

Final Report to the  
Transit Cooperative Research Program (TCRP)  
Transportation Research Board  
National Academies

on

**Project: No. E-7: Establishing a National Transit Industry  
Rail Vehicle Technician Qualification Program:  
Building for Success**

**TRANSPORTATION RESEARCH BOARD  
LIMITED USE DOCUMENT**

ENCLOSED IS THE *INTRODUCTION AND OVERVIEW* OF THE FINAL REPORT FOR TCRP PROJECT E-07. THIS REPORT HAS BEEN REVIEWED AND APPROVED BY THE TCRP PROJECT PANEL AND IS IN THE FORMAL TCRP PUBLICATION PROCESS. THIS IS A PRE-PUBLICATION UNOFFICIAL VERSION FOR YOUR USE.

**Transportation Learning Center  
Silver Spring, MD**

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# Introduction and Overview

Meeting the challenge of developing fully qualified transit rail car maintenance technicians is the goal of Transit Cooperative Research Project (TCRP) E-7, *Developing an Industry-Wide System of Qualification for Transit Rail Car Technicians – Building for Success*. The best answer, fine tuned by transit industry experts working on this project, is a new multi-part, industry-wide *system* of qualification. This system brings together a broad range of training components including:

- National training standards
- Progressive classroom curriculum and courseware integrated with structured on-the-job learning,
- A credential management system that keeps track of the worker’s training experience and skills
- Apprenticeship frameworks with well designed sequences of learning, support of learners by trained mentors, and specialized training for instructors.

All these components provide the foundation needed for written and hands-on assessments to confirm that technicians have the practical knowledge and skills required to perform their jobs at the highest level of expertise. This new system is designed to apply fully to new hires, with incumbent workers “grandparented” to protect them from any harm from the transition to a new training system that will raise skill levels across the industry.

Working together over the past seven years on the critical occupation of rail car maintenance technicians, the Subject Matter Experts on the National Committee on Transit Rail Car Training and on the Transit Cooperative Research Program E-7 Panel have now developed the components of a highly efficient, cost-effective, top quality training system that can be applied throughout the industry for training on any skilled occupation. This system has been sponsored broadly by transit management and labor organizations in the industry and staffed by the Center. The National Committee has been funded by grants from the US Department of Labor and the Federal Transit Administration as well as by the Transit Cooperative Research Program (TCRP).

This new system of qualification for transit rail car technicians is part of the transit industry’s broader project over the past dozen years to redesign and upgrade of frontline workforce development, with a particular focus on technical maintenance occupations. In addition to Transit Rail Vehicle Maintenance Technicians, this larger effort has addressed four other technical occupations in rail and bus transit – Maintenance Technicians for Transit Elevator-Escalator, Signals and Traction Power on the rail side as well as Bus Maintenance Technicians and Bus Operators on the bus side.

Transit rail car maintenance technicians, as the largest group of maintenance technicians within the rapidly growing transit rail side of public transportation, provide an excellent focus for the in-depth development of transit rail’s system of qualification. Over a five-year period the E-7 project has allowed industry experts to develop in-depth training tools that go beyond what has been developed so far for other transit technical maintenance occupations – Signals, Transit Elevator-Escalator, and Traction Power on the rail side and Bus Maintenance Technicians and Operators on the bus side. Importantly, Rail Car technician training also benefits from related work undertaken by the industry to develop quality standards-based training systems through ongoing industry-wide Training Consortia for Transit Elevator-Escalator and Signals technicians.

