate, consistent, and adequately prepares instructors for qualification. Standards also make certain that the qualification process is fair and equitable.

APTA, the Transportation Learning Center, NTI and others each have a great deal to offer a national program for instructor training and qualification. The process established by APTA and the Center for developing standards on a joint labor–management basis could be applied for developing instructor training and certification standards. Previous research done by the Center on mentoring could be applied in the training process, as well as elements contained in the train-the-trainer.

APTA's *Discussion Draft for Instructor Development* contains helpful guidance on increasing the instructor candidate pool, selection criteria, training curriculum, and support and mentoring that could be extremely useful to this project. So is APTA's *RP for Transit Vehicle Maintenance Instructor Training and Certification.*

NTI also has several elements of interest to this project. Its course offerings could be tailored to include those based on national standards and specifically designed to assist maintenance instructors achieve qualification as defined by this project. Their annual workshop could also be enhanced with a track of sessions designed for maintenance instructors.

The best practices used by SCRTTC to develop and validate courses for technicians certainly have relevance for this project. So does the concept of using community colleges to teach courses designed in collaboration with transit professionals, especially those that would enhance instructor communication skills. Much also could be applied from APTREX, transit's accredited professional certification institute.

Transit vendors also have much to offer including the e-Learning used by New Flyer and others that should be considered as a method to provide instructor training. The concept of pairing newly hired instructors with veteran mentors and using periodic workshops to exchange ideas also used by vendors appears to be a universal approach for preparing technical instructors. Thermo King's use of Langevin Learning Services (http://www.langevin.com) to help prepare its newly hired instructors should be explored as a possible instructor training resource for this program.

Best Practices from Other Industries

The Project Team also examined best practices used by organizations outside of transit including automotive, skilled building trades, and airlines. These industries are extensive and this investigation by no means covered them all. It did, however, reach out to seek noteworthy and representative instructor preparation and certification best practice examples with applicability to this project.

Automotive Manufacturing

Background

With about 15 million cars and light trucks sold annually, the automobile industry is extensive and arguably difficult to compare with transit. Dealerships are run as manufacturer franchises with specific requirements established for sales, service, and training. Each automaker has its own set of training requirements with the objective of ensuring that technicians are capable of making repairs properly to sustain customer satisfaction and repeat business in this highly competitive industry. The survival of automotive franchises and the manufacturers they represent depends

on having qualified technicians and instructors. With the need for training clearly established in the auto industry, automakers are keenly focused on how best to effectively provide that training.

With so many auto manufacturers, the task of reaching them all would be daunting and extremely time consuming. Instead, the best practice approach used here was to establish contact with a highly respected training executive who was asked to speak broadly, objectively, and candidly about all aspects of automotive training, specifically how instructors are trained and certified.

Various Training Approaches

As is the case with transit, the market for skilled automotive technicians is limited and the auto industry is keenly aware of the shortages brought on by retiring baby boomers. Given the large numbers of technicians to be trained, the representative admitted that OEMs use a variety of training approaches and are often forced to sacrifice effective training methods to accommodate training demand. According to the representative, hands-on training is the most effective, but it does require more time, smaller class size, and equipment with which to provide the training.

The executive implied that the days of sitting students in a classroom and lecturing them on how to maintain and repair equipment is over, especially with today's generation of students who have grown up with video games and computer apps. The ideal technical training scenario, according to the training executive interviewed, is to first use computer-based, online training to introduce a subject and provide some basic, up-front training through classroom instruction before moving on to hands-on training. The auto representative also strongly favors mentoring as an effective training approach and is seeking ways to incorporate it into a franchised dealer environment.

Instructor Recruitment and Selection

The auto representative, who has a strong background in education, once firmly believed that instructors should foremost possess a strong educational background and that having technical skill was secondary. After years of experience, however, he has come full circle, stating that: "It's easier to teach someone with a strong technical background to become an effective instructor than it is to teach technical skills to someone with a background in education." The next two critical attributes mentioned by the training executive include having a strong desire to teach and strong communications skills, emphasizing that the hiring process needs to ensure that applicants have all three essential attributes. It is interesting to note that the top three attributes cited by the auto training executive—technical proficiency, desire, and communication skills—are identical to those identified by this project.

Once technical experience and proficiency are established, the auto representative stated that he looks for training experience and the desire to teach, which could include community college teaching at night, experience working as a shop foreman, and experience as an informal mentor who reaches out to others to help them solve problems. Teaching courses at night shows that the candidate has a genuine desire to teach; so does mentoring.

Instructor Preparation and Evaluation

The representative revealed that the process of preparing auto instructors typically does not result in issuing formal certificates. OEMs typically participate in the various ASE programs described above where the entire training program, including instructors, is accredited. OEMs encourage instructors to participate in various ASE sponsored events once hired, but to get employed they typically use a rigorous screening process to hire already qualified instructors or those with technical proficiency that they can more easily train to become effective instructors.

Once they pass the screening process and are hired, newly hired instructors typically sit in on training courses given by senior instructors, a process similar to that used by CTA, King County Metro, and SEPTA. In time the OEMs typically refer to the instructors as being "certified." Obviously, each OEM has its own exact methods for preparing their instructors. However, while ASE assists OEMs to build a highly competent training staff, there does not appear to be an encompassing national program for automotive instructor certification.

Implications for Transit

The interview with an auto training executive with broad industry experience reinforces the need to assure through a qualification process that instructors have strong technical experience, a strong desire to teach, and have strong communication skills. The interview also emphasized that instructors need to deliver a blended training approach where students are actively engaged in the learning process with substantial hands-on exercises and computer-based programs that involve student participation. Mentoring is also recognized as an effective training approach, one that is more easily applied to transit than to franchised auto dealers.

Independent Automotive Organizations

Automotive Service Excellence

ASE is a nonprofit organization established by the automotive industry to improve the quality of vehicle repair and service through the voluntary testing and certification of automotive repair technicians. Through a TRB program, ASE certification has been adopted specifically for transit bus technicians. ASE developed the technician certification program on a joint labor–management basis with the support of the FTA, APTA, and the Transportation Learning Center.

ASE is also specifically engaged in several activities intended to improve the quality of automotive training programs and institutions. Rather than certifying only instructors, ASE founded the National Automotive Technicians Education Foundation (NATEF) to improve the quality of all aspects of automotive technician training programs offered nationwide at public and proprietary schools through voluntary accreditation. ASE believes the accreditation is needed because the motor vehicle repair industry has taken on a new level of sophistication, requiring advanced technical training and computer literacy.

Continuing Automotive Service Education (CASE) is the name of the voluntary certification program within NATEF. Under its NATEF/CASE program, ASE examines the structure and resources of training programs and evaluates them against nationally accepted standards. ASE's evaluation process ensures that accredited training programs meet or exceed these industry-recognized standards. ASE's CASE evaluation and accreditation process for technical training programs is supported by the state Departments of Education in all 50 states.

Benefits of Accreditation. ASE touts several accreditation benefits. For schools, program accreditation increases potential for funding from public and corporate sources and provides a mechanism for recruiting students based on demonstrated program excellence. For students, accreditation provides a means of identifying quality programs meeting national standards and ensures that training received is current, complete, and applicable, while employers are ensured a pool of well-trained entry-level technicians.

ASE Certification Standards. Through its program to evaluate and certify organizations that provide automotive technical education, ASE has identified certain elements of organization, structure, and method that contribute significantly to the development of high quality continuing automotive service education. This best practice application of standards, although developed to

certify entire training programs, can be applied to a transit instructor training and qualification program using the training standards developed by APTA and the Center as a guide.

Automotive Training Managers Council. The Automotive Training Managers Council (ATMC) is another nonprofit organization within ASE designed to promote the advancement of training and professional development within the automotive service industry. The Council sees itself as a think tank for the automotive training industry, using collective wisdom and experience from within the industry itself to project how students will learn in the future, and then helping its members prepare for it.

ATMC also conducts a yearly benchmark survey with training providers and technicians designed to keep the two groups in sync. The latest survey, available at http://www.atmc.org/Resources/Documents/ATMC%20Training%20Benchmark%20Survey%202013.pdf, concludes that the trend for classroom, instructor-led training is giving way to more engaging training delivery methods that include lab-based, hands-on, online, video, and others.

ASE Program Implications for Transit. The concept of providing accreditation for entire training programs is one worth considering once the instructor certification program is established. Once the instructor qualification program becomes a reality, thought should be given to developing a structure that would offer accreditation to the entire training program. Work done by APTA and the Transportation Learning Center regarding training standards, mentoring, apprenticeship, and others could be incorporated into the accreditation process. The four step process used by ASE/NATEF serves as a model.

The concept of periodic meetings and conferences where technical instructors convene and receive recognition is also a good one. Although NTI has such a venue, it tends to be directed more towards trainers engaged in non-maintenance related areas. Separately surveying transit instructors and technicians to identify trends and needs would also be useful. The concept of establishing standards exemplified by ASE and others, serves as another reminder of their importance for training and certification purposes.

Universal Technical Institute Inc.

Universal Technical Institute (UTI) is a nationally recognized provider of technical education training for students seeking careers as professional automotive, diesel, collision repair, motorcycle, and marine technicians. UTI provides on-site training for several public transit agencies, both through its own representation under the UTI banner and under contract through individual transit bus OEMs. Based on its experiences, UTI believes transit training to be too "academic" in nature with both agency and OEM instructors spending too much up-front training on theory. UTI's approach is that instructors need to engage students in task-based activities.

UTI does not offer a formal certification program for its technical instructors. Instead, UTI's overall training program, which includes instructor training, is accredited by the Accrediting Commission of Career Schools and Colleges (ACCSC). The ACCSC is listed by the U.S. Department of Education as a nationally recognized accrediting agency for the establishment of educational standards. Instructors take courses developed by UTI's large organizational structure and candidates are required to have extensive ASE certifications as master technicians.

Once hired, instructors then work with UTI staff to prepare them in UTI's training method, which is task-based and focuses heavily on hands-on training. Seasoned instructors work alongside novices as they assume greater teaching responsibilities, where they are critiqued and coached on both classroom presentations and hands-on exercises. The observation and coaching continues as newly hired instructors deliver their first series of classes and throughout their employment as instructors.

Craft Trades

The International Masonry Institute

The International Masonry Institute (IMI) provides training services for the masonry trade. IMI does provide training with certifications offered in five areas including three in various masonry crafts, one for foreman and supervisors, and another for instructors, called the Instructor Certification Program (ICP). Training is provided primarily at IMI's headquarters in Maryland and through various regional centers. The Bowie, Maryland facility consists of two buildings on a 25-acre site: a 61,000 square-foot, two-story open bay training center; and a 46,000 square-foot main building with dormitory rooms, recreation facilities, cafeteria, and meeting rooms to accommodate 108 students.

Instructor Certification Program. IMI's ICP is comprised of a 200-hour curriculum that takes at least five years to complete. Program participants must have at least five years of journey-level craft experience. Now in its 24th year, the curriculum is updated to address changing industry needs. The ICP keeps instructors informed of the latest technical and professional information, from new building products to personnel management, health and safety, and sexual harassment.

Masonry Industry Program Implications for Transit. The IMI is an excellent example of what could be achieved with regard to instructor development and certification, especially with ample dedication, resources and 24 years of experience. The need for applicants to have existing craft experience is consistent with the survey findings and prerequisites found in the auto and other industries where strong emphasis is placed on instructors having prior technical experience. The curriculum developed by IMI could serve as a model for transit, while their annual workshops reinforce the need to have instructors meet on a regular basis to exchange teaching ideas and skills.

United Association of the Pipefitting Industry

The United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry (UA) is a multi-craft union whose members are engaged in the fabrication, installation and servicing of piping systems. UA's training system consists of approximately 350 schools in the United States and Canada. This is in addition to other facilities that its apprenticeship programs use, such as community colleges and technical schools. The Great Lakes Training Center, Ann Arbor, Michigan, serves as the training headquarters. It consists of a dedicated facility on the campus of Washtenaw Community College, which works with the UA to provide the training in a collaborative arrangement. UA instructors typically provide technical training while Washtenaw Community College instructors provide the educational based courses. Washtenaw Community College offers instructor training programs for other trades, including the ironworkers.

As a way to bring training to students, UA uses Mobile Training Trailers, a fleet of 30 self-contained trailers that provide local unions with training anywhere in the United States and Canada. The mobile training units are also used to train UA instructors. The state of the art training trailers can be moved at a moment's notice to an area in need of extra training.

Instructor Training Program. A separate International Training Fund has been established to provide local union instructors with the educational resources they need to prepare UA apprentices and journeymen for their work in the piping industry. A number of courses are offered to help UA instructors enhance their teaching or update their certifications. The five year program trains nearly 2,000 UA instructors with 200 hours of classroom and hands-on training experience. The ICP, celebrating its 60th year, has instructors attending a national training conference, a full week (40 hours) of courses held each year at its headquarters in Ann Arbor.

Upon graduation, instructors then become certified to teach apprentices and journey-workers at their home local. Instructor development courses are also held at a number of locations throughout the year to meet UA local needs.

Various levels of instructor certifications are offered. The title of Certified Instructor of Journey-workers and Apprentices in the Plumbing and Pipefitting Industry is given to those who satisfactorily complete 200 hours of course work (including all mandatory classes). The title of Certified Coordinator of Journey-workers and Apprentices is given to those who satisfactorily complete 120 hours of required courses in the Coordinator's Certification Program. To earn a Certificate of Attendance, a candidate must complete all 40 hours of class during the Instructor Training Program. Certificates of Attendance are not offered for online courses.

A selection of courses is offered to achieve the various instructor certifications. Of general interest to this project is the course on public speaking designed to help UA instructors acquire essential speaking and listening skills for the classroom. Class exercises focus on the delivery of lecture material, conducting demonstrations, and gaining a heightened awareness of the relationship between a speaker and an audience. UA instructors are encouraged to bring materials from classes they are currently teaching as reference for class exercises. Also of interest is a course on Problem Solving and Innovations in Trade Teaching. Another course with applicability to transit is entitled Basic Computer for the Trade Teacher. This 20-hour course introduces instructors to the basics of computers. This could be especially useful in transit where many of the older technicians moving into instructor positions may not be thoroughly familiar with computer use.

Especially of interest is a course titled Interactive Teaching for the UA Trade Instructor. The course is designed to enhance teaching and interaction techniques for UA instructors who teach in a classroom environment. It provides instructors with the necessary tools to more effectively engage an audience, create individual and group discussion, structure classroom setup more conducive to individual participation, manipulate lesson plans to fit a set time frame, and to create student, instructor, and classroom cohesiveness, ultimately accelerating learning and comprehension.

Pipefitting Industry Program Implications for Transit. UA's training program serves as an excellent model for a craft training program, one that transit can aspire to achieve some day. The concept of holding an annual conference where instructor training is used to achieve certification is one that deserves serious consideration. Holding the training sessions on a community college campus such as Washtenaw Community College also deserves consideration as a third-party vendor because the college could offer essential communications and educational training for transit. The traveling training trailer concept is also a good one where instructors receive training at their own facility by seasoned instructors who carry needed training aids with them. The concept of oversight and mentoring of novice instructors by seasoned veterans is a common theme seen in all industries and should also be part of a national transit program.

Laborers' International Union of North America

Laborers' International Union of North America (LIUNA) Training and Education Fund runs an extensive network of 73 training centers in the United States and Canada. Training centers are supported by contractor collective bargaining agreements and to a small degree by targeted federal grants for technical training. LIUNA's rigorous selection, training, and credentialing process follows the ISO 17024 standard for the accreditation of certification of personnel agencies, and may be unique in U.S. technical instruction. The organization believes that formal credentialing is a key aspect of ensuring quality industry training.

LIUNA believes that a combination of training approaches are needed to create a well-rounded worker. LIUNA training is a strong proponent of both interactive and hands-on instruction.

All courses are designed with these components built-in. All instruction is tailored to the specific technical area being taught. This includes hands-on activities and classroom learning. Computers are a helpful instructional tool and are sometimes used to aid instruction as appropriate. Distance learning is used for training instructors and for some knowledge-based worker courses (primarily prerequisite and/or refresher training).

LIUNA instructors adjust their teaching to meet the needs of the students. This involves conducting an initial analysis of student skills such as language and technical knowledge of the subject.

Instructor Recruitment and Selection. Instructors are recruited based on their industry expertise and leadership abilities as demonstrated through their professional practice in the field. Interested recruits go through an interview process that typically involves a panel including the training facility's director. Final decisions are made based on demonstrated expertise, work experience, and interview results.

Selected instructors have industry knowledge obtained from direct professional practice in the field, preferably in a leadership position. Most trainer recruits are laborers with extensive work experience. Some have become job superintendents or project managers. The second important prerequisite is experience with on-the-job training or mentoring. These may be spontaneous mentors—skilled workers who share their expertise and support younger laborers—or part of a formal mentoring process maintained by an employer. Recruits are expected to have strong interpersonal skills as demonstrated through the ability to effectively work with individuals from diverse backgrounds and at multiple levels within the organization.

Instructor Preparation and Evaluation. After hire, instructors take a 16-hour online orientation course that introduces them to the concepts of adult education in a trade environment and provides basic tools to support instructional planning, training delivery, assessment of learning, and classroom management. Instructors are required to successfully complete an online test.

Successful hires are then assigned classroom duties as selected by the training director as they continue to develop their required competencies. As apprentice trainers they are supported and mentored. From hire to certification can take from 6 months to 3 years, depending on the courses they need and where they take them.

Teaching skills are assessed based on combined scores derived from the review of a lesson plan created by each instructor during a proctored and timed planning session, a 30-minute lesson delivered by each instructor to an expert panel of trained assessors, and the review of a post-lesson reflection submitted by each instructor. Instructors meeting the minimum requirements for certification in all four areas of competence—reading, math, computer and teaching—are eligible to sit for LIUNA Training's Instructor Certification Exam.

Instructors who do not meet certification requirements in one or more of the competence areas undergo training to build their skills. Instructors can elect to take instructor training through LIUNA-provided courses or through an approved training provider.

Instructors all use LIUNA training's accredited curriculum that includes standards, has measurable objectives, includes lesson plans, and uses both written and performance assessments. Instruction consists of 40 percent classroom and 60 percent hands-on training. Hands-on training is conducted in simulated job site conditions. This helps ensure workers have the necessary knowledge to do the work and are able to apply the skills on-the-job. Finally, LIUNA Training conducts annual monitoring visits to ensure that certified instructors adhere to instructional best practices.

LIUNA Program Implications for Transit. The well-structured approach used by LIUNA to certify its instructors can serve as another example for transit to emulate. Providing instructors

with the ability to deliver interactive and hands-on instruction is a noteworthy characteristic of any instructor development program and one that needs to be incorporated into the transit program. The ISO 17024 standard for accreditation certification is worth exploring further; so is the requirement for periodic monitoring of credentialed instructors to ensure what they learned is being followed.

Aircraft Maintenance

Aircraft mechanics are required to be trained and certified by the FAA per federal regulations, which define the qualifications of aviation maintenance technician schools and instructors. Each airline provides company-specific training to the certified mechanics it hires. There are recurring skills, policy and safety training, and courses whenever new equipment is introduced.

American Airlines

Instruction provided by American Airlines (AA), for example, replicates work conditions as much as possible. Real engines, cockpits, and other equipment are available or simulated. While hands-on instruction is the main mode, computers are often used just as they are in the mechanics' work. The airline has some outstandingly excellent and innovative trainers. They build their own equipment mock-ups and enhance presentations with photos or animations.

Instructor Recruitment and Selection. Continuing with the AA example, most instructors are hired from among the mechanic ranks, with about 10 percent coming from the military. Instructors are identified by the training staff or through applications in response to an announced opening. Applicants are interviewed by a 5-person panel and asked to prepare a 15 minute training session on an assigned topic that they are familiar with but not expert in, a process also used by SEPTA as described earlier.

Instructor Preparation and Evaluation. New instructors are sent through week-long trainer classes, usually at the aircraft OEM or at a community college. The course covers the skills needed to be an effective instructor, including gauging students' understanding and approaches to meet different learning needs. To prepare for teaching a course, the new instructor will participate in the course, talk it over with the experienced instructor, and co-teach a section in a longer course. The new instructor is observed by a manager who uses a standard competency form which is kept in the instructor's record. There are also annual assessments by a training manager using a similar form, who also provides direct critique. Courses are audited for content and effectiveness by an AA audit team and by the FAA. For new courses (on new procedures or equipment for example) the lead instructors develop a train-the-trainer session for that unit and provide it to all the instructors.

Instructor Certification. There is no formal certification program for instructors beyond the certification requirement for mechanics. Providing skills training qualifies as hand-on experience, so instructors continue to be certified as mechanics. In the view of AA's training director, a certification process would not change things for the airline because their instructor training program is so rigorous.

AA Program Implications for Transit. FAA requirements for aviation mechanics schools and the curricula and experience required for mechanics certification mean that mechanics are trained for the industry at an extremely high level before being hired. As in transit, AA recruits its trainers from among skilled aircraft mechanics with a will to share information and a thoughtful approach to training. Their hands-on approach relies to some extent on training materials produced by their equipment manufacturers. At the same time, they create courses based on their internal experience of maintenance problems and suited to their facilities.

This model of skilled mechanics with instructor potential being carefully trained, mentored and monitored relies on standards and resources that may not be available to smaller transit agencies, as they are not for the smaller commuter airlines. Even with a core qualification process, however, smaller transit agencies are not likely to be able to develop or need full-time skilled trainers. Support from larger agencies or a consortium of regional training programs may be needed to apply the lessons of effective instructor recruitment and qualification demonstrated by AA.

Conclusion and Application of Best Practice Lessons

The examination of best practices provides much guidance that can be applied to developing a training and certification program plan for transit vehicle maintenance instructors.

Training Approach

The interactive and hands-on approach to mechanics training described in transit and other industries represents an important and effective teaching process, one that should serve as the cornerstone for any program that prepares and certifies instructors. The core approach included in all programs reviewed is to instill in instructors an ability to blend instructional delivery using a variety of techniques that ultimately must engage students to learn given that the audience is one where they are responsible for the hands-on maintenance and repair of transit equipment. A mechanics instructor training program should teach instructors to keep students actively engaged through a blended training approach where lecture is kept to a minimum and learn-by-doing methods are maximized through hands-on exercises, group discussions, computer simulations, and lab work.

Instructor Recruitment and Selection

An ideal candidate for the instructor training program has strong technical skills, a positive work ethic, good communication skills, and an active desire to pass on skills and knowledge to others. Given transit's limited resources, a national transit program would need to prioritize which essential attributes are best taught and which are best left as existing prerequisites. As suggested by several best practice examples, technical skills, work ethic and desire are best obtained as prerequisites, while post-hire training and preparation can focus primarily on developing communication and other soft skills.

Developing highly qualified technicians into instructors is a way to improve retention and avoid losing skilled employees when they are no longer capable or willing to meet the physical demands of being a technician.

Instructor Preparation and Evaluation

As in other industries, instruction of mechanics includes upgrading their skills for new equipment and refresher training, as well as providing basic mechanics skills and knowledge for apprentices. Instructors need to be trained and assessed in communicating basic content areas and in learning and transferring new information and skills.

Given transit's limited resources and the wide distribution of transit agencies, an efficient approach to providing instructor training should be examined. Options to consider include:

- An annual workshop series;
- Mentoring by senior instructors in-house and from other agencies;

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- Use of videotaping or webinars to observe instructor delivery and provide constructive feedback; and
- General skills courses offered by community colleges, NTI, EDSI, SCRTTC, and other training institutions.

Annual workshops established by NTI, the Transportation Learning Center, APTA, and others are potential venues for convening transit instructors, providing them with training and opportunities to network and learn from their peers. These workshops could provide a platform for achieving certification.

Instructor training materials could be catalogued and shared, using a courseware sharing process such as that developed by the Transportation Learning Center for technicians.

Effective trainer instruction is ongoing. CTA, King County Metro, SEPTA, and others describe a mentoring relationship where newly hired instructors work alongside seasoned instructors. Work from the Transportation Learning Center and others on mentoring could be applied to this process. The format and requirements for mentoring could be established through a national peer review committee, which would evaluate, provide feedback, and certify candidate instructors either in person or through videotaping.

Instructor Certification Program

Standards

Some individual transit agencies currently have a process to qualify instructors to their own standards. A national program would need to clearly establish the essential elements for mechanics instructors. In the transit technical training and in other best practices reviewed, the use of concrete content and skills standards is an essential program element. Training standards developed by APTA and the Transportation Learning Center for bus and rail technicians are essential to developing similar standards for instructor training and certification. Standards developed by ASE, SCRTTC, and others should also be referenced. APTA's *Discussion Draft for Instructor Development* and its *RP for Transit Vehicle Maintenance Instructor Training and Certification* are essential documents that would be extremely useful for crafting a system of instructor training and certification for transit. Documents published by ASE and others also serve as useful reference materials.

The training and certification programs established by other trades should be considered in the program plan with the understanding that transit may have fewer resources. Although APTREX does not offer a certification program for maintenance instructors, the tenets of their program has relevance to this project and should be considered.

Structure

Just as SCRTTC establishes training courses at levels (basic, general, advanced and specialty), and the Transportation Learning Center develops training standards at various levels (100, 200, etc.) consideration will be given in the program plan to establishing instructor training and certification at various levels. Levels could be based on various technical subject areas (i.e., brakes, engines, etc.), training levels (classroom, hands-on, online, etc.), instructional design, curriculum development, and other training classifications. Doing so would also allow a development track for instructors and training professionals with various interests and skills.

While some industries certify the entire training program of which the instructor is one part, others specifically certify individual instructors. Regardless of how the certification process is established, the program plan needs to consider instructor certification as an integral part of a future effort to certify the entire training program as is the case with SCRTTC, the auto industry,

certain trades, and other industries. Legal and other implications associated with any certification process will need to be examined as part of the program plan.

Process

As demonstrated by the Transportation Learning Center and others, an instructor training and certification process benefits from joint SME involvement where technicians provide feedback as to which training techniques work best for them. Too often instructors who once worked as technicians are now removed from the new technology, the day-to-day work, and other changes that have taken place. The technicians being trained can provide important insight into both the effectiveness of the instructors and the content of the instruction. The Center's work on establishing labor–management partnerships would be useful.

Any partnership established as a result of this project should be made with an organization that has direct and extensive experience preparing and certifying instructors that teach students who work in technical trades. Although an organization may have extensive instructor training credentials in academic fields, the need to have those credentials specifically directed at providing effective instruction to frontline personnel who work with their hands cannot be overstated.

CHAPTER 4

Training and Certification Program Plan

Program Overview

The program plan developed through this project provides a roadmap that a future AO can use to establish a national structure for training and certifying transit vehicle maintenance instructors. Understanding that a strong training program makes a difference for both participants and their agencies, there is sufficient detail provided in this chapter to structure a comprehensive national program while at the same time giving the AO flexibility to finalize the program as it deems appropriate.

The main body of the National Vehicle Maintenance Instructor Training and Certification Program, also referred to in this report as the program or the national program, is composed of:

- Suggested recruitment qualifications for entering the program
- Core competencies and courses
- Course design and delivery methods
- Methods for validating attainment
- Course substitution guidelines
- Certification
- Time to completion and recertification

The program is designed as a national one where instructor candidates are guided by training and certification procedures established by the AO, and where the role of the agencies themselves is limited to selecting candidates and supporting them through the training and certification process.

Suggested Recruitment Qualifications for Entering the Transit Vehicle Maintenance Instructor National Program

Instead of establishing formal prerequisites that candidates must have before being allowed to enter the program, the program plan offers a set of suggested qualifications that agencies can use to determine which instructor candidates are best suited to enter the program and achieve certification. These suggested qualifications are based on the Transit Agency Best Practices from the Task 2 research presented in Chapter 3 and are illustrated in APTA's recommendations for instructor selection criteria. While this program makes recommendations for the knowledge, skills, and abilities that candidates should have, each agency should establish their own guidelines and evaluation procedures for vehicle maintenance instructor selection based on the suggestions presented in this model.

The vehicle maintenance instructor suggested qualifications for entering the Transit Vehicle Maintenance Instructor National Program as shown in Figure 4.1 include technical skills, basic computer skills, presentation skills, writing skills, "people" skills, and personal competencies.

Suggested Qualifications for Entering the Transit Vehicle Maintenance Instructor National Program		
Technical Skills	Presentation Skills	Writing Skills
Basic Computer Skills	"People" Skills	Personal Competencies

Figure 4.1. Suggested qualifications for entering transit vehicle maintenance instructor national program.

The first mentioned, transit vehicle maintenance technical skills, encompasses the technical skills and abilities acquired through years of experience as a vehicle maintenance technician with perhaps additional proven expertise in specific systems or technical certifications. As described in Chapter 3, Best Practices, instructors who do not have a strong background in transit mechanical experience are generally not perceived as credible instructors. Most organizations researched for this project require their instructors to have ample technical experience in the field they will be teaching in. Therefore, individuals who move out of the field and into the classroom to become instructors should have ample technical knowledge and skills in their content area.

Knowledge gained through years of experience and certifications can be beneficial in the classroom in providing detailed, comprehensive instruction as well as for hands-on teaching in labs and on-the-job learning settings. Knowledge of safety and related practices, such as first aid and proper use of tools, is also recommended for maintenance technicians who intend to become instructors. Safety is a critical element of the job, and instructors must have thorough knowledge of related practices within their technical field.

Writing and presentation skills are both basic communication skills and essential for instructors. While these skills will be enhanced through program courses and their respective elements, some basic proficiency is recommended prior to entering the program to help ensure program and job success. In the case of vehicle maintenance instruction, a basic ability to write for business and technical purposes is recommended. In many agencies, instructors are required to write updates for technical bulletins, SOPs, and new product evaluations. Likewise, oral communication will be a basic skill required for completion of the certification program. Thus, having some ability and enthusiasm to articulate and share knowledge through oral communication and presentation with others as well as observed leadership aptitude is recommended for program entrance.

Computers are often used in most jobs today and are certainly used in the field of instruction. Computers are used in bus and rail diagnostics, programming various vehicle systems, and for database applications. They also serve as a medium for communication of various forms such as email, and provide an additional avenue for learning and instructional purposes. As a result of these applications, another element of suggested prerequisite skills recommends basic computer skills and computer literacy for vehicle maintenance technicians who will enter the ICP as these are also skills required for both the program and job success.

Recommended transit vehicle maintenance technician attributes also include personal attributes and "people" skills. These soft skills routinely show as desired skills for instructors as indicated by the best practices research, and which APTA also recommends as instructor selection criteria. People skills refer to those skills that involve how a potential vehicle maintenance instructor

relates with other people. For instance, people skills may describe how someone works with diverse individuals, measures their listening skills, or indicates their ability to work as part of a team as well as their ability to learn from others. Personal competencies refers to basic foundational employment skills such as being accountable, timely, displaying a positive attitude, being goal oriented, and demonstrating a high level of trustworthiness, integrity, and ethics. In addition, embracing learning and the ability to use that for leadership and organizational development are desired personal attributes as was indicated by the research.

Table 4.1 summarizes suggested qualifications and provides methods for evaluating those qualifications. The set of recommendations and guidelines provided here are intended for both agencies who are selecting vehicle maintenance technicians to become instructors as well as for those maintenance technicians who aspire to become instructors.

Table 4.1. Suggested qualifications for entering the transit vehicle maintenance instructor national program.

Suggested Qualifications Topics	Suggested Qualifications	Suggested Methods for Qualification Evaluation
Transit Vehicle Maintenance Technical Skills	• As determined based on area of expertise; may include years of experience as a technician, expertise in specific systems, and/or completion of certification or qualification programs • Knowledge of on-the-job safety • Knowledge of general safety and first aid	• Technical certifications such as ASE Certification for bus and the National Rail Vehicle Technician Qualification Program • Professional affiliations and participation • Years of experience • Demonstration of skill level through on-the-job observation and performance evaluations
Basic Computer Skills	• Basic familiarity with applications such as Office Suite (Word/PowerPoint/Excel), Email/Internet, databases, and bus diagnostics	• Written test • Demonstration of skill
Writing Skills	• Business and technical	• Written test or provided example • Recommendations
Presentation Skills	• Articulates thoughts and ideas to others • Demonstrates leadership ability	• Interview • On-the-job observation • Recommendations
"People" Skills	• Comfortable working with diverse personalities, race, gender, age, etc. • Connects with people on a personal level • Respectful of others • Listening skills (including hearing what the student needs, not just teaching what you think they need) • Seeks conflict resolution • Team player • Coachable (ability to learn from others)	• Interview • On-the-job observation • Performance evaluations • Recommendations
Personal Competencies	• Trustworthiness/integrity/ethics • Passion and desire to be a trainer • Leads change to help the organization • Facilitates/embraces learning • Accountability/quality-consciousness • Flexible • Resilient, patient • Positive/optimistic outlook • Creative • Problem solver • Conscious of schedules / timely • Multitasks • Goal oriented • Practical/realistic	• Interview • On-the-job observation • Performance evaluations • Recommendations

Evaluation of Suggested Entrance Qualifications

Evaluation of suggested program entrance qualifications, as indicated in Table 4.1, will vary according to what is being evaluated as well as with agency resources and structures in carrying out the evaluations. In some cases, a written test may be used to determine a certain skill in a potential instructor candidate. Other times, the best measurement tool for another type of skill may be an interview or work place observation. Best practices, as described in Chapter 3, illustrate methods used by various agencies for skill and aptitude measurement for their potential instructors. Those best practices for evaluating potential instructors are summarized and explained here for individual agencies to utilize, in conjunction with the earlier described suggested qualifications, in developing an evaluation method for their present and future instructors who may enter the national certification program.

As illustrated in earlier tasks, first and foremost a potential instructor should have ample technical knowledge and experience prior to becoming an instructor and entering a national technical ICP. For example, after years of experience, the auto industry found, "It's easier to teach someone with a strong technical background to become an effective instructor than it is to teach technical skills to someone with a background in education." In the case of a vehicle maintenance instructor, this technical knowledge may be developed and measured through certifications such as ASE certifications for bus or the Rail Car Technician Qualification program for rail. Other ways to measure this skill area may be to review employer performance evaluations, through on-the-job observations, and by interviewing technicians. Because this is a vital skill set for a vehicle maintenance instructor and only obtainable through hands-on experiences and professional certification programs, it is recommended that a combination of measurement tools be utilized in evaluating potential instructors' technical abilities.

Computer or writing skills may be straightforward in terms of evaluation and obtainable through a form of testing. In most cases and as determined in Chapter 3 many transit and other similar organizations have an established program for measuring these skills in potential instructors. For example, in the case of evaluation for technical skills, an agency may evaluate the years of experience and technical certifications, such as ASE. At SEPTA for example, mechanical and technical mastery is measured by taking an in-house competency test prior to becoming an instructor. A transit agency may provide a basic computer literacy exam and/or evaluate a writing sample. Some transit agencies, such as King County Metro, require potential instructors to write a technical presentation as part of the selection process.

Measurement of attributes and "softer skills" may provide more of a challenge. Nonetheless, best practice agencies as presented in Chapter 3 indicated several effective approaches for obtaining this candidate data. For personal attributes, some agencies such as King County Metro conduct an interview as part of the selection process to gauge potential instructor competencies including soft skills. Other suggestions for measurement of these softer skills include consideration of letters of recommendation or examination of employee evaluations that contain data regarding personal attributes throughout their employment history.

While evaluation methods for selecting vehicle maintenance technician instructors exist at individual organizations, standardized methods for measurement for transit instructor selection qualifications do not. The oversight panel for this project thought it best to leave such assessments to each agency. However, the best practices described in Chapter 3 contain methods for evaluating qualifications for potential vehicle maintenance instructors and are summarized in Table 4.1. Each agency can use this guidance to determine eligibility for instructors wanting to enter the certification program.

In some cases where maintenance technicians may present some but not all of the recommended prerequisite skills for entering the national transit maintenance ICP, avenues should be considered for assisting the potential program candidate with supplemental instruction to help bridge those individual skill gaps. An individual's skill gap may be determined through in-house

evaluation procedures or may be decided upon by a transit vehicle maintenance technician. In either case, maintenance technicians who may not meet all of the foundational competencies or require foundational competency assistance prior to entering the vehicle maintenance ICP may consider courses through NTI, ASE or local community colleges to gain the additional prerequisite recommended foundation skills. In some agencies, such as MARTA, this skill enhancement is offered through in-house courses.

Once an agency determines eligibility by following the guidance offered here, all other aspects of the program will be handled in a uniform manner by the AO.

Transit Vehicle Maintenance Instructor National Core Competencies and Courses

Overview

The vehicle maintenance instructor core competencies are comprised of proficiencies with related learning objectives to be met through a series of courses delivered as part of a national program to achieve instructor certification. The following section provides descriptions of each core competency and related course, learning objectives that need to be achieved in each course, and expected outcomes for participants completing competency requirements to achieve national transit vehicle maintenance instructor certification.

As shown in Figure 4.2, the competency areas and courses needed to achieve instructor certification are thematically grouped into three areas: training delivery, instructional design, and

*A separate Mentoring and Coaching certification is also available for completion of this course.

Figure 4.2. Transit vehicle maintenance instructor competency model.

program design. In addition to the full certificate offered for instructors, a separate mentoring and coaching certificate is also available within the program to technicians who want to take a course to improve their mentoring skills and possibly go on to become an instructor by completing the remainder of the program.

Training Delivery Competencies and Courses

Training delivery competencies address the basic foundation by which instructors successfully facilitate, guide and deliver instruction both in the classroom and in the field. These are typically the competencies that new instructors need support and direction in mastering. Training delivery competencies and courses include Mentoring and Coaching; Communication: Oral and Written; Delivering Instruction: Classroom and Hands-on; and Adult Learning.

Mentoring and Coaching

Historically, the idea of a mentor originated in Homer's epic poem *The Odyssey* where Odysseus, King of Ithaca, entrusted the care of his son to a mentor. A mentor in the workplace today serves a similar role: an individual with more experience who helps guide and develop another individual's knowledge and growth in a job. Mentors often provide the basic hands-on instruction and on-the-job training to novice technicians, and their role is critical for fostering this important element of learning.

A course on mentoring and coaching is not only essential to instructors, but also to the approximately 3,300 vehicle maintenance mentors from a total of 52,929 vehicle maintenance employees who would be interested in passing their wealth of experience and skills on to others in a more effective way. As suggested by the best practices research, mentors who receive instruction and training support tend to be more effective. With this in mind, a stand-alone Mentoring Certificate is offered within the program, which could then be used to obtain a full instructor certificate for those technicians seeking a career pathway. Given the high numbers of technicians in transit, there could be a high need and demand for this course, which will not only increase program participation but will serve to introduce technicians to a new and logical career as an instructor.

Mentoring and Coaching is a unique competency that not only applies to vehicle maintenance instructors, but also to the many technicians working on the shop who continually provide valuable learning experiences every day to fellow technicians in need of assistance. In addition to providing a course on Mentoring and Coaching for instructors, the course will also be available to technicians as a separate certificate for those interested in becoming more effective at passing on their wealth of experience and knowledge before they retire. For technicians interested in becoming instructors as a career move, receiving a Mentoring and Coaching certificate becomes the first step in achieving full instructor certification. Having qualified mentors is especially critical for transit agencies seeking to maximize their training capacity where mentors can supplement formal classroom instruction with on-the-job learning as a coordinated training effort.

Upon completion of Mentoring and Coaching, participants will be able to use key questioning and narrating skills to facilitate on-the-job learning, demonstrate job safety requirements to others, use various forms of documentation to aid in job task explanations, and track mentor progress. Assessment for Mentoring and Coaching should include a Level Two evaluation, measuring learning gain. Such an evaluation would include a written assessment as well as performance demonstrations of maintenance tasks and related safety measures that reflect the stated learning objectives. The recommended course hours for Mentoring and Coaching are eight.

Learning objectives for Mentoring and Coaching include:

- Demonstrate, narrate and clearly explain the purpose of each maintenance task as it is performed.
- Reinforce important safety considerations for performance of each task.
- Utilize agency SOPs, methods and schedules through mentoring.
- Observe and assess trainee's hands-on performance.
- Use manuals during training and encourage trainee's use of manufacturer documentation, SOPs or other material.
- Develop key instructional questions to facilitate learning through a demonstration (e.g., What should you do next? Why is that next? What does that do? Why is that the right tool?).
- Track time spent with trainee, tasks performed, and skill progress.
- Identify basic interactive and directive counseling and coaching techniques.