## The Problem: Demographic Transitions, Industry Growth and New Technology

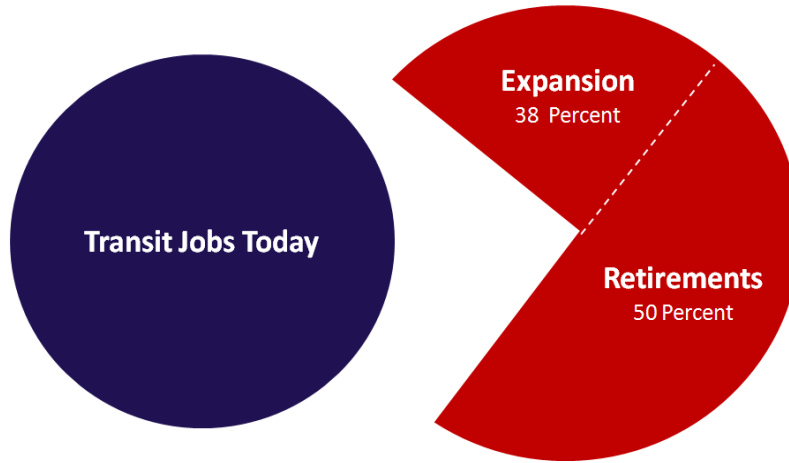
A world class system of qualification is needed because the industry is facing an unprecedented technical skills challenge. Demographic and technological change and growing public demand for public transportation are creating a critical shortage of workforce skills. Among the industry's most acute skills shortages are those for frontline maintenance technicians in transit rail operations, the frontline skills challenge is driven by three factors: the pending retirements of many technicians who helped establish new rail transit systems, concentrated industry growth in rail transit, and the pervasive inroads of electronic and especially digital systems with rail transit.

Among transit rail's frontline technical occupations, rail car maintenance technicians are the largest group, with an estimated 6,200 employees across the industry. This large group provides a natural focus for this ground-breaking five-year effort. It should be remembered, of course, that other frontline occupations in transit rail are facing similar skills challenges that are just as severe, even though their work forces are not as large. Whether for Signals maintainers, Traction Power technicians, or Transit Elevator-Escalator mechanics, top quality skills in all these occupations are critical for passenger safety and reliable transit service as those of Rail Car Maintenance Technicians.

For twenty years TCRP reports have documented that skilled transit mechanics are the industry's most difficult group to recruit (for example, TCRP Report 29, 1998; TCRP Report 77, 2002; TCRP Special Report 275, 2003). There are few "feeder industries" that utilize the specialized technology of transit's technical occupations, particularly for transit rail car technicians. In addition, the long arriving specter of baby boomer retirements is already hitting the industry. US DOT estimates 50 percent of the workforce in public transportation will be retiring in the next 10 years (DOT Workforce Summit, 2012). Compounding the challenge, retiring technical workers are those with the greatest experience and, in many cases, the highest effective skill levels. These workers will need to be replaced with fully qualified personnel.