Communication: Oral and Written

Communication is a basic yet essential requirement and competency for a transit vehicle maintenance instructor. Communication can be defined as a meaningful exchange between individuals for the purpose of sharing ideas and knowledge. As a leader in the classroom and in the field, learning can only be most effective when an instructor can clearly communicate with participants both orally and in written form, and through effective hands-on and on-the-job demonstrations. In addition, instructors are often expected to communicate beyond the training environment for a variety of organizational purposes.

Thus, upon completion of the course for Communication: Oral and Written, participants will have met competency for knowledge of various types of communication and mediums for various purposes including:

- Classroom, hands-on, and on-the-job training (OJT) communication strategies including methods for active listening, conflict, communication challenges, and basic coaching techniques.
- Communication practices to encourage a motivational learning environment.
- Effective feedback strategies.
- Writing skills for general transit organizational purposes.

Assessment for Communication: Oral and Written should include a Level Two evaluation containing a written assessment as well as an oral demonstration of acquired skills and knowledge that reflect stated learning objectives. The recommended course hours are four to eight.

Learning objectives for Communication: Oral and Written include:

- Identify types of communication: intrapersonal, interpersonal, small group, organizational, public, and mass communication.
- Identify effective mediums for execution of various types of communication.
- Identify communication strategies for diverse learners.
- Describe and apply active listening skills.
- Develop and apply conflict resolution strategies.
- Identify methods for dealing with communication challenges.
- Identify communication and learning activities that can influence a motivational learning environment.
- Identify effective strategies for providing effective feedback.
- Identify and apply writing skills: technical and business.

Delivering Instruction: Classroom and Hands-on

Delivering instruction can occur in a variety of ways and should always be primarily focused on participant involvement and expected outcomes. For transit maintenance applications,

instruction is usually delivered through classroom activities and through various interactive and hands-on demonstrations. Activities that a transit maintenance instructor should be familiar with and utilize include instructor-led activities, shared instructor-participant-led activities, and participant-led activities. Typical activities consist of a limited amount of lecture and presentations (live or pre-recorded) supplemented by a great deal of events that engage students such as group discussions, case studies, interactive exercises, mock-up and equipment demonstrations, computer simulations, lab exercises, and games to name a few.

Hands-on activities could be integrated into the classroom, held in dedicated labs, or conducted as shop-floor exercises. Additional areas of focus for this course include cooperative and collaborative learning, techniques for creating effective classroom environments, and best practices for demonstrations and hands-on learning. Delivering Instruction: Classroom and Hands-on should include a Level Two evaluation containing a written assessment as well as the delivery of an instructional presentation demonstrating acquired skills and knowledge reflective of all stated learning objectives. The recommended course hours are eight.

Learning objectives for Delivering Instruction: Classroom and Hands-on include:

- Effectively deliver lesson plans.
- Identify at least three areas that make a good presentation.
- Identify the do's and don'ts of presentations.
- Structure a presentation to effectively deliver information.
- Improve presentation skills and audience communication.
- Describe and demonstrate how to maintain audience interest during a presentation.
- Implement effective and dynamic question techniques during presentation of material.
- Structure presentations for participant centered and driven learning.
- Assess effectiveness of learning activities, integrate student feedback.
- Apply strategies for cooperative and collaborative learning and instruction.
- Describe techniques for creating an effective classroom environment with consideration for variables such as classroom size, audience and instructional goals.
- Identify best practice methods for labs, use of mock-ups, and hand-on learning.
- Integrate live demonstrations or simulations and opportunities for hands-on learning throughout the courses.

Adult Learning

Andragogy, or adult learning, is the processes and means by which adults learn in the context of adult needs, experiences and pre-existing knowledge. Since the participants of a vehicle maintenance training program are adults, an instructor in this adult learning environment should have knowledge of adult learning theories and psychology as well as how these theories relate to practical classroom application.

Specific areas of adult learning addressed in this competency include basic educational psychology and adult learning theories, a comparison of pedagogy to andragogy, barriers for adult learners in the maintenance classroom, and legal aspects of training. Adult Learning should include a Level Two evaluation containing a written assessment as well as a demonstration of acquired skills and knowledge reflective of all stated learning objectives. Recommended course hours are eight.

Learning objectives covered include:

- Identify the basic principles behind educational psychology.
- Identify learning theories and methods important in adult education.
- Discuss Malcolm Knowles and his theory of self-directed learning.

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- Discuss Howard Gardner and his Multiple Intelligences Theory.
- Define the eight intelligences in the theory.
- Implement the Multiple Intelligence Theory into lessons using the MI (multiple intelligence) planning sheet.
- Explain Edward Thorndike's Laws of Learning and their practical application.
- Identify techniques to engage and motivate adult learners/maintenance technicians.
- Review and compare the theories of pedagogy and andragogy as they apply to adult learners and specifically hands-on maintenance technicians.
- Identify barriers unique to adult learners/maintenance technicians.
- Understand legal aspects of training.

Instructional Design Competencies and Courses

Instructional design competencies are those competencies that provide the backbone for instructional development. Lesson planning, assessment, material development, and instructional technology are all designed and developed through instructional design. Competencies reflective of instructional design for the transit vehicle maintenance ICP and related course descriptions are explained below.

Lesson Plan Design

A basic format and structure for instruction is the lesson plan. A lesson plan is a guide for an instructor which divides classroom and OJT experiences into a predictable pattern of dynamic events that promote and engage participant learning. While lesson plans may vary somewhat in design, most often they include basic components such as an opening to the lesson, a direction for the lesson, an element of recall, the lesson content, various levels of application and feedback, and conclude with an assessment and summary of the lesson. An instructor must be knowledgeable of both the format and in how to develop, follow, utilize, reflect, and build upon this key component of vehicle maintenance instruction.

In addition to the basic lesson plan, an instructor must also be able to differentiate instruction for various learners and needs in the learning environment. Having both the knowledge of and methods for addressing the needs of a diverse audience is a critical component of lesson plan design.

In the Lesson Plan Design course, participants will identify key theories as related to lesson planning, explore learning objectives and their parts, and identify and describe various learning models and instructional methods. Lesson Plan Design should include a Level Two evaluation containing a written assessment as well as a completed lesson plan demonstrating acquisition of skills and knowledge reflective of all stated learning objectives. The recommended number of course hours is eight.

Learning objectives for Lesson Plan Design include:

- Identify Gagne and describe the nine components of instruction (master sheet and lesson plan matrix).
- Identify and write goals and behavioral objectives for a lesson.
- Identify goals for a lesson plan.
- Identify parts of a learning objective.
- Describe Bloom's taxonomy in the context of lesson planning.
- Determine behavioral objectives.
- Write behavioral objectives for a lesson plan.
- Define differentiated instruction and benefits.

- Identify considerations for teaching diverse groups of learners.
- Identify ways to create a learning environment accommodating differentiated instruction.
- Identify techniques that work best with each type of learner.
- Describe various learning models and instructional methods.
- Identify and use resources/methods taught in previous lessons to select methods and plan a lesson.
- Identify five different ways maintenance technicians learn.

Assessment and Process Analysis

Assessment is defined as an evaluation or judgment about an activity based on an understanding of a given situation. In classroom and OJT settings, assessment is an extension of the communication taking place between instructors and participants. For example, an instructor may assess a participant's knowledge using questions. The participant's response will help the instructor determine how the participant is learning and should help guide further instruction. This idea can also be applied to peer-to-peer learning both in the classroom and in the field.

Assessment is also a means of learning measurement for both the instructor and participant. For instructors, developing, engaging, and using assessment for instructional decisions is a critical component of teaching. Likewise, facilitating classroom and OJT settings where self and peer-assessment can take place is also critical for adult learning and especially for instructor training purposes. Assessment should occur in both oral and written form, as well as through hands-on performance demonstrations prior to, during, and after instruction. Assessment and Process Analysis should include a Level Two evaluation containing a written assessment as well as performance demonstrations reflecting acquired skills and knowledge as related to all stated learning objectives. The recommended course hours are four to eight.

Upon completion of Assessment and Process Analysis, participants will be able to develop and use appropriate and effective assessment methods, use assessment to enhance instruction, and employ comprehensive reflective learning and self-assessment practices.

Learning objectives for Assessment and Process Analysis include:

- Identify and use appropriate and effective assessment methods.
- Identify best practices for questioning: oral and written.
- Describe and apply active listening and reflective questioning techniques for real-time assessment purposes.
- Develop a written assessment.
- Develop a hands-on assessment.
- Utilize written and hands-on assessments to enhance and adjust instruction.
- Identify comprehensive reflective learning and self-assessment reflective practices for learning purposes.

Instructional Material Development

Instructional material refers to resources used in the classroom to support, extend, execute, assess or enhance instruction. In many cases, instructors are faced with acquiring and developing some if not all of the instructional materials needed for their classroom and participant needs. Instructional material typically includes projected media, assessments, SOPs, OEM manuals, and professional articles.

Instructional Material Development offers vehicle maintenance instructors the opportunity to learn methods and tools needed to develop effective instructional material to fit their classroom needs. Upon completion of this course, participants will be able to explain how to create

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better presentations using instructional material; use supplemental material to assist in meeting organizational needs; construct a participant training aid for their learners; and integrate safety aspects into their material development. Understanding that good instructional material may have been developed by others, the course will also include methods for locating and incorporating those materials. Instructional Material Development should include a Level Two evaluation containing a written assessment as well as a demonstration using developed and selected instructional material illustrating acquired skills and knowledge reflective of all stated learning objectives. Recommended course hours are eight.

Learning objectives for Instructional Material Development include:

- Account for safety principles in developing all material.
- Describe how projected media can enhance or detract from a presentation.
- Integrate balance, clarity, and simplicity while creating presentations.
- Develop, locate, and use effective training aides (transit-specific material).
- Identify supplemental material (from news, industry, OEMs, etc.).
- Use OEM training material to develop unique presentations based on actual problems faced at local agency (include local deviations from manufacturer norms and recommendations).

Instructional Technology

Technology for instructional purposes can be beneficial in the classroom and for OJT in many ways and encompasses a variety of equipment and methods. Instructional technology may include delivery tools and methods such as videos, software tools, OEM software, computer-based learning, PowerPoint presentations, social media posting boards, etc. Instructional technology may also refer to technology employed by an organization for the purpose of learning management. Instructors at the advanced level should have an understanding and know how to most effectively use instructional technology for the appropriate purposes.

Participants completing Instructional Technology should be able to develop effective multimedia lessons for appropriate and intended purposes, understand methods and tools for computer-based learning, be knowledgeable in technology for learning management purposes, and be able to stay up-to-date on technology beyond the purposes of the required immediate course. Instructional Technology should include a Level Two evaluation containing a written assessment as well as a demonstration of instructional technology used for learning purposes to show acquired skills and knowledge reflective of all stated learning objectives. Recommended course hours are eight.

Learning objectives for Instructional Technology include:

- Develop a multi-media lesson using various instructional technologies.
- Identify various software to support and enhance training.
- Identify applications for video demonstrations and simulations.
- Integrate various OEM software into training demonstrations.
- Describe computer-based learning and methods for instructional purposes.
- Identify computer-based training tools and software.
- Identify methods for online social learning and professional networking.
- Identify instructional technology tools for learning management.
- Identify methods for remaining up-to-date on instructional technology.

Program Design Competencies and Course

Accomplished instructors often face instructionally related tasks beyond the immediate training environment setting. In addition, accomplished instructors may have the opportunity to

become learning managers or serve as learning leaders in their agencies. Thus, the last phase of courses relates not only to advanced instructional practices related to the classroom and OJT environment, but also addresses competencies related to the larger field of instruction and related program development which a nationally certified vehicle maintenance instructor should know. These competencies include Curriculum Development: Standards-Based Training, Program Management and Evaluation, and Curriculum Development.

Standards-Based Training

A recommended prerequisite for transit vehicle maintenance instructors is to be technically qualified in their field. In other words, they ideally should have knowledge and experience as technicians prior to teaching these skills.

Thus, the competency Standards-Based Training is not intended to teach transit vehicle maintenance skills but to instead teach how to identify standards and certifications for vehicle maintenance and incorporate those standards into their instructional practices. As standards and/or technologies change, instructors must also know how to stay-up-to-date with the latest developments. Consequently, methods for managing those changes in instructional practices are also addressed in this competency and related course.

Upon completion of Standards-Based Training, the participant should be able to identify and implement national training standards and certifications into instructional practices, be able to remain up-to-date on standards and technology for instructional purposes, and have a working knowledge of the general organizational structure of the vehicle maintenance organization for workplace development purposes. Standards-Based Training should include a Level Two evaluation containing a written assessment as well as a developed lesson plan integrating industry standards as a demonstration of acquired skills and knowledge all reflective of stated learning objectives. The recommended course hours are eight to 16.

Learning objectives for Standards-Based Training include:

- Identify national training standards and certification/qualification systems for transit bus and rail vehicle maintenance.
- Implement standards and certification systems into instructional practices.
- Identify methods to keep up-to-date on new technologies and updates to standards.
- Describe the general human resource structure and organization of the bus and rail transit systems.

Program Management and Evaluation

As established in a needs analysis, the needs of an organization are determined and, when appropriate, targeted instruction is subsequently planned and delivered in an effort to help meet those needs. Understanding whether or not a learning program is working and meeting organizational needs is important for successful instruction. Thus, instructors at this level should be able to complete an assessment at the classroom and program level using Kirkpatrick's four level evaluation model. From there, instructors should be able to use knowledge gained through course and program evaluations to manage various aspects and methods for workplace learning.

In Program Management and Evaluation, participants should learn how to construct effective assessments for the purpose of program evaluation; develop a program evaluation based on the Kirkpatrick model; understand "Return on Investment" and its challenges; and be able to use evaluation for learning management. Program Management and Evaluation should include a Level Two evaluation containing a written assessment as well as a developed program evaluation

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plan for a demonstration of acquired skills and knowledge reflective of all stated learning objectives. Recommended course hours are four to eight.

Learning objectives for Program Management and Evaluation include:

- Develop effective pre- and post-course assessments based on course objectives.
- Develop a program evaluation using the Kirkpatrick evaluation model and training return on investment (ROI) analysis.
- Describe the benefits and challenges of ROI analysis.
- Identify methods for learning management.
- Use program evaluation for learning management purposes.

Curriculum Development

Curriculum generally refers to a series of courses with related learning objectives and resources that help an instructor and learner achieve specific instructional goals. Often instructors, and especially instructors at advanced levels, are required to participate in curriculum development. As facilitators of workplace learning and development, experienced instructors are often seen as the go to resource for organizational knowledge. Thus, knowledge of workplace organization will be beneficial in identifying workplace organization knowledge needs.

Upon completion of this course and based on instructional design (ISD) principles, the Curriculum Development: Transit Maintenance Instruction course provides participants with basic principles, methods, and tools for vehicle maintenance instructors to assess course needs; plan for related instructional goals, strategies and methods; integrate national standards; and identify methods for organizational learning management. Curriculum Development: Transit Maintenance Instruction should include a Level Two evaluation containing a written assessment as well as a developed curriculum plan presenting acquired skills and knowledge reflective of all stated learning objectives. Recommended course hours are eight.

Learning objectives for Curriculum Development: Transit Maintenance Instruction include:

- Use ISD principles (e.g. Bloom Hierarchy, DLK, ADDIE Model) and practices when planning lessons and curriculum.
- Perform a skill gap/training needs analysis.
- Use a needs analysis to develop training program.
- Describe Bloom's taxonomy in the context of curriculum development.
- Define the instructional strategies and appropriate uses of each strategy.
- Select instructional methods that best suit the material and audience.
- Utilize the instructional model of method selection.
- Develop the ability to select new methods by using the instructional strategies/methods selection tool.
- Develop curriculum and training materials based on national standards.
- Identify methods for system-based learning management.

Table 4.2 summarizes the learning objectives for each core competency, thereby allowing the AO to develop targeted program courses that address these objectives. When evaluating and approving alternative courses, the learning objectives identified here can also be used for that AO function.

Table 4.3 summarizes the suggested hours for each program course to help guide the Administrating Organization in structuring the program.

Table 4.2. Transit vehicle maintenance instructor national core competencies and courses.

Core Competencies	Learning Objectives
	Training Delivery
Mentoring and Coaching	• Demonstrate, narrate and clearly explain the purpose of each maintenance task as it is performed • Reinforce important safety considerations for performance of each task • Utilize agency SOPs, methods, and schedules through mentoring • Observe and assess trainee's hands-on performance • Use manual during training and encourage trainee's use of manufacturer documentation, SOP's or other material • Develop key instructional questions to facilitate learning through a demonstration (e.g., What should you do next? Why is that next? What does that do? Why is that the right tool?) • Track time spent with trainee, tasks performed, and skill progress • Identify basic interactive and directive counseling and coaching techniques
Communication	• Identify types of communication: intrapersonal, interpersonal, small group, organizational, public, and mass communication o Identify effective mediums for execution of various types of communication • Identify communication strategies for diverse learners o Describe and apply active listening skills o Develop and apply conflict resolution strategies o Identify methods for dealing with communication challenges • Identify communication and learning activities that can influence a motivational learning environment • Identify effective strategies for providing effective feedback • Identify and apply writing skills: technical and business • Identify effective mediums for various types of communication
Delivering Instruction: Classroom and Hands-On	• Effectively deliver lesson plans o Identify at least three areas that make a good presentation o Identify the do's and don'ts of presentations o Structure a presentation to effectively deliver information o Improve presentation skills and audience communication ▪ Describe and demonstrate how to maintain audience interest during a presentation ▪ Implement effective and dynamic question techniques during presentation of material ▪ Structure presentations for participant centered and driven learning o Assess effectiveness of learning activities, integrate student feedback • Apply strategies for cooperative and collaborative learning and instruction • Describe techniques for creating an effective classroom environment with consideration for variables such as classroom size, audience and instructional goals • Identify best practice methods for engaging students through hands-on and other interactive learning • Integrate live demonstrations, simulations and other opportunities that engage students throughout the learning process
Adult Learning	• Identify the basic principles behind educational psychology • Identify learning theories and methods important in adult education o Discuss Malcolm Knowles and his theory of self-directed learning o Discuss Howard Gardner and his MI theory o Define the eight intelligences in the theory o Implement the MI theory into lessons using the MI planning sheet o Explain Edward Thorndike's Laws of Learning and their practical application o Identify techniques to engage and motivate adult learners/maintenance technicians • Review and compare the theories of pedagogy and andragogy as they apply to adult learners, and specifically hands-on maintenance technicians o Identify barriers unique to adult learners/maintenance technicians • Understand legal aspects of training

(continued on next page)

Table 4.2. (Continued).

Core Competencies	Learning Objectives
	Instructional Design

Lesson Plan Design	• Identify Gagne's Nine Events of Instruction
	• Identify and write goals and behavioral objectives for a lesson
	  o Identify goals for a lesson plan
	  o Identify parts of a learning objective
	  o Describe Bloom's taxonomy in the context of lesson plan design
	  o Determine behavioral objectives
	  o Write behavioral objectives for a lesson plan
	• Define differentiated instruction and benefits
	  o Identify considerations for teaching diverse groups of learners
	  o Identify ways to create a learning environment accommodating differentiated instruction
	  o Identify techniques that work best with each type of learner
	• Describe various learning models and instructional methods
	• Identify and use resources/methods taught in previous lessons to select methods and plan lesson
	• Identify five different ways maintenance technicians learn

Assessment and Process Analysis	• Identify appropriate and effective assessment methods
	  o Identify best practices for questioning: oral and written
	  o Describe and apply active listening and reflective questioning techniques for real-time assessment purposes
	  o Develop a written assessment
	• Utilize assessment to enhance and adjust instruction
	• Identify comprehensive reflective learning and self-assessment reflective practices for learning purposes

Instructional Material Development	• Account for safety principles in developing all material • Describe how projected media can enhance or detract from a presentation • Integrate balance, clarity, and simplicity while creating presentations and OJT activities • Develop and use effective training aides (transit-specific material) • Identify supplemental material (from news, industry, OEMs, etc.) • Use OEM training material to develop unique presentations based on actual problems faced at local agency (include local deviations from manufacturer norms and recommendations)

Instructional Technology	• Develop a multi-media lesson using various instructional technologies
	  o Identify various software to support and enhance training
	  o Identify applications for video demonstrations and simulations
	• Integrate various OEM software into training demonstrations
	• Describe computer-based learning and methods for instructional purposes
	  o Identify computer-based training tools and software
	  o Identify methods for online social learning and professional networking
	• Identify instructional technology tools for learning management
	• Identify methods for remaining up-to-date on instructional technology

	Program Design
Standards-Based Training	• Describe components of standard-based effective training—local and national training, certification/qualification and apprenticeship systems for transit bus and rail vehicle maintenance occupations • Integrate national training standards into local training programs • Identify methods to keep up-to-date on new technologies and updates to standards • Describe the general human resource structure and organization of the bus and rail transit systems
Program Management and Evaluation	• Develop effective pre- and post-course assessments based on course objectives • Develop a program evaluation using the Kirkpatrick evaluation model and training ROI analysis • Describe the benefits and challenges of ROI analysis • Identify methods for learning management • Use program evaluation for learning management purposes

Table 4.2. (Continued).