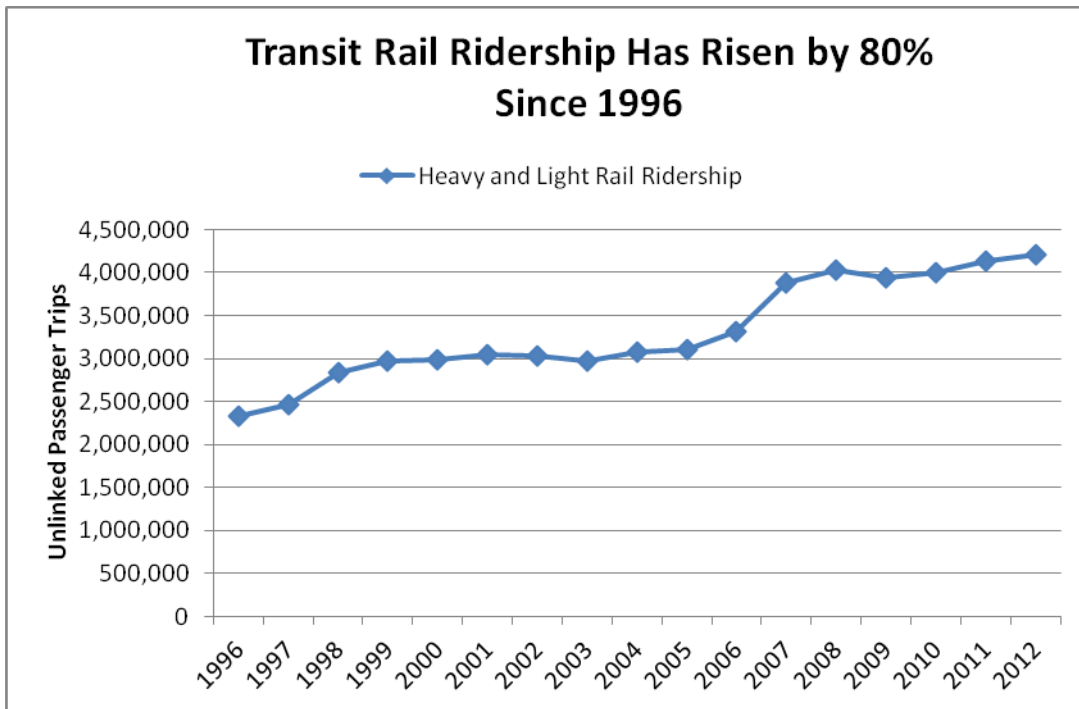
Heightening the challenge, the transit rail industry is growing very rapidly. The US Department of Labor has projected that growth in the transit industry will expand its overall employment by 38 percent over the same 10 years (Bureau of Labor Statistics), and a large share of that increase inevitably will be on the rail side of public transportation. These new jobs will require high skill levels.

Combining the forecasts of 50 percent replacement and 38 percent growth means that the transit industry in the next 10 years will need to hire and train a workforce equal to 88 percent of today's total workforce (Figure 1). Again, transit rail is facing an even steeper challenge, given the rapid growth in transit rail – with ridership up 80 percent between 1996 and 2012 (Figure 2) and new rail investments being made across the industry (APTA, 2012).



Source: Transportation Learning Center, based on data from US DOL and DOT

**Figure 1: Need to Train Equivalent of 88 Percent of Transit’s Total Staff in the Next 10 Years**



Source: American Public Transportation Association.

**Figure 2: Transit Rail Ridership Has Risen by 80% since 1996**

Beyond the relentless pressure of retirements and industry growth for hiring and qualifying new technicians, rapid technological innovation is continually raising the bar for the skills required of transit’s frontline technicians. Transit rail vehicles in particular are seeing dramatically increased technological content in virtually every area. Digital subsystems, programmable logic controllers and multiplexed sensors and controls have already driven the skill requirements of today’s frontline technicians far beyond

what was needed 20 or even 10 years ago. Tomorrow's skill requirements will certainly continue this trend toward higher knowledge and technical proficiency.

Is the transit industry prepared for this massive workforce challenge? The only honest answer has to be a clear "No". And that "No" is not just for the industry as a whole: In the Research Team's engagement with transit agencies across the country, not a single one has been able to say it is ready to hire and train a new skilled workforce on the scale and level of sophistication that will be required.

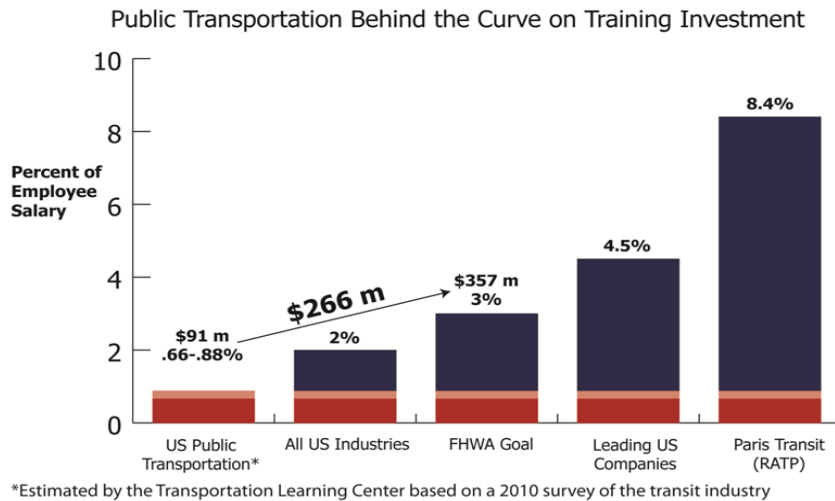
The new system of qualification developed in this project is designed to meet this major workforce challenge. It will provide free access to a suite of training models and resources that will greatly increase the quality of transit training and skill while reducing the cost of that training. It will also support a transition to a modern high performance, problem-solving culture in the transit industry, one that will build in continuous learning and continuous improvement in operations and maintenance.