Core Competencies	Learning Objectives
Curriculum Development	• Use ISD principles (e.g., Bloom Hierarchy, DLK, ADDIE Model) and practices when planning lessons and curriculum o Perform a skill gap/training needs analysis o Use a needs analysis to develop training program o Describe Bloom's taxonomy in the context of curriculum development o Define the Instructional Strategies and appropriate uses of each strategy • Select Instructional Methods that best suit the material and audience o Utilize the instructional model of method selection o Develop the ability to select new methods by using the Instructional Strategies/Methods selection tool • Develop curriculum and training materials based on national standards • Identify tools for system-based learning management

Table 4.3. Transit vehicle maintenance instructor national core competencies and courses suggested hours.

Courses	Hours
Mentoring and Coaching	4 – 8
Communication: Oral and Written	4 – 8
Delivering Instruction: Classroom & Hands-On	8
Adult Learning	8
Lesson Plan Design	8
Assessment and Process Analysis	4 – 8
Instructional Material Development	8
Instructional Technology	8
Standard-Based Training	8 – 16
Program Management & Evaluation	4 – 8
Curriculum Development	8
Capstone - Putting it all Together	8 – 16

Course Design, Delivery Methods, Time Limits and Recertification

Course Design

While the courses are thematically grouped, the Project Team is recommending that participants should have the flexibility to take these courses by the groupings as indicated or à la carte in the order of their choice or need for certain skill development. For the Mentoring and Coaching certificate, the process is straightforward in that there is only one course to take. A candidate pursuing full certification, however, should be given the option to start with Training Delivery courses if those courses fulfill a pressing need for improvement. For another instructor with a more immediate need to better understand standards in instruction, he/she would be better served beginning with Standards-Based Training. Therefore, the model needs to be flexible to accommodate specific instructor needs with the understanding that all course requirements must be satisfied before a certificate is issued.

The intended target audience for each course shall have met the suggested prerequisite KSAs described earlier as determined by their individual agency. Student–teacher ratio recommendations based on best practices as outlined in Chapter 3 indicate that smaller class size is proven to be more effective for training, and especially for hands-on training purposes. Therefore, the recommended class size should be kept to no more than 12 to 15 students with 6 to 10 participants as the optimum.

It is essential that all courses be developed in such a way that candidate instructors go back to their agencies with the ability to deliver a blend of instructor and participant-led learning such that the student is actively engaged in the learning process to the greatest extent possible. As supported by the best practices research, training courses must dynamically involve students if they are to be effective, especially if transit maintenance hopes to attract younger workers accustomed to computers and interactive video games. As illustrated by theorists such as Gagne and Dewey, students best retain concepts presented to them when they are actively engaged in the learning process. Use of interactive computer programs, lab exercises, OJT, equipment mock-ups, cutaways, and hands-on exercises are examples of activities that supplement classroom training and engage students to learn. If the ultimate goal of maintenance training is to instill in students the ability to perform job tasks, then the learning environment must serve to facilitate the manual dexterity needed to accomplish those tasks. Thus, a blend of delivery including instructor and participant-led learning along with other interactive classroom strategies and delivery methods is strongly recommended for this program.

Facilitators for both program courses as well as approved alternative courses must be knowledgeable and experienced in the content area of the course they are facilitating. The AO needs to have a process in place to ensure that all facilitators have proven experience in facilitation and instruction. For technical courses such as Instructional Technology, the instructors must have the technical knowledge and experience as required for the participants.

While not part of the official program design, agencies who have participants in the program should consider adding in-house mentoring for those instructors completing the national certification program. In-house mentoring is a best practice used by many agencies where instructors receive feedback and support as they grow to become more independent masters of program competencies as maintenance instructors.

Course Delivery Methods

Course delivery to meet training and certification requirements for candidate instructors needs to take into account limited agency budgets and the limited time instructors have to travel to take all of the required courses. As shown in Chapter 3, organizations use a variety of methods to deliver courses to candidate instructors such as traditional in-person type classroom style setting, computer-based and/or web setting, approved alternative courses offered by third-party providers, or through a combination of blended traditional in-person classroom and computer-based training. Another effective but somewhat costly option is to offer annual workshops where candidate instructors receive training and exchange learning ideas with their peers. Also revealed in the best practices chapter was SEPTA's approach whereby videotaped presentations are used to critique and assess instructor performance.

The Core Competency Course Delivery section of Chapter 5 recognizes that the methods of course delivery to candidate instructors represent a major program cost and outlines the advantages and disadvantages associated with three specific course delivery methods. Ultimately, it will be up to the AO to take the best practices gleaned from transit and other industries presented in Chapter 3 along with the business considerations outlined in Chapter 5 to develop a course delivery structure that is both effective and sustainable, given participation levels and budgetary constraints.

Time Limitations and Recertification

Because course competencies vary in content and potential participant or agency need, the Project Team is recommending that there be no time limit established in which to complete

the program. Instructors should be given as much time as needed to complete the program and achieve certification. This is especially important for smaller agencies where the instructor has many responsibilities and may be unable to devote as much time to the program as an instructor from a larger agency with sufficient back-up staff. However, because some competencies may be time sensitive due to technological advances, courses to meet those competencies should be considered for completion within a certain time frame prior to certification and possibly required to be taken for refresher in order to maintain certification over time. Except for a possible requirement to take certain time sensitive courses closer to certification as established by the AO, it is recommended that there be no general recertification requirements for those already certified.

The program model should be reviewed every three to five years by the AO for updates to content, standards, and technological advancements.

Methods for Validating Attainment

Validation for attainment of the National Vehicle Maintenance Instructor Training and Certification Program is completed by means of a thorough evaluation process. This process is made up of two components: a portfolio containing National Course Assessments completed at the end of each course and a comprehensive National Capstone Project completed at the conclusion of the program. This assessment process ensures the participants will meet individual competency requirements for each course as well as comprehensive mastery of the full program woven together.

Both the portfolio and the final Capstone Project should be evaluated by an appointed SME Evaluation Team. Both approved components should be completed and approved by the Subject Matter Evaluation Team in order to achieve certification. The assessment process is presented here as a series of recommendations to the AO, which ultimately will develop and manage the entire assessment process including having direct responsibility for assessing program courses and overseeing SME involvement in the assessment process.

SME Evaluation Team

It is recommended that a group of SMEs be appointed as the official evaluation team with the sole purpose of reviewing all portfolio assessments throughout the program and all elements of the Capstone Project at the end of the program to determine if instructor certification is warranted. Reviews will be made of written materials as well as video tapes or similar materials submitted by candidates as examples of actual training delivery. This evaluation team must be appointed by the AO to represent all of the interests in the certification process and must each be independently qualified as a SME as required for this content. At a minimum, these teams should consist of at least three SMEs. A chair should be appointed by the group to facilitate the process.

The Portfolio and Course Performance-Based Assessments

Upon the conclusion of each completed course, participants in the National Vehicle Maintenance Instructor Training and Certification Program should complete National Course Assessments reflective of the course and competency met. Each course assessment should contain two summative assessments, one being written and one being demonstrative. The written assessment should contain an assortment of multiple choice and essay-type questions measuring content learned in the course. The demonstrative assessment should be designed to measure the application of the content learned in the course. In some cases, videotaping or distance-based techniques may

be a required medium for demonstrative assessments in order to reduce travel costs and time needed to conduct those types of assessments.

Each summative course assessment, as completed and developed by the certificate candidate, should then get applied to their final portfolio for review by the SME Evaluation team. The earlier described learning objectives should be the standard by which to develop and measure each assessment.

The assessments used to determine certification are based on the late Donald Kirkpatrick's Four Level Evaluation Model as first published by the American Society for Training and Development (ASTD). The model is widely accepted and utilized for workplace employee training and development evaluation. Kirkpatrick's four levels of evaluation include a Level One measurement of course reaction; a Level Two measurement of knowledge gained; a Level Three measurement of behavior and job performance; and a Level Four measurement of results and ROI. Although the Kirkpatrick model contains four levels, each individual course assessment should contain a Level Two written and demonstrative assessment from that model to determine what the participant learned in each course throughout the certification program. Table 4.4 summarizes the recommended performance-based assessments for each core competency.

Table 4.4. Transit vehicle maintenance instructor national core competencies and performance-based assessments.

Core Competencies	Competency Assessment
Training Delivery	
Mentoring and Coaching	• Written assessment • Demonstration of explained vehicle maintenance task and related safety measures
Communication	• Written assessment • Oral presentation demonstrating ability to communicate technical instruction (involves videotaping)
Delivering Instruction: Classroom and Hands-On	• Written assessment • Presentation of a 20-minute lesson (involves videotaping)
Adult Learning	• Written assessment • Case study illustrating how adult learning theories are applied to a transit maintenance class
Instructional Design	
Lesson Plan Design	• Written assessment • Develop a lesson plan for a transit maintenance training session
Assessment and Process Analysis	• Written assessment • Develop an oral and written assessment for a given transit maintenance lesson
Instructional Material Development	• Written assessment • Demonstration of selected and developed instructional materials for a given transit maintenance lesson
Instructional Technology	• Written assessment • Develop a multi-media lesson of a transit maintenance training session for demonstration (involves videotaping)
Program Design	
Standards-Based Training	• Written assessment • Develop a lesson for a transit maintenance classroom with integrated industry standards
Program Management and Evaluation	• Written assessment • Develop a program evaluation based on the Kirkpatrick model and explain how the evaluation will be used for management purposes
Curriculum Development	• Written assessment • Given a transit maintenance course, develop a curriculum plan using ISD principles and methods

National Capstone Project Requirements

Upon conclusion of the program, the participant should complete a capstone project. The capstone project requirements for certification should involve three comprehensive elements all relating to each course in the program. This process is recommended to assure mastery of each course and to connect all of the courses to the process of certification. Like the portfolio, a participant's capstone project should be reviewed and approved by the appointed SME evaluation team.

Each candidate will be required to complete the following elements to an assigned level of mastery to qualify for national certification.

Element 1—Comprehensive Exam

Each certificate candidate must complete a comprehensive examination that will include two essay questions from each course in the certification program. These will be directly related to the content for each course and will be developed based on the objectives for each specific course. These questions will provide each student an opportunity to apply the content of a course in a real-world context. Each exam will be reviewed by a group of appointed SMEs and an evaluation of pass or fail will be applied to each question. A student must have a final grade of 70 percent or higher for these questions to pass this portion of the capstone requirement.

Element 2—Reflective Paper

Each certificate candidate will be required to reflect on each course in the program and construct how the content of each course can be applied to improving the courses they now teach, or will teach in the future. There will be a minimum requirement of 250 words for each reflection. Each reflective paper will be reviewed by a team of SMEs and assigned a pass or fail evaluation. A student must have a 70 percent or higher evaluation to pass this element of the certification.

Element 3—Case Study

Each certificate student will be required to complete a case study assignment that requires each student to demonstrate a solution for a specific real-world problem that typically exists in the training environment at the level of an instructor. A minimum of 500 words will be required for the written product which will be reviewed by a team of SMEs. An evaluation of pass or fail will be assigned to each case study response.

Course Substitution Guidelines

To provide added flexibility for candidate instructors, approved program course substitutions will be a factor in the national certification program. In some cases, instructor candidates desiring to enter the national vehicle maintenance instructor program may have already completed similar courses elsewhere, for which credits will need to be given.

Although guidance and recommendations are provided here, it will be the AO's final determination regarding how non-program courses will be selected and approved, and how credits will be assigned for those courses. Regardless, the Project Team is recommending that in situations where students have taken courses that qualify as substitutes for a program required course, they will still be required to complete all capstone elements to the same level of mastery as a student who has taken all required courses through the program. This assures that the requirements of certification are maintained regardless of where the course was taken. Detailed course substitution guidelines and example alternative courses are provided here.

Course Substitution Process and Examples of Alternative Courses

This section provides a preliminary listing of possible alternative courses and describes the conditions under which candidates seeking national instructor certification can apply these courses. The intent is to allow those candidates who have already received instruction that meets certain conditions to achieve certification, thereby avoiding duplication and saving time. The process also permits candidates to fast track the certification process by taking approved alternative courses in advance of those scheduled by the certification program. The flexibility is intended to give instructor candidates increased choices towards reaching certification without compromising the program's validity.

Regarding alternative courses, a challenge that faced the search effort is the limited numbers of those that are "plug-and-play," ones that fully satisfy the duration and learning objectives established within this project. Many courses, for example, are part of larger educational programs where it is uncertain if the provider will make certain elements available à la carte. In other cases, some examples are not fully developed course offerings, but instead consist of reference materials or related work accomplished by competent organizations. The collective information does, however, provide the eventual AO with a set of potential courses and a list of organizations with the ability to either develop new courses or modify existing ones to suit program requirements.

Course Substitution Process

The Project Team proposes that any candidate seeking certification under this program may request that a non-program course be considered for substitution for one of the required certification courses using the following guidelines:

- A substitute course must contain equal or greater contact hours as the certification course.
- A substitute course must cover the same or greater content area as the certificate course as determined by course objectives.
- A substitute course must have equal or greater academic rigor and complexity as the certificate course.
- Evaluation of student mastery must be equal to or greater than that required in the certification course.
- A student must present a certificate of completion, transcript or other official instrument documenting satisfactory participation and completion of the substitute course.
- The capstone course will not be considered for substitution under any circumstances.
- Acceptance of substitute courses does not in any way change the certification requirements of the capstone course and subsequent certification.
- A substitute course must have been completed no later than 5 years from the time the requested substitution is filed.
- A fee may be applied to each requested course substitution, regardless of outcome.
- No more than four (4) courses can be substituted for certification courses.

An initial group of equivalent courses will be determined within the first year of the program and additional courses may be added later as required. The initial group of courses and each subsequent review for substitute course requests will be determined by the program's eventual AO. It is envisioned that the course validation process will be conducted by a team of SMEs and instructional designers under the direction of the AO to assure conformity to both content and academic standards established for the certification process.

Also, as part of the alternative course process, if someone has earned an associate degree in a related field, he/she may be able to substitute suitable courses obtained through that degree to meet certain National Instructor Certification requirements. The same team of SMEs

and instructional designers will make these determinations under program management guidance.

Examples of Alternative Courses

As stated above, alternative courses will be selected and approved through a formal process developed by the AO. The list of alternative courses provided here as Appendix A is by no means comprehensive nor is it intended as the only suitable alternative course listing available to the program. However, a preliminary listing of alternative courses organized by each subject area will provide the AO with a good start for making its final determination. Each of the alternative course recommendations listed in Appendix A contain contact information for the organization providing the materials, an overview of the organization, details about its training products, and whether those products relate specifically to transit. A summary of those courses is provided here.

Mentoring and Coaching

There are several sources for mentor training. Management Mentors, for example, offers interactive, online courses on mentoring training. The firm uses audio skits, interactive quizzes, and dynamic tutorials to address several aspects of mentoring and coaching. The Association for Talent Development (ATD), formerly ASTD, offers mentoring courses that can be delivered on-site or online. Two community colleges were identified that offer mentor training. Chronus offers development software to assist organizations develop their own mentoring and coaching programs, while EDSI has developed a course on mentoring and coaching specifically for transit applications. The Transportation Learning Center's Mentoring Guidebook is also included as a reference for developing mentoring programs in a transit environment.

Adult Learning

The Murphy Institute, associated with the City University of New York, offers two programs focused on instruction of adult learners—Graduate Certificate in Adult Learning: Program Design and Facilitation, and Certificate in Understanding How Adults Learn. ATD has a course entitled *Essentials of Adult Learning*, which explains the principles of adult learning in the context of workplace implementation. The ed2go network offers several instructor-led online courses including one entitled *Teaching Adult Learners* that explores the unique needs and motivations of adult students. EDSI offers two complete courses on *Learning Styles and the Adult Learner*, while FTA's *Principles of Adult Learning and Instructional System Design* serves as a useful reference document.

Communication: Oral and Written

In addition to the sources provided here and in Appendix A, courses on oral and written communication are readily available through the community college network and other sources. The search revealed that Langevin, a company used by Thermo King as discussed in Chapter 3, has a self-study kit designed for training professionals who want to write clear, concise, and professional training materials. They also offer a one-day workshop entitled *Polishing Your Presentation Skills.* Mind Tools, an online training provider, offers a variety of courses dedicated to improving writing skills in specific areas. Improving Communications, a New York based training firm, offers courses on business writing and public speaking.

Delivering Instruction: Classroom and Hands-on

Washtenaw Community College, a community college in southern Michigan, has a course on Interactive Teaching designed specifically to enhance teaching and interaction techniques

for technical instructors. The course provides instructors with tools to more effectively engage an audience, create individual and group discussion, and structure classroom setup more conducive to individual participation. The CUTR provides several courses to assist instructors with setting up training for transit technicians in classrooms and labs. The NTI offers the course, *Training and Coaching Skills*, which provides instructors with skills to structure effective classroom presentations, improve presentation skills, and encourage audience participation.

ATD's *Master Trainer Program* also contains courses to help instructors master all aspects of training delivery. EDSI offers a course entitled *Presentation Skills* where participants get to understand what makes a good presentation and their own strengths and weaknesses regarding making presentations. Two useful reference materials were identified including MIT's *Training Delivery Guide* that addresses what makes a training program excellent and how to select optimal delivery methods. OSHA's *Best Practices for Development, Delivery & Evaluation Workbook* provides best practice elements to help instructors to better develop, deliver and evaluate training.

Assessment and Process Analysis

CUTR, which extensively uses assessments to evaluate their course offerings and to measure learning, has the capability to develop a course for this project based on the assessment processes it uses. The National Occupational Competency Testing Institute (NOCTI) works with specific industry SMEs to develop assessment courses either on-site or distance based. ATD offers an *Evaluating Learning Impact Certificate* as an online course where students receive a solid foundation in all aspects of the measurement and evaluation of learning.

Standards-Based Training

The search for alternative courses did not locate a single course applicable to this project. However, several organizations were identified with the potential to create such courses. APTA, for example, has worked with transit agency and union stakeholders to develop national training standards for bus and rail vehicle maintenance. Although a specific course is not offered, APTA is well qualified to develop one to assist instructors integrate national training standards into local training programs. The NATEF, a division of ASE, certifies automotive professionals. Procedures they use could be useful for developing a course on standards-based training in transit. SCRTTC, EDSI and the Transportation Learning Center (TLC) also have the experience to develop courses on standards-based training.

Lesson Plan Design/Instructional Material Development

TLC Seminars, which has significant experience in advanced instructor training programs, offers the course *Custom Training Development* designed to assist instructors with producing new training programs and upgrading existing programs. The West Virginia Department of Education has a document titled *Quality Lesson Design*, which describes why lesson plans should be created, what needs to be included, and where to find examples of comprehensive lesson plans. EDSI, which developed instructional material for several of the APTA bus and rail training standards, also offers courses on lesson plan design and instructional design.

Curriculum Development

Courses on curriculum development are found at community and other colleges that specialize in education. UTI, which offers automotive technician training, has a Custom Training Group (CTG) that can tailor one of its existing course offerings on creating curriculum specifically for transit applications. EDSI's course entitled *Curriculum Development* is designed to assist qualified instructors with developing curriculum off of existing responsibility and task lists.