### Background: the Baseline - Transit's Under-Investment in Human Capital

While many public transportation leaders have recognized the need for more and better training, inadequate resources have been invested to solve the problem. The industry's investment in training in general has been very low – one of the lowest among US industries and far behind transit industries in other countries (see Figure 3).

The transit industry's legacy approach to technical training requires each transit agency to invent its own system from the ground up, determining for themselves what technicians need to know and be able to do, how to teach them, how best to develop training materials and systems and then how to determine whether the needed skills have been mastered. Without a consistent or standardized approach, training has been developed and delivered by individual agencies from scratch, with little if any interaction from other transit systems or the industry as a whole. One result of this go-it-alone approach to training is that training costs for each custom-built program are inevitably high. But that uncoordinated approach also assures that the quality of training is low and the results inconsistent across agencies.

All of this has led transit systems to significantly under-invest in workforce training. In fact the transit industry currently spends less than one percent of its payroll on workforce training – among the lowest levels of investment in workforce skills of any US industry. The most recent survey results (prior to the 2008 Great Recession) indicate that transit's training investment falls between 0.66 and 0.88 percent of payroll (Transportation Learning Center, 2010).



Source: Transportation Learning Center

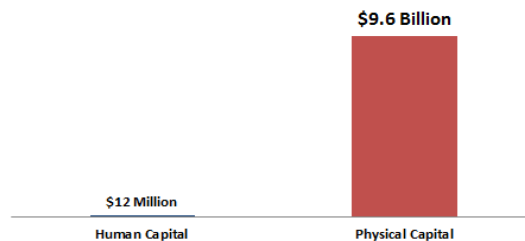
**Figure 3: Transit Lags in Human Capital Investment**

Transit’s human capital investment of less than one percent of payroll contrasts with an average investment among all US industries of two percent of payroll invested in training. The Federal Highway Administration, noting the aging workforces and pending retirements in state DOTs recommended that they spend three percent of payroll on training their workforces, even without the prospect of a growing number of employees. (For transit workforce investment to reach the 3% level recommended by FHWA, the industry would spend an additional \$266 million on training annually.) The most successful US companies spend between four and five percent of payroll on training. And in a telling comparison, the Paris regional transit system (RATP) invests over eight percent of payroll in training the workforce for its very safe and reliable transit system.

One source of transit’s underinvestment in workforce skills, or human capital as economists identify it, is that federal policy in the transit industry has provided very limited support for transit workforce development (see Figure 4).

**Federal Investment in Transit Human Capital Lags:  
Only 0.1% of its Investment in Physical Capital**

- Annual federal investment in transit workforce development (NTI, Innovative Workforce Programs) in MAP-21 – **Total \$12 million**
- Annual federal investment in physical capital – **Total \$9.6 billion**



Source: Transportation Learning Center

**Figure 4: Federal Investment in Transit Human Capital Lags**

Economists recognize human capital (durable workforce skills and knowledge) as a necessary match to physical capital – the industry’s equipment (trains and buses) and structures (tracks, bridges and stations). Capital equipment (physical capital) cannot operate well, safely or reliably without the adequate human capital that is developed by recruiting and training a skilled workforce. The federal government invests about one thousand times as much in the transit industry’s physical capital as it does in transit human capital. (Or, conversely, federal investment in transit’s human capital investment is about one-tenth of one percent as much as its investment in physical capital.) The shortfall in federal human capital investment is even more extreme when it comes to meeting the training needs of transit’s frontline workforce. Eighty percent of the transit workforce - the frontline transit technicians who deliver and maintain public transportation services – over the decades have received less than 20 percent of the limited funds available for transit workforce training. On a per-employee basis, that’s less than one-sixteenth as much funding for training for these critical frontline technical employees as for white collar administrative staff.