Certification

A national certification will be granted to vehicle maintenance instructor participants that successfully complete all 11 courses outlined in the competency model or approved substitute courses, as well as the completed and approved final capstone project. The certification provides tangible proof that instructors have demonstrated they are qualified to perform their jobs, and provides recognition for their knowledge and abilities. This nationally recognized credential is portable if the certified instructor seeks employment at another agency.

Time to Completion and Recertification

Because course competencies vary in content and potential participant or agency need, the Project Team is not recommending a limit in which to complete the program, nor is it recommending a formal recertification process. However, because some competencies may be time sensitive due to technological advances, courses to meet those competencies should be considered for completion within a certain time frame prior to certification and possibly required to be taken for refresher in order to maintain certification over time.

CHAPTER 5

Business Plan

Business Plan Overview

In order to implement the certification on a nationwide basis, a clear structure must be developed, and an organization must be identified with a capacity to develop, implement and maintain the structure. This business plan assumes there will be two main players involved in implementing the program. First, there will be a national steering committee responsible for issuing an RFP and contracting with an administrator, ensuring overall quality of implementation, and being responsible to the industry. This organization may be a successor to the Project F-19 panel, a newly established nonprofit, a subcommittee of APTA, or an informal committee of industry leaders. This steering organization will in turn select an AO. The AO, through a credentialing management system, will provide a consistent and timely confirmation of a participant's progress through the competency model, and issue the certifications. The AO will also, either directly or through subcontractors, develop an infrastructure to directly deliver the training needed for the competency model, as well as overseeing the approval and acceptance of alternative courses.

Structural Elements of AO

The Project Team envisions that the AO could be an existing organization with the appropriate capacity and experience, or a newly formed nonprofit created for the purpose of implementing the program. It seems likely though, that a brand new organization whose sole purpose would be running the ICP would have more significant fixed costs than an existing organization with experience running similar or complementary programs. The organization should meet the requirements and be answerable to a standing committee of industry representatives to ensure that all expectations for the program are met.

As part of the program launch, a number of critical qualifications for the AO should be sought in the RFP. The selected organization should possess these characteristics, listed in rough order of priority:

- Ability to manage a program of national scope: The organization will need to communicate the value of the program to the industry as a whole and be able to administer the program without bias to any geographic region.
- Experience working with transit industry: The organization should have the ability to work with multiple transit stakeholders and understand the challenges and limitations transit organizations face.
- Documented instructional design expertise and material development capacity: The organization will need to finalize the design of the competency model and develop all material to implement the curriculum in the identified delivery methods.

- Training delivery experience, especially to instructors: The organization will need to deliver directly or subcontract with experienced trainers. It will be advantageous to have experienced training professionals and transit personnel.
- Certification program administration experience and program design and administration staff: The organization will need to show a plan to use a robust credentialing management system that can seamlessly track a participant's progress and communicate progress to participants and employing agencies.
- IT infrastructure (Training and certification information management system): Experience with an adequate credentialing management system and the IT capacity to implement the program will be critical.
- Sound legal system to protect against liabilities.
- ADA requirements.
- Program maintenance: The organization will need to have a plan to regularly review the program, update core competencies, and revise the program as necessary to meet the ongoing needs of the industry.

Potential Organizations for Program Development and Delivery

In Task 1 of the project, SME survey respondents provided a list of organizations that may have the potential to develop and deliver all or some components of the national training and certification program. The suggested organizations included:

- Colleges, universities and technical schools (13): Many respondents consider any educational institution that prepares teachers in teaching methods for adult learners as potentially capable of carrying out the program. A dozen examples were given by the respondents, mostly local colleges and universities in their areas.
- For profit and not-for-profit training, research and technical assistance organizations (8): Many of these organizations have provided training and/or certification programs to transit maintenance personnel or trainers.
- Industry associations (2): Industry associations have increasingly taken on workforce development as a priority of their services to members. In the Project F-19 survey, respondents mentioned one national and one state public transportation association as examples.
- Large transit agencies (2): Large training departments can have well-developed programs to prepare skilled technical workers to become equally skilled instructors. These training environments stress strong preparation for classroom time, solid documentation on what is taught and hands-on and interactive learning. Survey participants included two examples of large transit agencies as potential providers. The full details of these programs are included in the Task 2, *Best Practices Report* found in Chapter 3.
- OEMs (4): Despite their role in transit technical training, only one respondent listed transit OEMs as potential organizations for delivering instructor training.

The organizations with potential in developing and delivering instructor training and/or certification as identified through the SME survey are listed in Appendix B, along with their locations and respondent comments. An original task assignment called for the Project Team to assess the capabilities of these organizations. However, the oversight panel thought it best to leave that work for the future competitive RFP process and instead steered the Project Team toward identifying the qualification requirements needed for a national AO, and identifying existing training programs and courses that could be considered as equal alternatives to core program offerings. The list of potential organizations provides a reference point to the future AO selection process.

Core Competency Course Delivery

A major factor in determining costs for development, delivery, and administration of the program depends on the method of course delivery selected. There are three possible options for managing the delivery of each course described in the core competency model. First, existing courses from outside providers could be accepted as equivalent for meeting all competency requirements of the model. For each core competency course, the AO will confirm that a course submitted meets the requirements, and review the reflection paper and/or course capstone requirements against an objective model. The process for evaluating these courses is described later. Alternatively, the AO or a single subcontractor could directly offer courses specifically designed to meet these competencies and delivered directly to transit instructors. Further, each of those courses could be delivered either through a traditional classroom setting or an e-learning/video conferencing platform.

There are a number of advantages and disadvantages to pursuing the different approaches as shown in Table 5.1.

It seems that, with the exception of the course for mentor core competencies, there will not usually be enough participation in the program to make centralized in-person delivery of the courses viable. It would require travel for multiple days to a central location, or an instructor traveling to different regions, but in that case achieving a sufficient class size will be very difficult. In turn, with a very small class size, per student and per course cost will need to be higher, and that will further suppress participation. However, the AO may be able to identify some courses that could be offered on a limited basis in person, perhaps by tying it to another event that will draw instructors and transit professionals nationwide, such as the NTI Transit Trainers' workshop or various APTA conferences.

The e-learning and video conferencing option will almost certainly require a significant up-front development investment, but would offer flexible scheduling of courses at a reasonable cost to the AO and a reasonable charge to those pursuing certification. (Note: There may also be some existing e-learning courses that some potential AO, or subcontractors to the AO, may have that may meet some or all of the program requirements. Identifying if these exist and how to make them viable for use in the certification program will be an important part of determining development

Table 5.1. Advantages and disadvantages of course delivery approaches.

Advantages	Disadvantages
Outside Equivalent Courses	
• The courses already exist and are dispersed geographically • Interaction with instructors from other industries • Courses not limited to transit instructor population means they can be offered more regularly	• Inconsistent experiences and emphases • May require more time and commitment than necessary (i.e., enrollment in full grad program)
Directly Delivered Courses – In-Person	
• Consistent delivery of content that can be continually evaluated • In-person interaction of transit instructors sharing best practices	• Need funding for development of single approved curriculum and courseware • Travel costs for instructor and/or students • Limited scheduling ability; would need to cancel course if enrollment not sufficient
Directly Delivered Courses – E-Learning / Video Conferencing	
• Consistent delivery of content that can be continually evaluated • Interaction of transit instructors sharing best practices • More flexible scheduling	• Substantial development cost for platform and e-learning material • Inconsistent equipment on user end to participate in the classes

costs accurately.) Using a centrally developed e-learning and video conferencing curriculum also ensures that all participants receive the same information and level of quality and will provide opportunities for participants to learn from each other in a collaborative environment. However, it also seems important to offer the flexibility for students to submit equivalent outside courses to demonstrate the competencies.

The conclusion is that the advantages and disadvantages for delivering the course on different platforms, or accepting existing courses as equivalent, will be slightly different for each course that is part of the program plan. There is no distinct advantage to forcing all courses into one mode of delivery, and the AO will need to explore the best available options for each course. The business plan therefore assumes a mix of delivery methods will be used. The operating cost and revenue projections included later assume an offering of e-learning classes will be available for all courses except mentoring, and that mentoring will be delivered in person. The projections also assume that at least one equivalent existing course will be identified for each part of the program plan, and that these outside courses will be chosen by 50 percent of the participants.

Initial Development Costs

Developing a full suite of e-learning and video conferencing materials for delivering the core competency model will require a significant investment. A common rule of thumb is that for each hour of instruction, 10–25 hours of professional instructional design time is necessary. With the necessity of extensive interactive material, it is reasonable to think these costs would be on the high end of that estimate. This would give an estimated development cost of:

92 hours instructional time × 20 hours of development per hours of instruction

× $100/hr fully loaded cost of professional instructional design = $184,000

As shown later in the operating cost and revenue projections, even at a high rate of participation among transit maintenance instructors, the projected revenue surplus is not enough to attract an organization to front the money for initial development at this level. It seems very likely that some initial source of the money needs to be found through a consortium of transit agencies, newly established nonprofit, or potential grants. A similar situation was faced with the launch of the Transit Bus Mechanic testing program, where ASE received funding to develop the initial tests in exchange for an agreement to offer and administer the tests for a minimum of five years regardless of participation levels. As mentioned earlier, there may be some courses for which some of this development has already been completed, but it is likely there will still be significant investment needed.

Another possibility to be explored is if the participation levels could be significantly expanded by changing the focus of the credential from maintenance instructors only to all transit instructors. This possibility was mentioned during the Project Team's presentation and discussion at NTI's Transit Trainers' Workshop. The operating side of transit receives a lot of attention, and it was suggested that including operating trainers would garner more organizational support of the program. While some changes in the core competency model would be needed, it would in large part apply to all instructors as is. Unfortunately, the research done on participation levels to this point focused solely on maintenance instructors, and it is unclear how much larger the full instructor population is and if the NTI participants correctly estimated the interest level. If this is explored further it may be the case that a significantly higher participation level could provide enough surplus revenue to amortize the significant up-front development costs. However, because of the uncertainty, the analysis that follows assumes a program focused only on the maintenance instructor population.

Participation Projections and Operating Cost Analysis

For the transit trainer certification program to be sustainable, several critical items must be present:

- Sufficient participation levels from transit trainers and agencies initially and over time.
- Revenues from participants fully cover the long term costs of the organization(s) implementing the program.
- Charges for certification are set to levels that are reasonable for agencies, and provide a clear ROI.

Participation Estimates

To determine the projected participation over time, the Project Team looked at three different populations identified in Task 1: current transit agency instructors (~600), projected annual new instructors (~40), and current mentors (~3,700).

For incumbent instructors, the Project Team assumes that participation levels will be lower than participation levels for new instructors after the certification program is launched. This is due to a number of incumbent instructors being in the middle or latter part of their careers, and the likelihood that transit agencies may "grandfather" or otherwise not incentivize participation of current employees in the program in the same way as new employees. Based on these understandings, the Project Team projected that over the first five years of the program, 20–40 percent of the instructor population would participate, but that 40–80 percent of each year's new crop of instructors would begin the program.

Mentors may benefit from portions of the certification program. The development of strong mentoring practices may help identify talent for future full-time instructors, improve the overall culture of training, and be key to the sustainability of the certification program. The Project Team estimated a steady population of 3,700 instructors, and that 6–10 percent will participate in some portion of the program each year. These assumptions provide the following projections over 10 years as shown in Table 5.2.

Assumptions Applied to Revenue/Cost Projections

It should be noted that Year 1 draws only from incumbent trainers; "new trainers" begin with Year 2. Also, after Year 5 the Project Team assumes that all of the present populations of trainers

Table 5.2. Ten-year participant projections.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Instructor Participants										
High Projection	48	80	80	80	80	32	32	32	32	32
Medium Projection	36	60	60	60	60	24	24	24	24	24
Low Projection	24	40	40	40	40	16	16	16	16	16
Mentor Participants										
High Projection	370	370	370	370	370	370	370	370	370	370
Medium Projection	296	296	296	296	296	296	296	296	296	296
Low Projection	222	222	222	222	222	222	222	222	222	222

who will participate have participated and so there is a drop off at that point. However, the fixed costs will also be front loaded in the early years, so a smaller participation level is necessary for sustainability after the initial costs are covered.

Although the courses are not assigned to a strict time frame in the competency model, for the purposes of projecting revenue the Project Team has assumed that students, on average, will move through the program over the course of three years. The Project Team has also assumed some attrition through the program. It is projected that 10 percent of those who begin will not proceed to the second year of courses and an additional 20 percent will not proceed to the third year. The team projected that of the 10 courses identified, participants will submit the equivalent course documentation for four of them and take the remainder directly administered through the program.

Whether these participation levels are sufficient to sustain the program will depend on the costs charged and the variable and fixed costs to the implementing organization. The plan to achieve the necessary participation will be discussed later.

Annual Operating Costs (Fixed and Variable)

As noted earlier, depending on the structure chosen for delivering classes, there may be substantial up-front development costs for e-learning and other courseware development, and platforms for delivering courses remotely via video conferencing. This analysis focuses on ongoing fixed and variable operating costs. It will almost certainly be necessary for separate funding from agencies, other organizations, or the steering organization to be identified to cover the pre-program launch costs.

Each year, there will be relatively fixed costs for a website, marketing of the program to agencies, the credentialing management system license and administration, and ongoing updates of the competency model. An initial analysis estimates that these costs will be in the range of $35,000–50,000 per year. A detailed projection is provided in Table 5.3.

Other costs will be variable based on the number of participants and the attrition and progress of participants through the program. The main types of costs are per course offering for courses offered directly through the AO, and the review of equivalent courses, evaluation of portfolios and other deliverables to confirm that competencies have been achieved, and the evaluation of the final capstone project.

The cost projection is $1,000 per offering of an 8-hour course via video conferencing, or $1,500 for courses offered in person. The primary driver of these costs is direct instructor time; other costs such as curriculum development and updating are included elsewhere. The number of offerings of the course needed was calculated by the projected participation, assuming a goal of eight enrollees per course offering, and assuming that half of participants would take the course directly through the certification program and half would submit an equivalent outside course. Review of portfolios and reflection papers is projected at $25 per course and $100 for the capstone project.

Revenues

To cover the administration costs, several fees would be charged to participants during the certification program:

- Initial registration fee (proposed at $100).
- Review of course documentation and portfolios for four Training Delivery courses: $200.
- Review of course documentation and portfolios for four Instructional Design courses: $200.

Table 5.3. Operating revenue vs. cost analysis of transit trainer and mentor certification program—high participation estimate.

			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Participation												
	Participating Trainers (from Year 1 population)		**48**	**48**	**48**	**48**	**48**	**0**	**0**	**0**	**0**	**0**
	Participating Trainers (from New Hires each year)		**0**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
	Participating Mentors		**370**	**370**	**370**	**370**	**370**	**370**	**370**	**370**	**370**	**370**
Fees/Income (Constant $ in Thousands)												
	Certification System Registration (Charged at beginning to participating instructors)	$100	4.8	8.0	8.0	8.0	8.0	3.2	3.2	3.2	3.2	3.2
Training Delivery Courses	Mentoring Course (In-Person)	$250	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5
	Oral and Written Communication	$250	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
	Adult Learning	$250	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
	Delivering Instruction	$250	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
Instructional Design Courses	Assessment and Process Analysis	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Instructional Technology	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Lesson Plan Design	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Instructional Material Development	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
Program Design Courses	Standards-Based Training	$250	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Program Evaluation and Management	$250	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Curriculum Development	$250	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Review of Course Documentation and Portfolios (Training Delivery Level)	$200	9.6	16.0	16.0	16.0	16.0	6.4	6.4	6.4	6.4	6.4
	Review of Course Documentation and Portfolios (Instructional Design Level)	$200	0.0	8.6	14.4	14.4	14.4	14.4	5.8	5.8	5.8	5.8
	Review of Course Documentation and Portfolios (Program Design Level)	$150	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Review of Final Capstone Project	$150	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
Total Fees/Income			**123.7**	**179.1**	**227.3**	**244.1**	**244.1**	**212.9**	**178.3**	**153.1**	**153.1**	**153.1**

Table 5.3. (Continued).

Costs (Constant $ in Thousands) Note: These are recurring operating costs, both fixed and variable. There are other one time startup costs that will have to be invested and recovered over time or covered through other possible sources.												
			Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Fixed Costs (Overall)	Updates for Task Analysis, Competency Model and Program Review (ongoing and major update every 5 yrs, incl. SME travel)		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	Marketing to Agencies / ROI Analysis		10.0	10.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Public Website Maintenance		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Legal Costs (incl. insurance)		7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	Credential Management System License and Admin		15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Total Fixed Costs			**47.5**	**47.5**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**
Variable Costs			**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Training Delivery Courses	Mentoring Course (In-Person)	$1,500	46.5	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Oral and Written Communication	$1,000	6.0	10.0	10.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0
	Adult Learning	$1,000	6.0	10.0	10.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0
	Delivering Instruction	$1,000	6.0	10.0	10.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0
Instructional Design Courses	Assessment and Process Analysis	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
	Instructional Technology	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
	Lesson Plan Design	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
	Instructional Material Development	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
Program Design Courses	Standards-Based Training	$1,000	0.0	0.0	5.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0
	Program Evaluation and Management	$1,000	0.0	0.0	5.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0
	Curriculum Development	$1,000	0.0	0.0	5.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0
	Review of Course Documentation and Portfolios (Training Delivery Level) ($25/person/course)	$25	4.8	8.0	8.0	8.0	8.0	3.2	3.2	3.2	3.2	3.2
	Review of Course Documentation and Portfolios (Instructional Design Level) ($25/person/course)	$25	0.0	4.3	7.2	7.2	7.2	7.2	2.9	2.9	2.9	2.9
	Review of Course Documentation and Portfolios (Program Design Level) ($25/person/course)	$25	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
	Review of Capstone Projects	$100	0.0	0.0	3.4	5.6	5.6	5.6	5.6	2.2	2.2	2.2
Total Variable Costs			**69.3**	**117.3**	**153.1**	**163.0**	**163.0**	**140.2**	**115.9**	**98.0**	**98.0**	**98.0**
Total Costs			**116.8**	**164.8**	**193.1**	**203.0**	**203.0**	**180.2**	**155.9**	**138.0**	**138.0**	**138.0**
Annual Cost Excess/Shortage			**6.9**	**14.2**	**34.2**	**41.1**	**41.1**	**32.7**	**22.5**	**15.1**	**15.1**	**15.1**
Cumulative Reserve/Loss			**6.9**	**21.1**	**55.4**	**96.5**	**137.6**	**170.3**	**192.7**	**207.9**	**223.0**	**238.1**

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- Review of course documentation and portfolios for three Program Design courses: $200.
- Review of final capstone project and issuing certification: $150.

Total cost to agency or trainer for certification: $850.

There will also be costs for taking the courses themselves. If a participant is taking an approved equivalent course from an outside provider, the charges will be paid directly to that provider. It is projected that a fee of $250 per course for those taking courses directly through the certification managing organization.

10-Year Operating Profit/Loss Projections

Tables 5.3 to 5.6 show one year cost and revenue projections based on different assumptions. Table 5.3 assumes participation for mentors and instructors will follow the "High" level projection model. Under this level of participation and using the fees indicated. Under this model, there is a projected operating profit starting with Year 1 and an ongoing projected profit of $15,000 per year from Year 8 forward.

Table 5.4 assumes participation follows the "Low" model. In this case there is an operating loss almost every year, and the program would not be sustainable without significant fee increases. However, those fee increases might further decrease participation, leading to a spiral downward. Participation must certainly come in above the low projections for the program to work, and a strong marketing program and understanding of the ROI among the agencies will be critically necessary to achieve the required participation.

Table 5.5 takes the "Medium" level of participation and projects the necessary fees to break even. In this case only a slight increase to the charge for the mentor course (to $260) would provide fiscal stability, as the excess from the mentor course can subsidize the overall program.

Finally, Table 5.6 projects the necessary participation level given the initial projected fees. The key takeaway here is that the sustainability of the program *decreases* with higher instructor participation unless the mentor participation increases by a similar amount. In the long term, participation of 32 instructors per year and 270 mentors per year would provide a small annual operating surplus.

All of the numbers in these projections are very preliminary and have a wide margin of error. As even the most optimistic projections do not show a substantial operating margin, the implementation of the program in an efficient manner by a well-qualified flexible organization will be critical for success. A focus of upcoming meetings with SMEs will be to determine the reasonableness of these assumptions and what steps will be necessary to ensure the required participation levels. A significant part of the evaluation of the RFP responses should be the organization's plan to achieve the necessary participation levels for sustainability.