As a result of these imbalances, the need for a cost-effective system of technical training for transit’s frontline workforce is all the more urgent.

## The Transit Industry’s Solution: Industry Initiatives to Build Effective Technical Training Systems

### **The Foundation: Developing Industry-Wide Training Standards**

Over the past ten years the leadership of all the major stakeholders in the US transit industry has come together to create a standards-based partnership solution to the industry’s technical skills challenge. APTA joined with the major transit labor unions – the Amalgamated Transit Union (ATU) and the Transport Workers Union (TWU) – and the leaders of over forty different transit agencies and local unions to make this effort possible. This decade long effort has been staffed and facilitated by the industry’s jointly governed nonprofit for frontline workforce training, the Transportation Learning Center.

The first step, begun in 2004 and continued through 2009 with critical financial support from the U. S. Departments of Labor and Transportation, was to develop consensus industry-wide training standards for five frontline technical transit occupations:

- Signals
- Traction Power
- Transit Elevator-Escalator
- Rail Car
- Bus technicians

For each of these frontline occupations, National Joint Training Standards Committees and related efforts were developed with volunteer Subject Matter Experts (SMEs) drawn from knowledgeable frontline technicians, supervisors and trainers from across the industry. National Training Standards Committees were established for each of these occupations, with senior co-chairs drawn from labor and management. Across these five “founding” training standards committees, and a later one for Bus Operator Training Standards, dozens of transit agencies and their local unions designated SMEs to help develop quality national standards for transit technical training. For the first five technical occupations, the final training standards included 4,163 separate learning objectives in 728 modules and 132 courses (see Table 1 for breakdown).



**Table 1: Transit Training Standards**

Maintenance Occupations	Courses	Modules	Learning Objectives
Bus Technician	7	186	1,551
Rail Car	42	177	1,346
Rail Signals	27	86	467
Traction Power	17	36	232
Transit Elevator/Escalator	39	243	567
<b>Total</b>	<b>132</b>	<b>728</b>	<b>4,163</b>

The training standard for Rail Vehicle Maintenance Technicians reflected the complexity of modern transit rail cars. The classroom learning curriculum consists of 1,346 separate learning objectives in 42 courses and 177 modules that the subject matter experts felt were necessary for a person to become a top notch rail vehicle maintainer across the 11 fundamental systems on rail vehicles, along with prerequisite fundamental skills and advanced Diagnosis and Troubleshooting.

**Table 2: Rail Car Technician Training Standards**

Topic Area	Courses	Modules	Learning Objectives
<b>Fundamental Skills</b>	17	70	478
1. Couplers	2	7	68
2. Trucks & Axles	2	17	211
3. Propulsion & Dynamic Braking	2	5	91
4. Auxiliary Inverters & Batteries	2	9	34
5. Friction Brakes	2	11	82
6. HVAC	2	14	80
7. Current Collection & Distribution	2	11	54
8. Car Body	2	7	64
9. Doors	2	5	39
10. Communication Systems	2	6	67
11. CBTC (ATP - ATO)	2	8	52
12. Diagnostics and Troubleshooting	3	7	26
<b>Total:</b>	<b>42</b>	<b>177</b>	<b>1346</b>

The jointly developed training standards for Rail Car Technicians and the other four original technical occupations were completed by 2009. All five were reviewed and formally adopted as part of the APTA standards process in 2010 as recommended practices for the transit industry.