Summary of Projections

The projected operating surpluses or losses (not including up-front development costs before Year 1) are shown in Table 5.7.

These figures assume that all courses except mentor training are offered in an online, video conferencing format, that one half of courses are taken directly through the program, while the others are taken through equivalent outside courses, and that there are eight participants per course offering. All participants, regardless of where courses are taken, would be required to pay the full registration fee.

Table 5.4. Operating revenue vs. cost analysis of transit trainer and mentor certification program—low participation estimate.

			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Participation												
	Participating Trainers (from Year 1 population)		**24**	**24**	**24**	**24**	**24**	**0**	**0**	**0**	**0**	**0**
	Participating Trainers (from New Hires each year)		**0**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**
	Participating Mentors		**222**	**222**	**222**	**222**	**222**	**222**	**222**	**222**	**222**	**222**
Fees/Income (Constant $ in Thousands)												
	Certification System Registration (Charged at beginning to participating instructors)	$100	2.4	4.0	4.0	4.0	4.0	1.6	1.6	1.6	1.6	1.6
Training Delivery Courses	Mentoring Course (In-Person)	$250	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5
	Oral and Written Communication	$250	3.6	6.0	6.0	6.0	6.0	2.4	2.4	2.4	2.4	2.4
	Adult Learning	$250	3.6	6.0	6.0	6.0	6.0	2.4	2.4	2.4	2.4	2.4
	Delivering Instruction	$250	3.6	6.0	6.0	6.0	6.0	2.4	2.4	2.4	2.4	2.4
Instructional Design Courses	Assessment and Process Analysis	$250	0.0	3.2	5.4	5.4	5.4	5.4	2.2	2.2	2.2	2.2
	Instructional Technology	$250	0.0	3.2	5.4	5.4	5.4	5.4	2.2	2.2	2.2	2.2
	Lesson Plan Design	$250	0.0	3.2	5.4	5.4	5.4	5.4	2.2	2.2	2.2	2.2
	Instructional Material Development	$250	0.0	3.2	5.4	5.4	5.4	5.4	2.2	2.2	2.2	2.2
Program Design Courses	Standards-Based Training	$250	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
	Program Evaluation and Management	$250	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
	Curriculum Development	$250	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
	Review of Course Documentation and Portfolios (Training Delivery Level)	$200	4.8	8.0	8.0	8.0	8.0	3.2	3.2	3.2	3.2	3.2
	Review of Course Documentation and Portfolios (Instructional Design Level)	$200	0.0	4.3	7.2	7.2	7.2	7.2	2.9	2.9	2.9	2.9
	Review of Course Documentation and Portfolios (Program Design Level)	$150	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
	Review of Final Capstone Project	$150	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
Total Fees/Income			**71.1**	**98.8**	**122.9**	**131.3**	**131.3**	**115.7**	**98.4**	**85.8**	**85.8**	**85.8**

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Table 5.4. (Continued).

Costs (Constant $ in Thousands) Note: These are recurring operating costs, both fixed and variable. There are other one time startup costs that will have to be invested and recovered over time or covered through other possible sources.												
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fixed Costs (Overall)	Updates for Task Analysis, Competency Model and Program Review (ongoing and major update every 5 yrs, incl. SME travel)		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	Marketing to Agencies / ROI Analysis		10.0	10.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Public Website Maintenance		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Legal Costs (incl. insurance)		7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	Credential Management System License and Admin		15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Total Fixed Costs			**47.5**	**47.5**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**
Variable Costs			**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Training Delivery Courses	Mentoring Course (In-Person)	$1,500	28.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	Oral and Written Communication	$1,000	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0	2.0
	Adult Learning	$1,000	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0	2.0
	Delivering Instruction	$1,000	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0	2.0
Instructional Design Courses	Assessment and Process Analysis	$1,000	0.0	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0
	Instructional Technology	$1,000	0.0	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0
	Lesson Plan Design	$1,000	0.0	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0
	Instructional Material Development	$1,000	0.0	3.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0
Program Design Courses	Standards-Based Training	$1,000	0.0	0.0	3.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0
	Program Evaluation and Management	$1,000	0.0	0.0	3.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0
	Curriculum Development	$1,000	0.0	0.0	3.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0
	Review of Course Documentation and Portfolios (Training Delivery Level) ($25/person/course)	$25	2.4	4.0	4.0	4.0	4.0	1.6	1.6	1.6	1.6	1.6
	Review of Course Documentation and Portfolios (Instructional Design Level) ($25/person/course)	$25	0.0	2.2	3.6	3.6	3.6	3.6	1.4	1.4	1.4	1.4
	Review of Course Documentation and Portfolios (Program Design Level) ($25/person/course)	$25	0.0	0.0	1.3	2.1	2.1	2.1	2.1	0.8	0.8	0.8
	Review of Capstone Projects	$100	0.0	0.0	1.7	2.8	2.8	2.8	2.8	1.1	1.1	1.1
Total Variable Costs			**39.9**	**63.2**	**84.5**	**89.5**	**89.5**	**78.1**	**63.9**	**55.0**	**55.0**	**55.0**
Total Costs			**87.4**	**110.7**	**124.5**	**129.5**	**129.5**	**118.1**	**103.9**	**95.0**	**95.0**	**95.0**
Annual Cost Excess/Shortage			**-16.3**	**-11.9**	**-1.6**	**1.8**	**1.8**	**-2.4**	**-5.5**	**-9.2**	**-9.2**	**-9.2**
Cumulative Reserve/Loss			**-16.3**	**-28.2**	**-29.8**	**-28.0**	**-26.2**	**-28.6**	**-34.1**	**-43.3**	**-52.5**	**-61.7**

Table 5.5. Operating revenue vs. cost analysis of transit trainer and mentor certification program—medium participation estimate/adjusted pricing.

			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Participation												
	Participating Trainers (from Year 1 population)		**36**	**36**	**36**	**36**	**36**	**0**	**0**	**0**	**0**	**0**
	Participating Trainers (from New Hires each year)		**0**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**
	Participating Mentors		**296**	**296**	**296**	**296**	**296**	**296**	**296**	**296**	**296**	**296**
Fees/Income (Constant $ in Thousands)												
	Certification System Registration (Charged at beginning to participating instructors)	$100	3.6	6.0	6.0	6.0	6.0	2.4	2.4	2.4	2.4	2.4
Training Delivery Courses	Mentoring Course (In-Person)	$260	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
	Oral and Written Communication	$250	5.4	9.0	9.0	9.0	9.0	3.6	3.6	3.6	3.6	3.6
	Adult Learning	$250	5.4	9.0	9.0	9.0	9.0	3.6	3.6	3.6	3.6	3.6
	Delivering Instruction	$250	5.4	9.0	9.0	9.0	9.0	3.6	3.6	3.6	3.6	3.6
Instructional Design Courses	Assessment and Process Analysis	$250	0.0	4.9	8.1	8.1	8.1	8.1	3.2	3.2	3.2	3.2
	Instructional Technology	$250	0.0	4.9	8.1	8.1	8.1	8.1	3.2	3.2	3.2	3.2
	Lesson Plan Design	$250	0.0	4.9	8.1	8.1	8.1	8.1	3.2	3.2	3.2	3.2
	Instructional Material Development	$250	0.0	4.9	8.1	8.1	8.1	8.1	3.2	3.2	3.2	3.2
Program Design Courses	Standards-Based Training	$250	0.0	0.0	3.8	6.3	6.3	6.3	6.3	2.5	2.5	2.5
	Program Evaluation and Management	$250	0.0	0.0	3.8	6.3	6.3	6.3	6.3	2.5	2.5	2.5
	Curriculum Development	$250	0.0	0.0	3.8	6.3	6.3	6.3	6.3	2.5	2.5	2.5
	Review of Course Documentation and Portfolios (Training Delivery Level)	$200	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
	Review of Course Documentation and Portfolios (Instructional Design Level)	$200	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Review of Course Documentation and Portfolios (Program Design Level)	$150	0.0	0.0	3.8	6.3	6.3	6.3	6.3	2.5	2.5	2.5
	Review of Final Capstone Project	$150	0.0	0.0	3.8	6.3	6.3	6.3	6.3	2.5	2.5	2.5
Total Fees/Income			**100.4**	**141.9**	**178.1**	**190.7**	**190.7**	**167.3**	**141.3**	**122.4**	**122.4**	**122.4**

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Table 5.5. (Continued).

Costs (Constant $ in Thousands) Note: These are recurring operating costs, both fixed and variable. There are other one time startup costs that will have to be invested and recovered over time or covered through other possible sources.												
			Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Fixed Costs (Overall)	Updates for Task Analysis, Competency Model and Program Review (ongoing and major update every 5 yrs, incl. SME travel)		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	Marketing to Agencies / ROI Analysis		10.0	10.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Public Website Maintenance		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Legal Costs (incl. insurance)		7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	Credential Management System License and Admin		15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Total Fixed Costs			**47.5**	**47.5**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**
Variable Costs			**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Training Delivery Courses	Mentoring Course (In-Person)	$1,500	37.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
	Oral and Written Communication	$1,000	5.0	8.0	8.0	8.0	8.0	3.0	3.0	3.0	3.0	3.0
	Adult Learning	$1,000	5.0	8.0	8.0	8.0	8.0	3.0	3.0	3.0	3.0	3.0
	Delivering Instruction	$1,000	5.0	8.0	8.0	8.0	8.0	3.0	3.0	3.0	3.0	3.0
Instructional Design Courses	Assessment and Process Analysis	$1,000	0.0	4.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0	3.0
	Instructional Technology	$1,000	0.0	4.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0	3.0
	Lesson Plan Design	$1,000	0.0	4.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0	3.0
	Instructional Material Development	$1,000	0.0	4.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0	3.0
Program Design Courses	Standards-Based Training	$1,000	0.0	0.0	4.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0
	Program Evaluation and Management	$1,000	0.0	0.0	4.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0
	Curriculum Development	$1,000	0.0	0.0	4.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0
	Review of Course Documentation and Portfolios (Training Delivery Level) ($25/person/course)	$25	3.6	6.0	6.0	6.0	6.0	2.4	2.4	2.4	2.4	2.4
	Review of Course Documentation and Portfolios (Instructional Design Level) ($25/person/course)	$25	0.0	3.2	5.4	5.4	5.4	5.4	2.2	2.2	2.2	2.2
	Review of Course Documentation and Portfolios (Program Design Level) ($25/person/course)	$25	0.0	0.0	1.9	3.2	3.2	3.2	3.2	1.3	1.3	1.3
	Review of Capstone Projects	$100	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
Total Variable Costs			**56.1**	**89.7**	**120.3**	**129.3**	**129.3**	**110.7**	**91.4**	**78.0**	**78.0**	**78.0**
Total Costs			**103.6**	**137.2**	**160.3**	**169.3**	**169.3**	**150.7**	**131.4**	**118.0**	**118.0**	**118.0**
Annual Cost Excess/Shortage			**-3.2**	**4.6**	**17.8**	**21.4**	**21.4**	**16.6**	**9.9**	**4.4**	**4.4**	**4.4**
Cumulative Reserve/Loss			**-3.2**	**1.4**	**19.2**	**40.6**	**62.0**	**78.6**	**88.5**	**93.0**	**97.4**	**101.8**

Table 5.6. Operating revenue vs. cost analysis of transit trainer and mentor certification program—break even participation level.

			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Participation												
	Participating Trainers (from Year 1 population)		**48**	**48**	**48**	**48**	**48**	**0**	**0**	**0**	**0**	**0**
	Participating Trainers (from New Hires each year)		**0**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
	Participating Mentors		**270**	**270**	**270**	**270**	**270**	**270**	**270**	**270**	**270**	**270**
Fees/Income (Constant $ in Thousands)												
	Certification System Registration (Charged at beginning to participating instructors)	$100	4.8	8.0	8.0	8.0	8.0	3.2	3.2	3.2	3.2	3.2
Training Delivery Courses	Mentoring Course (In-Person)	$250	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5
	Oral and Written Communication	$250	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
	Adult Learning	$250	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
	Delivering Instruction	$250	7.2	12.0	12.0	12.0	12.0	4.8	4.8	4.8	4.8	4.8
Instructional Design Courses	Assessment and Process Analysis	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Instructional Technology	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Lesson Plan Design	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
	Instructional Material Development	$250	0.0	6.5	10.8	10.8	10.8	10.8	4.3	4.3	4.3	4.3
Program Design Courses	Standards-Based Training	$250	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Program Evaluation and Management	$250	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Curriculum Development	$250	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Review of Course Documentation and Portfolios (Training Delivery Level)	$200	9.6	16.0	16.0	16.0	16.0	6.4	6.4	6.4	6.4	6.4
	Review of Course Documentation and Portfolios (Instructional Design Level)	$200	0.0	8.6	14.4	14.4	14.4	14.4	5.8	5.8	5.8	5.8
	Review of Course Documentation and Portfolios (Program Design Level)	$150	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
	Review of Final Capstone Project	$150	0.0	0.0	5.0	8.4	8.4	8.4	8.4	3.4	3.4	3.4
Total Fees/Income			**98.7**	**154.1**	**202.3**	**219.1**	**219.1**	**187.9**	**153.3**	**128.1**	**128.1**	**128.1**

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Table 5.6. (Continued).

Costs (Constant $ in Thousands) Note: These are recurring operating costs, both fixed and variable. There are other one time startup costs that will have to be invested and recovered over time or covered through other possible sources.												
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fixed Costs (Overall)	Updates for Task Analysis, Competency Model and Program Review (ongoing and major update every 5 yrs, incl. SME travel)		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	Marketing to Agencies / ROI Analysis		10.0	10.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Public Website Maintenance		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Legal Costs (incl. insurance)		7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	Credential Management System License and Admin		15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Total Fixed Costs			**47.5**	**47.5**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**	**40.0**
Variable Costs			**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Training Delivery Courses	Mentoring Course (In-Person)	$1,500	34.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
	Oral and Written Communication	$1,000	6.0	10.0	10.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0
	Adult Learning	$1,000	6.0	10.0	10.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0
	Delivering Instruction	$1,000	6.0	10.0	10.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0
Instructional Design Courses	Assessment and Process Analysis	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
	Instructional Technology	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
	Lesson Plan Design	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
	Instructional Material Development	$1,000	0.0	6.0	9.0	9.0	9.0	9.0	4.0	4.0	4.0	4.0
Program Design Courses	Standards-Based Training	$1,000	0.0	0.0	5.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0
	Program Evaluation and Management	$1,000	0.0	0.0	5.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0
	Curriculum Development	$1,000	0.0	0.0	5.0	7.0	7.0	7.0	7.0	3.0	3.0	3.0
	Review of Course Documentation and Portfolios (Training Delivery Level)	$25	4.8	8.0	8.0	8.0	8.0	3.2	3.2	3.2	3.2	3.2
	Review of Course Documentation and Portfolios (Instructional Design Level)	$25	0.0	4.3	7.2	7.2	7.2	7.2	2.9	2.9	2.9	2.9
	Review of Course Documentation and Portfolios (Program Design Level)	$25	0.0	0.0	2.5	4.2	4.2	4.2	4.2	1.7	1.7	1.7
	Review of Capstone Projects	$100	0.0	0.0	3.4	5.6	5.6	5.6	5.6	2.2	2.2	2.2
Total Variable Costs			**57.3**	**103.8**	**139.6**	**149.5**	**149.5**	**126.7**	**102.4**	**84.5**	**84.5**	**84.5**
Total Costs			**104.8**	**151.3**	**179.6**	**189.5**	**189.5**	**166.7**	**142.4**	**124.5**	**124.5**	**124.5**
Annual Cost Excess/Shortage			**-6.1**	**2.7**	**22.7**	**29.6**	**29.6**	**21.2**	**11.0**	**3.6**	**3.6**	**3.6**
Cumulative Reserve/Loss			**-6.1**	**-3.4**	**19.4**	**49.0**	**78.6**	**99.8**	**110.7**	**114.4**	**118.0**	**121.6**

Table 5.7. Operating surpluses or losses.

	10 year cumulative reserve/(loss)	Long-term annual reserve/(loss) (Year 8 and later)
Low Participation	-$61,700	-$9,200
Medium Participation	$101,800	$4,400
High Participation	$238,100	$15,100

The numbers show that, if the "medium level" of participation can be achieved and the other participation assumptions hold valid, the program can be sustainably offered. However, the margins are always fairly small and the potential AO will always be in a somewhat precarious position where a small change in demand or costs will result in an operating loss. Even at a high level of participation, the projected cumulative reserve over 10 years is not likely to attract an organization to invest in the up-front development costs. An ongoing commitment of the industry and the steering committee will be necessary for the program to be implemented.

Making the Business Case to Transit Organizations—Impact and Potential ROI of Instructor Training and Certification

Understanding that agencies will need to make significant investments to support the program in terms of paying for registration fees and allowing instructors the time needed away from work to complete the program, it is essential that agency managers value the outcome. When it comes to measuring the impact and ROI of an instructor training, development, and certification program, one question becomes essential: How much does a transit agency benefit from technical training and how is that benefit enhanced by skilled instructors? Research shows that in both cases investment in technical training pays dividends.

Transit Technical Training Makes a Difference

A study aimed specifically at transit calculated significant gains regarding ROI from technical workforce training (Transportation Learning Center 2010b). Research conducted at the Capital District Transportation Authority (CDTA), Albany, NY, showed that as a result of training provided under a special program:

- Average test scores improved by 43 percent.
- Some test scores improved by 70 percent.
- Miles between breakdowns improved by 18 percent.
- Bus spare ratio fell from 20 percent to 13 percent.
- More maintenance repair work stayed in-house.
- Work culture among technicians also improved.

In total, 23 classes developed in-house by CDTA instructors were provided to 202 students over a one year period. The training addressed both basic and advanced technology subjects including engines, transmissions, hydraulics, and preventive maintenance. The results were impressive.

A true measure of an agency's maintenance program is to keep vehicle defects to a minimum. Defects left unattended lead to breakdowns, passenger interruptions, and safety concerns. Fortunately for the effort to measure ROI at CDTA, the agency has an annual fleet inspection

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conducted by an independent contractor to measure overall maintenance efficiency. One activity is to inspect a percentage of the bus fleet on an annual basis and itemize the number of defects found. After conducting the extra training, the average number of per-bus defects at CDTA fell from 8.4 to 5.9 percent, an impressive 30 percent improvement.

When the defect reduction was compared to specific training classes given through the program, the results were even more impressive. Regarding engine defects for example, where five training classes were provided, the number of defects in this critical category fell 44 percent. The training at CDTA also led to the reduction of outsourcing, a practice where vendors perform certain repair and maintenance work because the agency's own technicians lack the required technical knowledge and ability. The practice brings with it many disadvantages. The primary disadvantage is that extensive outsourcing makes the agency dependent on others to do much of their work. As a result, costs and scheduling cannot be controlled. Such was the case with CDTA: lack of skills was making the agency dependent on others to do much of the critical engine and transmission work. Following training in these specific areas, however, the agency was able to bring 50 percent of this work back in-house and make the repairs themselves. Based on interviews with 20 maintenance personnel, the ability to perform work in-house combined with the enhanced skills made possible by the training has re-energized the workforce, improved working relations, and established a "can do" attitude throughout the maintenance department.

Training ROI in Pennsylvania

The transit ROI study also included the benefits derived from over 11,000 maintenance training opportunities provided to various transit agencies in Pennsylvania. In this example, results of the technical training show a return of five to 12 times the training investment. The SEPTA, the largest agency participating in the training program, demonstrated several quantifiable gains derived through the training. In the area of mean distance between failures (MDBF), an indication of in-service vehicle reliability, the research compared SEPTA's bus garages that did not receive any preventive maintenance (PM) training to those garages that did receive training. Following PM training where technicians were taught to identify and repair defects before they result in a mechanical failure, MDBF showed improvements each month with up to 1,797 more miles traveled between failures, or 39 percent improvement in miles driven between failures. This translates to fewer passengers being inconvenienced by buses that fail in service, thereby improving the agency's performance and public image.

At a smaller transit agency in Pennsylvania where technicians lacked essential electrical skills, specialized training led to a sharp reduction in charging system related failures. Prior to taking these classes, many technicians were replacing perfectly good batteries because of their inability to properly diagnose charging system faults. Following the training, battery costs were reduced 26 percent.