### **Building on Training Standards to Develop Complete Technical Training Systems**

Important as they are, industry-wide training standards themselves cannot be used to deliver training. They identify detailed learning objectives and curricula designs that describe course and module content, but they don't tell us how training should be delivered. What training standards do provide is the needed

foundation for developing a common framework for training and for training materials that can be customized by agencies and training programs for use with particular fleets and equipment as well as for specific local practices for maintenance, career ladder advancement and training.

The occupation of Rail Car Maintenance Technician was the first of three transit rail technical occupations that have made major progress toward developing standards-based training systems since the new training standards were first developed in 2006-2008. TCRP support for the E-7 project, starting in 2008, has enabled the industry’s Rail Vehicle training stakeholders to take the lead as the first of these standards-based initiatives, building upward from the new training standards to developing systems of standards-based training or, more broadly, qualification. Each of these early initiatives has followed its own path: Transit stakeholders for Transit Elevator-Escalator Maintenance Technicians (starting in 2010) and Signals Technicians (starting in 2013) have developed industry-wide Training Development Consortia co-funded by member agencies and unions with partial match funding from the Federal Transit Administration. With TCRP support for their earlier start in 2008, the Rail Vehicle TCRP Panel, assisted by the larger National Training Committee, has been able to frame out a comprehensive approach to a system of qualification program that addresses standards-based training not only for Rail Vehicle technicians, but the full range of transit’s frontline blue collar occupations. The research in this TCRP project has helped establish the design of a comprehensive, shared framework for qualification that will strengthen all transit technical training systems going forward.

Each of these three early initiatives for developing systems of rail training have followed the same underlying systemic framework for consistent, high quality occupational training that has been developed by research under the E-7 project. Within E-7 the Research Team examined successful nationwide training programs for frontline blue collar workers in other US industries and in other countries (see below, and the E-7 research report, *International and Domestic Comparisons: Building Capacity for Transit Training*, in Appendix B). These successful systems of training – or more broadly, qualification – have a number of critical features. They integrate classroom and hands-on, on-the-job learning. And technicians advance through the system of learning through progressive stages of hands-on and classroom learning (See Figure 5).

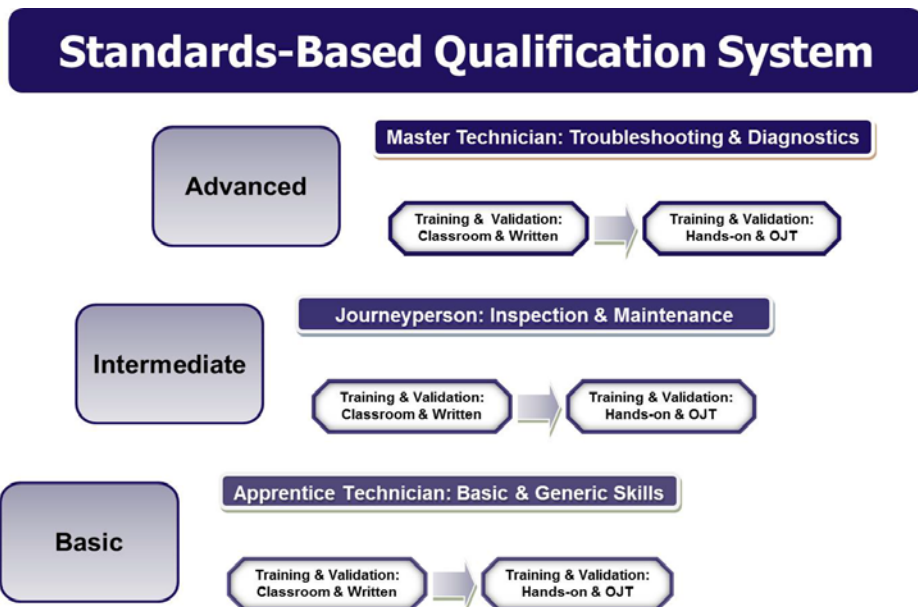