Another key measurement in bus maintenance is the ratio between scheduled maintenance events where activities are accomplished as planned service events, and unscheduled maintenance where repair jobs are usually the result of breakdowns. It is more advantageous to accomplish repairs while the vehicle is receiving scheduled maintenance than having to chase unscheduled repairs where vehicle downtime is not anticipated. Following the training provided to SEPTA technicians, unscheduled maintenance activities fell from 51 percent to 42 percent of the total maintenance activities. The reduction of unscheduled maintenance is a strong indicator of improved equipment performance, which generates cost savings from not having so many disruptive and costly breakdowns and unscheduled overtime.

The time and effort spent on BMT at all skill levels also produced impressive improvements in parts and labor cost reduction in many of SEPTA's major maintenance/repair categories.

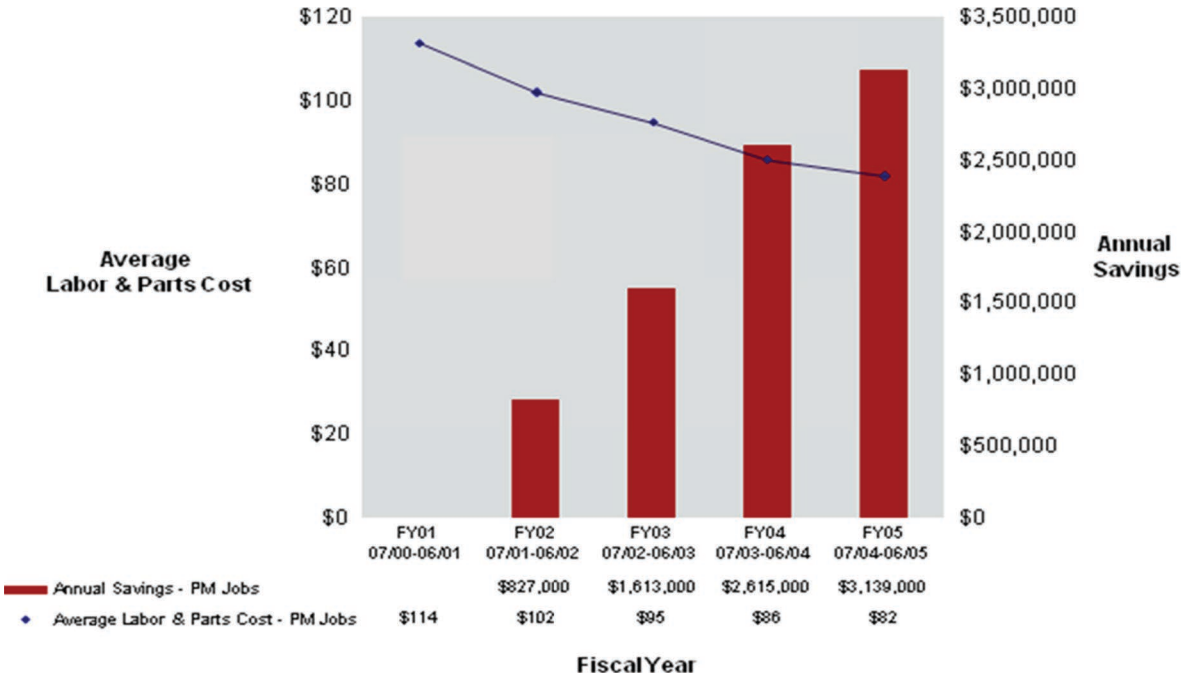


Figure 5.1. Average labor & parts cost and annual savings—SEPTA bus PM jobs.

Figure 5.1 showcases an example of such savings. A PM job that once cost $114 in labor and materials now cost only $82 after four years of training because of improved skill levels, a result of improved diagnostic abilities and an overall reduction in the time needed to make repairs. SEPTA has saved a total of $8,194,000 on bus PM jobs due to its training initiatives.

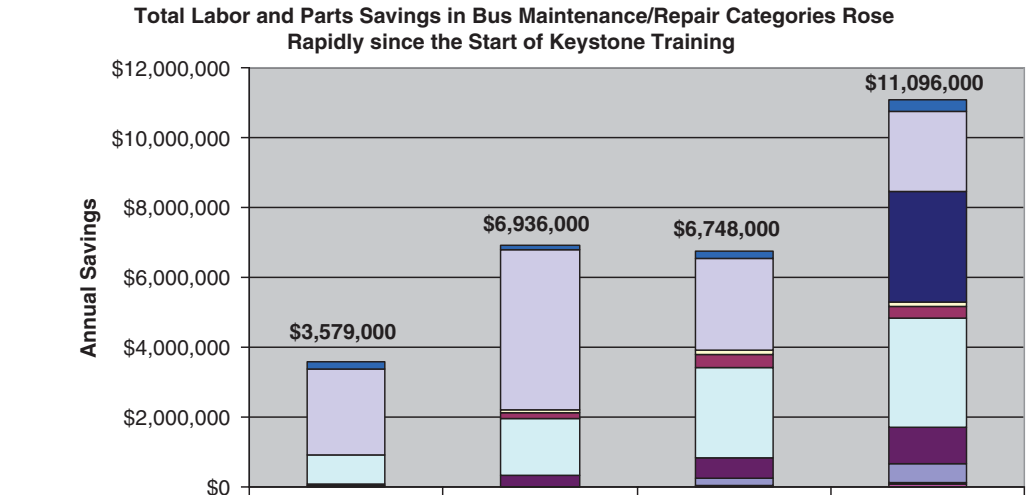
A broader cost/benefit analysis shows that SEPTA's training investment has produced impressive financial gains. Figure 5.2 summarizes the total savings from reduced labor time and materials needed to accomplish maintenance jobs at SEPTA throughout the training period. As illustrated in Figure 5.2, annual savings in all bus maintenance/repair categories rose rapidly from $3.6 million in 2002 (the first year of Keystone) to $11 million in 2005.

Understanding that calculating the effect of training is not an exact science, the study estimated that SEPTA's investment of $2,625,127 to train its bus maintenance workforce over a four-year period led to a combined cost savings of between $10 million and $22 million. The savings in vehicle maintenance, repair, and bus capital costs provides solid evidence that investment in training does provide financial benefits.

Instructor Training and Development Makes a Difference: Research Evidence

It's commonly understood that highly proficient teachers and instructors do make a difference when it comes to student achievement. Unfortunately, there is no known ROI study that quantifies instructor effectiveness in a transit maintenance environment.

However, a study conducted by the ROI Institute, Inc. regarding the impact of instructor development on student retention and corresponding ROI in an automotive training environment produced impressive findings (Imagine America Foundation 2010). The research was conducted at a campus of UTI, a provider of technical training for students seeking careers as automotive, marine and heavy-duty truck technicians. UTI is featured in the Best Practices chapter of this project.



	FY02 07/01-06/02	FY03 07/02-06/03	FY04 07/03-06/04	FY05 07/04-06/05
Accident	$187,000	$163,000	$187,000	$329,000
Capitalization (Overhaul)	$2,461,000	$4,566,000	$2,628,000	$2,320,000
Inspection Repairs	$0	$0	$0	$3,140,000
Operator Report	$32,000	$68,000	$142,000	$138,000
Overhaul	$0	$184,000	$356,000	$341,000
Preventive Maintenance	$827,000	$1,613,000	$2,615,000	$3,139,000
Running Repairs	$0	$326,000	$586,000	$1,021,000
Service Failure	$5,000	$0	$197,000	$540,000
Vandalism	$35,000	$16,000	$34,000	$64,000
Warranty	$32,000	$0	$3,000	$64,000

Figure 5.2. Total labor and parts savings—SEPTA maintenance jobs.

The ROI study focused on measuring the impact of a comprehensive faculty development program provided to UTI by the Center for Excellence in Education (CEE), a career college employee development and performance improvement initiative. Conclusions from the study found that the CEE program had a positive effect on UTI instructors and the students they taught. Seventy-nine percent of the instructors reported their teaching performance had been enhanced as a result of the program, improving their ability to:

- Incorporate multiple teaching styles to better suit a diverse class;
- Develop more ways to make presentations;
- Involve students in classroom teaching to help learners be more active; and
- Increase listening skills to hear students' concerns.

After isolating the effects of the program, converting the measures to monetary value, and identifying the fully loaded costs, the result was a positive ROI of 517 percent for UTI. Enhanced instructor skills contributed to an improvement in student retention and the number of additional courses taken by the students because of the higher quality instruction they received. Additionally, there were notable intangible benefits of the program, including job satisfaction, faculty career development, and student satisfaction.

In addition to the UTI study, there is anecdotal evidence from several technicians whose careers have benefitted from instructors that made a difference. Michele Winn, a woman working as an automotive technician, is one example. She credits the instructors at a technical school that she attended for helping her to achieve a perfect 4.0 grade average and land a well-paying and

satisfying job. The instructors at this particular technical school provided just enough classroom instruction to prepare students for intensive hands-on education, combining theory and practice in a way that engaged students and prepared them for real-world job experiences.

In the article, "The Value of the Maintenance Instructor" (Chamberlin 2010), an aircraft mechanic reflects back on the instructors that made a difference in his career. Over the years Chamberlin observed many instructors in action. As he notes, most were just average, a few were really good, and some had no business being in the profession. The reason he gives for the high number of poor technical instructors is that rarely are there any requirements for them to have received formal training in teaching skills.

Chamberlin goes on to contrast the many investments being made in training technologies such as e-learning with the lack of investment being made with regard to instructor training and preparation. As he notes, the training aids are only valuable tools when used correctly by a skilled instructor. Chamberlin asks: "What's really important in your training program? Is it having the latest technological advances in training aids? Or is it selecting good instructors and providing them with the tools they need to accomplish their jobs?" Hopefully, transit agencies can have both.

Direct evidence pointing to the benefits offered by quality instructors in more traditional teaching settings is plentiful. In the book, *Teacher Quality: Understanding the Effectiveness of Teacher Attributes*, by Jennifer King Rice, the author proves that teacher quality does in fact matter (Rice 2003).The book contends that the teacher is the most important school-related factor influencing student achievement. The publication lends credibility to best practices findings that experience has a positive effect on teacher effectiveness, especially when it comes to "learn-by-doing" instruction. The research also validates this effort in this project to certify transit maintenance instructors because it suggests that teachers who are certified have an increased impact on student achievement.

The study goes on to state that teaching is a complex activity influenced by many elements of teacher quality. The research suggests that investing in teachers can make a difference in student achievement. In a conventional school setting it is estimated that the difference between having a good teacher and a bad one can exceed one grade-level equivalent in annual achievement growth. The book points to several studies that argue that the single most important factor affecting student achievement is the teacher, and the effects of teachers on student achievement are both additive and cumulative. Further, the studies contend that lower-achieving students are the most likely to benefit from increases in teacher effectiveness. This is especially important in today's transit environment where many transit technicians may have been subjected to poor quality training in the past.

A study conducted by the Australian Council for Educational Research Annual Conference, *Building Teacher Quality* (Hattie 2003), also provides a direct correlation between teacher quality and student accomplishment. It shows that the students themselves account for about 50 percent of the variance of achievement. It's what students bring to the table that predicts achievement more than any other single variable. Of the remaining 50 percent, teachers account for 30 percent of the variance with schools, principals, and peer effects accounting for the remainder.

The study identified five major characteristics of excellent teachers as those with the ability to:

- Identify essential representations of their subject,
- Guide learning through classroom interactions,
- Monitor learning and provide feedback,
- Attend to affective attributes, and
- Influence student outcomes.

Taken together, the sources provided here and elsewhere conclude that quality teachers are a critical determinant of student achievement. There is clear evidence to suggest that technicians are in a better position to perform their jobs when provided with effective instructors.

Certification Improves Instructor Employment Opportunities

While research clearly shows that providing instructors with enhanced teaching skills contributes significantly to student achievement, there is also evidence that instructors themselves benefit from attaining certifications. In the article, "Does Your Resume Need New Acronyms?", the author strongly indicates that in today's business climate, anything that differentiates job candidates from the crowd is critical to building a substantial career (Zupek 2009).

Certifications show employers that job candidates are dedicated and committed to a particular profession and they are credible and knowledgeable about current trends and best practices in their field. The article indicates that certifications are especially beneficial when coupled with an appropriate number of years of experience in a given field of work.

A scan of institutions that offer instructor and teacher certifications points to several other benefits:

- Certification ensures that instructors are trained to consistent skill levels.
- Certified people are more employable; hiring managers believe certified individuals are more productive than their non-certified counterparts.
- Certificated people are typically more productive.
- Certification reduces downtime because staff members have the skills needed to cope with issues as they arise.
- Gaining certifications typically results in increased salaries.
- Certification ensures that knowledge has been retained.
- Certification results in lower staff turnover.

The National Training and Certification Program seeks to improve and verify instructor skills with the intent of not only improving the quality of training delivery to students to make them more proficient, but to elevate the position of maintenance instructor within the transit community. Examples provided in other occupations indicate that these benefits can be achieved for transit maintenance technicians and instructors.

Recommended Procurement Language

At the interim meeting, the panel directed the Project Team to recommend language for transit agencies to include in future vehicle procurement contracts specifying vendor instructor qualifications. APTA's Standard Bus Procurement Guidelines document already contains a section on training. It is proposed that the relevant section be changed to read:

> The Contractor shall have at least one qualified instructor certified through the National Training ICP who shall be available at the Agency's property for [insert number] calendar days between the hours of [insert starting time] and [insert closing time] per month for [insert number] months prior to, and [insert number] months after, acceptance of the first vehicle. Instructor(s) shall conduct schools and advise the personnel of the Agency on the proper operation and maintenance of the equipment. The Contractor also shall supplement classroom instruction with hands-on training and provide visual and other teaching aids (such as manuals, slide presentations, literature and other teaching aids) designed to engage students for use by the Agency's own training staff and which shall become the property of the Agency.

CHAPTER 6

Conclusion

The goal of TCRP Project F-19 was to create the framework for a world-class and credentialed population of professional transit vehicle maintenance instructors. Through collaboration with the Project F-19 panel, diligent and detailed research and the involvement of numerous SMEs in the field, the Project Team designed the foundation for creating, implementing, and sustaining a national program addressing the challenge of training and certifying the vehicle instructor population.

The methodical process of building this program design involved four distinct elements to assure a reasoned and thorough approach ensuring both credibility and confidence in the resulting program model. The first element was a feasibility study, followed by a best practices report, a training and certification program plan and finally a business plan. While each of these elements separately provide a wealth of information and direction toward the eventual program goal, once combined in this report the roadmap for a successful and sustainable instructor training and certification program is truly ready to become a reality.

As with any complex program development effort, Project F-19 was the product of a diverse team of dedicated professionals starting with the Project F-19 panel, TCRP leadership, and the Project Team and including literally hundreds of professionals from the ranks of transit leadership, labor, SMEs, and instructors. As would be expected, there exist many divergent views on almost every aspect of this process and eventual program model. And, while some might see this as an inherent weakness, the Project Team embraced this difference and used it to create a process and product that reflected the widest possible range of ideas and interests while also finding resonance in the best approaches and solutions available.

The program that emerged and that is represented in this report has the potential to radically change the way transit vehicle maintenance instructors are trained and credentialed. Not only does this ensure a national plan of action for the process of training these professionals, it provides a rigorous path to certification that assures that any instructor meeting the credentialing requirements is without question qualified both as an expert technician and as a training professional.

The anticipated next step in this process is the creation of a national organizational body to oversee the implementation and governance of this program. It will be their charge to build the organizational foundation to support this program. The selection of an AO will be one of the key responsibilities of this group, as will the final specifications of the training and certification process.

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List of Abbreviations, Acronyms, Initials, and Symbols

ACCSC	Accrediting Commission of Career Schools and Colleges
APTA	American Public Transportation Association
APTREX	American Public Transit Exam Institute
ASE	Automotive Service Excellence
ASTD	American Society for Training and Development
ATD	Association for Talent Development
ATMC	Automotive Training Managers Council
ATU	Amalgamated Transit Union
BFM	General—Bus Fleet Maintenance
BMT	Bus Maintenance Training
CASE	Continuing Automotive Service Education
CDTA	Capital District Transportation Authority
CEE	Center for Excellence in Education
Center	Transportation Learning Center
CTG	Custom Training Group
CUTR	Center for Urban Transportation Research at the University of South Florida
DBE	Disadvantaged Business Enterprise
DOL	Department of Labor
E/E Consortium	Elevator/Escalator Training Consortium
FAA	Federal Aviation Administration
FTA	Federal Transit Administration
GM	General Motors
HVAC	Heating, Ventilation, and Air Conditioning
ICP	Instructor Certification Program
IMI	International Masonry Institute
ISD	Instructional System Design
ITCRB	International Transit Certification Review Board
LACMTA	Los Angeles County Metropolitan Transportation Authority
LIUNA	Laborers International Union of North America
LYNX	Public Transportation System in Orlando, Florida
MARTA	Metropolitan Atlanta Rapid Transit Authority
MDBF	Mean Distance Between Failures
NATEF	National Automotive Technicians Education Foundation
NOCTI	National Occupational Competency Testing Institute
NTD	National Transit Database
NTI	National Transit Institute
NYCT	New York City Transit

OEM	Original Equipment Manufacturer
OJT	On-the-Job Training
ROI	Return on Investment
SAE	Society of Automotive Engineers
SCRTTC	Southern California Regional Transit Training Consortium
SEPTA	Southeastern Pennsylvania Transportation Authority
SME	Subject Matter Expert
SOP	Standard Operating Procedures
TCRP	Transit Cooperative Research Program
TK	Thermo King
TLC	Transportation Learning Center
TRB	Transportation Research Board
TTN	Transit Training Network
TWU	Transport Workers Union
UA	Unified Association of the Pipefitting Industry
US DOL	United States Department of Labor
UTI	Universal Technical Institute
VIA	VIA Metropolitan Transit (San Antonio, Texas)
WMATA	Washington Metropolitan Area Transit Authority

APPENDIX A

List of Alternative Courses

Course Substitution Process and Alternative Courses

This section provides a preliminary listing of possible alternative courses, and describes the conditions under which candidates seeking national instructor certification can apply these courses. The intent is to allow those candidates who have already received instruction that meets certain conditions to achieve certification, thereby avoiding duplication and saving time. The process also permits candidates to fast track the certification process by taking approved alternative courses in advance of those scheduled by the certification program. The flexibility is intended to give instructor candidates increased choices towards reaching certification without compromising the program's validity.

Note: The alternative courses listed below are preliminary; research continues to seek additional course offerings. A challenge facing the search effort is the limited number of "plug-and-play" courses that fully satisfy the duration and learning objectives established within this project. Many courses, for example, are part of larger educational programs where it is uncertain if the provider will make certain elements available a la carte. In other cases, some of the examples presented here are not fully developed course offerings but instead consist of reference materials or related work accomplished by competent organizations. The collective information provides the Panel and eventual program management with a preliminary indication of organizations with existing courses or that have the experience and ability to develop suitable courses.

Course Substitution Process

The Research Team proposes that any candidate seeking certification under this program may request that a non-program course be considered for substitution for one of the required certification courses using the following guidelines:

- A substitute course must contain equal or greater contact hours as the certification course.
- A substitute course must cover the same or greater content area as the certificate course as determined by course objectives.
- A substitute course must have equal or greater academic rigor and complexity as the certificate course.
- Evaluation of student mastery must be equal to or greater than that required in the certification course.
- A student must present a certificate of completion, transcript or other official instrument documenting satisfactory participation and completion of the substitute course.
- The capstone course will not be considered for substitution under any circumstances.
- Acceptance of substitute courses does not in any way change the certification requirements of the capstone course and subsequent certification.

- A substitute course must have been complete no later than 5 years from the time the requested substitution is filed.
- A fee may be applied to each requested course substitution, regardless of outcome.
- No more than four (4) courses can be substituted for certification courses.

An initial group of equivalent courses will be determined within the first year of the program and additional courses may be added later as required. The initial group of courses and each subsequent review for substitute course requests will be determined by the program's eventual management team. It is envisioned that the course validation process will be conducted by a team of subject matter experts (SME's) and instructional designers under the direction of the program management to assure conformity to both content and academic standards established for the certification process.

Also, as part of the alternative course process, if someone has earned an associate degree in a related field, he/she may be able to substitute suitable courses obtained through that degree to meet certain National Instructor Certification requirements. The same team of SME's and instructional designers will make these determinations under program management guidance.

Alternative Courses

As stated above, alternative courses will be selected and approved through a formal process developed by the program management team. The list of alternative courses provided here is by no means comprehensive nor is it intended as the only suitable alternative course listing available to the program. The Research Team also wants to be clear that final determination for the alternative courses will be made by the eventual program management.

Mentoring and Coaching

Mentoring and coaching courses need not be maintenance specific to be effective. Many of the attributes of a successful mentoring program apply regardless of the occupation. Although the program course will tailor its instruction specifically to a transit maintenance audience, several sources are available for developing these skills in a more generic manner. Potential alternative courses are listed first followed by reference material on mentoring.

Mentoring and Coaching

Source	Details
Management Mentors www.management-mentors.com/	**Overview:** Management Mentors is a consulting firm specializing in designing and implementing successful mentoring programs. **Training Products:** Management Mentors offers an interactive, online course on mentoring training for $79 per student. The course introduces students to crucial mentoring skills and key concepts of organizational mentoring programs. It uses audio skits, interactive quizzes, and dynamic tutorials to address several aspects of mentoring and coaching. Mentoring University, its sister company, also offers a mentoring certification program based on experience and tested principles of mentoring that the company has used for 20 years. **Transit Specific**: No
Association for Talent Development (ATD) www.astd.org/	**Overview:** The Association for Talent Development (ATD), formerly ASTD, claims to be the world's largest association dedicated to those who develop talent in organizations. They take the knowledge, skills, and abilities of others and help them achieve their full potential. **Training Products:** A course entitled *Essentials of Coaching SMEs to Facilitate Learning* prepares SMEs in a particular organization to deliver value-added learning. Courses can be delivered on-site or online. **Transit Specific:** No
EDSI Solutions www.edsisolutions.com	**Overview:** EDSI is a workforce development, customized training and consulting company. EDSI has worked with many different public transit agencies to analyze jobs, perform skill gap analysis and develop training curriculum. EDSI has also developed and delivered train-the-trainer programs to transit agencies across the country. **Training Products:** EDSI has developed a course on mentoring and coaching specifically for transit applications. **Transit Specific:** Yes

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Lorain County Community College (LCCC) www.ohiohighered.org	**Overview:** LCCC is part of The University System of Ohio, serving almost 600,000 students. **Training Products:** LCCC's course on mentoring and coaching provides students with a comprehensive understanding of the concepts, principles, and practice of coaching and mentoring through theoretical and practical applications. Although they offer traditional semester-long courses, they, like other community colleges, may be willing to offer abbreviated courses tailored for specific instructor certification program needs. **Transit Specific:** No
Germanna Community College (GCC) www.germanna.edu	**Overview:** GCC is one of twenty-three community colleges in Virginia that comprise the Virginia Community College System. **Training Products:** GCC offers an Online Mentoring Program for instructors who wish to learn new online teaching methods. This particular course, although not directly applicable to certification candidates, may be of interest to the firm that ultimately takes management control of this project because many of the courses developed for the instructor certification program may be online courses. **Transit Specific:** No
Reference Material	
Chronus http://get.chronus.com	**Overview:** Offers development software to assist organizations to develop their own mentoring and coaching programs. Although the firm does not appear to offer specific courses, materials provided through the firm could serve as useful reference materials for developing the program course. As an example, a one-hour webinar is available that uses a series of best practice examples as the basis for designing and implementing a mentoring and coaching program. Chronus materials have been used at leading institutions including Comcast, Staples, PNC Bank, The Federal Reserve, MIT, and the American Diabetes Association. **Transit Specific: No**
Transportation Learning Center (TLC) www.transittraining.net	**Overview:** Mentoring Guidebook addresses how to structure a mentor program with material on adult learning, roles of mentors and mentees, selection process, and benefits. **Transit Specific:** Yes

Adult Learning

Source	Details
The Murphy Institute (CUNY School of Professional Studies) http://sps.cuny.edu	**Overview:** The City University of New York provides high-quality, accessible education for more than 269,000 degree-credit students and 270,000 adult, continuing and professional education students at 24 campuses across New York City. **Training Products:** Offers two programs focused on instruction of adult learners - Graduate Certificate in Adult Learning: Program Design and Facilitation, and Certificate in Understanding How Adults Learn. **Transit Specific:** No
Association for Talent Development (ATD) http://www.astd.org/	**Overview:** (See Mentoring and Coaching above) **Training Products:** A course entitled *Essentials of Adult Learning* explains the principles of adult learning in the context of workplace implementation, providing tips for design as well as facilitation. In addition to "classic" theorists like Malcolm Knowles, participants learn new approaches to adult learning, capitalizing on new brain research and informal learning processes. **Transit Specific:** No
ed2go http://www.ed2go.com/	**Overview:** The ed2go network offers instructor-led online courses. New courses start monthly, and all courses run for six weeks and are composed of 12 lessons, representing 24 hours of instruction. Students can ask questions and give or receive advice at any time during the course. **Training Products:** A course entitled *Teaching Adult Learners* explores the unique needs and motivations of adult students to reveal their expectations in class, examines different learning styles and multiple intelligences, and looks at how instructors can teach to each learner's strengths. **Transit Specific:** No
EDSI Solutions www.edsisolutions.com	**Overview:** (See Mentoring and Coaching above) **Training Products:** EDSI offers two complete courses on Learning Styles and the Adult Learner. The introductory course provides basics regarding learning styles and adult learning principles including ways to engage adult learners. The advanced course provides students with concrete theories and tools to use in real training experiences. Participants will be able to apply the principles from Malcolm Knowles' theory of Adult Learning and Howard Gardner's theory of Multiple Intelligences to specific learners and learning situations. **Transit Specific:** No

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Reference Material	
Federal Highway Administration www.nhi.fhwa.dot.gov	Principles of Adult Learning and Instructional System Design https://www.nhi.fhwa.dot.gov/downloads/freebies/172/PR percent20Pre-course percent20Reading percent20Assignment.pdf **Transit Specific:** No

Communication: Oral and Written

Source	Details
Langevin Learning Services http://www.langevin.com	**Overview:** Langevin claims to be the world's largest Train-The-Trainer company and a leader in the industry with the most days of training scheduled per year, the largest selection of workshops, the largest faculty of full-time, dedicated course leaders, and the largest client base in the training profession. Several course offerings apply to this project and deserve further investigation. Langevin is used by ThermoKing to help prepare its training staff. **Training Products:** Langevin offers a one-day workshop entitled Polishing Your Presentation Skills for $599. Attendees also receive free one-year follow-up service where by students send in a video-recording of themselves instructing and Langevin will provide detailed feedback to further develop communication skills. *Note: This course does not address written communication.* **Transit Specific:** No
Mind Tools	**Overview:** Mind Tools is an online provider that delivers over 1,000 pieces of training content in an "a la carte" fashion. **Training Products:** A variety of online products are available to improve writing skills in specific areas. A website is dedicated to written communication, including a "browse by category" box to target specific communication skills. Individuals can access training products at fees starting at $200 per year. **Transit Specific:** No
Improving Communications www.improvingcommunications.com	**Overview:** Improving Communications is a New York based training firm that offers business writing, public speaking, customer service, and leadership & management training. **Training Products:** Offers several training courses in NY City. One in particular, Writing

	Like a Superstar, is a four hour course that provides clarity and correctness in written communication. **Transit Specific:** No
Reference Material	
Langevin Learning Services http://www.langevin.com	**Overview:** Self-study kit designed for training professionals who want to write clear, concise, and professional training materials. It shows you how to transform job-related knowledge and skill into written communication that is targeted to your audience for a fee of $499. **Transit Specific:** No

Delivering Instruction: Classroom and Hands-on

Source	Details
Washtenaw Community College (WCC) http://www.wccnet.edu	**Overview:** Washtenaw Community College is a large community college in southern Michigan. Its programs in Apprenticeship and Occupational Studies lead to certificates and associates degrees in skilled trades and automotive technologies. Current skilled trade clients include the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry (UA) and the iron workers. **Training Products:** A course on Interactive Teaching for the UA Trade Instructor is designed to enhance teaching and interaction techniques for technical instructors in the classroom. It provides instructors with tools to more effectively engage an audience, create individual and group discussion, structure classroom setup more conducive to individual participation, manipulate lesson plans to fit a set time frame, and to create student, instructor, and classroom cohesiveness, accelerating learning and comprehension. **Transit Specific:** No
Center for Urban Transportation Research (CUTR)/Florida DOT Maintenance Training http://www.cutr.usf.edu/	**Overview:** The Center for Urban Transportation Research (CUTR) at the University of South Florida is an internationally recognized resource for policymakers, transportation professionals, and the public. CUTR also is the home for the National Center for Transit Research and the National Bus Rapid Transit Institute. **Training Products:** CUTR's Transit Maintenance Analysis and Resource Center (TMAARC), originally formed as The Florida Maintenance Training Program (FMTP), provides several courses in setting up training for transit technicians in classrooms and labs. Courses are delivered through a mix of contracted services and in-house training modules. **Transit Specific:** Yes

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National Transit Institute (NTI) www.ntionline.com	**Overview:** The National Transit Institute, at Rutgers, The State University of New Jersey, was established under the Intermodal Surface Transportation Efficiency Act of 1991 to develop, promote, and deliver training and education programs for the public transit industry. **Training Products:** Transit Trainers' Workshop is a national event focused on training in the transit industry. Individual courses are also provided. NTI's Training and Coaching Skills course provides instructors with skills to structure effective classroom presentations, improve presentation skills, and encourage audience participation. **Transit Specific:** Yes
Association for Talent Development (ATD) http://www.astd.org/	**Overview:** (See Mentoring and Coaching above) **Training Products:** ATD's *Master Trainer Program* uses their expert facilitators to help clients master all aspects of training delivery. The program offers a unique assessment-based certificate that covers the entire process of delivering training, including assessment, preparation, creating a positive learning environment, facilitating learning, and evaluating learning. **Transit Specific:** No
EDSI Solutions www.edsisolutions.com	**Overview:** (See Mentoring and Coaching above) **Training Products:** EDSI offers a course entitled *Presentation Skills*. Course participants get to understand what makes a good presentation and their own strengths and weaknesses regarding presentation skills. This course is highly interactive and focuses on helping improve structure, voice, and content of presentations. Another course on Enhancing Presentations Through PowerPoint demonstrates the pros and cons of using PowerPoint to convey information to an audience. **Transit Specific:** No
Reference Material	
MIT Training and Development http://web.mit.edu/	**Overview:** Training Delivery Guide addresses what makes a training program excellent, how the optimal delivery method might be chosen, and how are we, as diverse participants, engaged and inspired to learn at our best. **Transit Specific:** No
OSHA, Best Practices for Development, Delivery & Evaluation, Susan Harwood Training Grants www.osha.gov	**Overview:** Workbook provides best practice elements to help grantees to better develop, deliver and evaluate training to workers and employers. https://www.osha.gov/dte/shar-wood/best-practices-booklet.pdf **Transit Specific:** No

Assessment and Process Analysis

Source	Details
Center for Urban Transportation Research (CUTR)/Florida DOT Maintenance Training http://www.cutr.usf.edu/	**Overview:** (See Delivering Instruction: Classroom & Hands-On above) **Training Products:** CUTR extensively uses assessments to evaluate their course offerings and to measure learning. Course surveys are completed by each transit agency twice a year before each training session to assess what areas and topics should be covered in classes. Pre- and post-class tests are given to monitor student progress. Assessments are also used to evaluate instructor performance. CUTR has the capability to develop a course for this project based on the assessment processes it uses. **Transit Specific:** Yes
National Occupational Competency Testing Institute (NOCTI) http://www.nocti.org/	**Overview:** NOCTI is a leading provider of high-quality technical competency assessment products and services for secondary and post-secondary educational institutions in the United States and around the world. Their services include job and task analysis, standards development, assessment development and delivery, scoring and analysis services, and student recognition. **Training Products:** NOCTI offers customized assessment solutions to meet the unique needs of a school, district, college, state, or association. NOCTI follows rigorous industry test development guidelines and standards to ensure validity and reliability for every assessment developed. By working with specific industry SMEs, NOCTI facilitates an assessment development workshop facilitated onsite or via web conference to save on travel costs. **Transit Specific:** No
Association for Talent Development (ATD) http://www.astd.org/	**Overview:** (See Mentoring and Coaching above) **Training Products:** *Evaluating Learning Impact Certificate* is a three-day on-site or 21 hour online course where students receive a solid foundation in all aspects of the measurement and evaluation of learning and performance solutions, including making the shift from activity- to results-based learning and development programs, the basics of evaluation design, Kirkpatrick's Levels 1-4, a brief introduction to ROI, communicating results, and practical tips and considerations for making evaluation work in organizations. **Transit Specific:** No

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Standards-Based Training

Source	Details
American Public Transportation Association (APTA) www.apta.com	**Overview:** APTA is an international organization representing the transit industry for over 100 years. APTA members are public organizations engaged in the areas of bus, paratransit, light rail, commuter rail, subways, waterborne passenger services, and high-speed rail. **Training Products:** APTA has worked with transit agency and union stakeholders to develop national training standards for bus maintenance and rail vehicle maintenance, among other technical occupations and maintains a standards Website. Although a specific course is not offered, APTA along with the other organizations listed in this section below is qualified to develop such a course to assist instructors to integrate national training standards into local training programs. **Transit Specific:** Yes
National Institute for Automotive Service Excellence (ASE) www.ase.com	**Overview:** The Institute for Automotive Service Excellence (ASE) works to improve the quality of vehicle repair and service by testing and certifying automotive professionals. More than 350,000 automotive technicians hold ASE certifications, including those developed specifically for bus transit. **Training Products:** The National Automotive Technicians Education Foundation (NATEF), a division of ASE, examines the structure, resources and quality of training programs and evaluates them against standards established by the industry. These standards reflect the skills that students must master to be successful in the industry. The same approach could be applied to developing a course for standards based training in transit. **Transit Specific:** No
Southern California Regional Transit Training Consortium (SCRTTC) www.scrttc.com	**Overview:** SCRTTC was created in response to the industry's need for a trained technical workforce. It includes a coalition of 22 transit agencies, 14 community colleges and other educational institutions, and three private industry partners, based in California and Colorado. **Training Products:** A standard operating procedure (SOP) developed by SCRTTC ensures that courseware and instructors meet established validation, certification and accreditation standards. SCRTTC has the experience needed to develop a course to encourage standards based training. **Transit Specific:** Yes

EDSI Solutions www.edsisolutions.com	**Overview:** (See Mentoring and Coaching above) **Training Products:** In *Extending and Deepening National Transit Training Standards,* EDSI helped the Transportation Learning Center (TLC) develop a methodology to map courseware to curriculum and to address gaps in local courseware and training programs. This research has resulted in significant improvements in local transit training and a piloting of the national training standards. The same expertise could be applied to developing a course for this project. **Transit Specific:** Yes
Transportation Learning Center (TLC) www.transportcenter.org	**Overview:** TLC is a partnership of national leaders of the US transit industry that develops industry-wide solutions and provides support for local and statewide partnerships in areas of common labor-management interest, such as workforce development, training, and safety. **Training Products:** TLC has developed national training standards for six frontline technical occupations, including bus maintenance and rail vehicle maintenance, as well as elevator-escalator maintenance, signals and traction power maintenance, and bus operation. The experience could be useful in developing a course for standards-based training. **Transit Specific:** Yes

Lesson Plan Design/Instructional Material Development

Source	Details
EDSI Solutions www.edsisolutions.com	**Overview:** (See Mentoring and Coaching above) **Training Products:** EDSI, which developed instructional material for several of the APTA bus and rail training standards, offers a series of courses on lesson plan design, instructional design, curriculum development, train-the-trainer, adult learning and other topics of relevance to this project. **Transit Specific:** Yes
TLC Seminars http://www.tlcsem.com	**Overview:** TLC Seminars has significant experience in building people skills with its presentation skills, basic instructor, and advanced instructor training programs, and also in developing new or custom training programs to meet customer needs.

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	Training Products: *Custom Training Development* assists instructors to produce new training programs for new areas and upgrading existing programs. Understanding that existing programs can quickly become outdated because of new models, equipment changes or by their familiarity and repeated use, TLC Seminars can refresh or update any program to meet current trends and technologies. **Transit Specific:** No
Reference Material	
West Virginia Department of Education http://wvde.state.wv.us	**Overview:** Quality Lesson Design describes why lessons plan should be created, what needs to be included, and where to find examples of comprehensive lesson plans. http://wvde.state.wv.us/teach21/quality-lesson-design.html **Transit Specific:** No

Curriculum Development

Source	Details
Universal Technical Institute (UTI) http://www.uti.edu/	**Background:** Universal Technical Institute (UTI) offers automotive, diesel, collision repair, motorcycle, and marine technician training to 19,000 full-time students in the US. **Training Products:** UTI's Custom Training Group (CTG) has worked with companies worldwide to develop special needs courses on a variety of technical training subjects. Training can occur at one of the campuses, or on-site at the customer's facility. CTG can tailor an existing course offering on creating curriculum specifically for transit. **Transit Specific:** No
EDSI Solutions www.edsisolutions.com	**Overview:** (See Mentoring and Coaching above) **Training Products:** EDSI's course entitled *Curriculum Development* is designed to assist qualified instructors with developing curriculum off of existing responsibility and task lists. Focus is on how to organize the information in a logical sequence and grouping. This is a workshop course where each participant will take part in designing a curriculum, therefore, gaining hands-on experience to develop curriculum. **Transit Specific:** Yes

APPENDIX B

Potential Administrating Organizations

Organization Name	Location	Respondent Comments
Colleges, Universities and Technical Schools		
American River College	Sacramento, CA	Clean diesel program
Buffalo State University	Buffalo, NY	
City University of New York (CUNY)	New York, NY	
Davis Applied Technology College (DATC)	Kaysville, UT	
Erie Community College	Orchard Park, NY	Associates degree for Automotive Technology
Hudson Valley Community College	Troy, NY	Local junior college
Los Angeles Trade Technical College	Los Angeles, CA	Curriculum development for So. Cal. Regional Transportation Consortium
New York Institute of Technology (NYIT)	Westbury, NY	
Salt Lake Community College (SLCC)	Salt Lake City, UT	
Tennessee Technology Center at Knoxville	Knoxville, TN	Diesel school, automotive school, and collision repair school
Universal Technical Institute (UTI)	Scottsdale, Arizona	Locations all over the country
University of Buffalo		
Washtenaw Community College	Ann Arbor, MI	Working with the pipefitters trades and iron workers to provide training in a collaborative arrangement
For Profit and Not-for-Profit Training, Research and Technical Assistance Organizations		
Center for Urban Transportation Research (CUTR)/Florida Department of Transportation Maintenance Training	Tampa, FL	
EDSI Consulting	Dearborn, MI	Train the trainer program
Life Cycle Engineering (LCE)	Charleston, SC	Strong combination of engineering, asset, and change management
National Institute for Automotive Service Excellence (ASE)	Leesburg, VA	Testing of technical knowledge
National Transit Institute (NTI)	New Brunswick, NJ	Contact with the SMEs in transit industry
Southern California Regional Transit Training Consortium (SCRTTC)	Long Beach, CA	Group of local transit and community colleges
State Board for Educator Certification (Government)	Austin, TX	Example provided by the survey respondent was the Texas State Board for Educator Certification
Transportation Learning Center	Silver Spring, MD	Development of standard-based training programs in bus, rail car maintenance, etc.

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Organization Name	Location	Respondent Comments
Industry Associations		
APTA	Washington, DC	Connections with OEM bus and components manufacturers
State Association Training Programs (New York Public Transit Association (NYPTA) Transit Training Institute)	Albany, NY	Offers similar education seminars at locations throughout NY
Large Transit Agencies		
King County Metro	Seattle, WA	Large dedicated staff with substantial resources
VIA Metro Transit	San Antonio, TX	Developed and are delivering a transit vehicle maintenance instructor training program. Currently 3 individuals in training
OEMs		
GMC, Ford, Cummins, Allison	Various	

The Association for Talent Development (ATD) (http://www.astd.org) revealed through the best practices research is another organization with the potential to develop a national instructor training and certification program.

Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation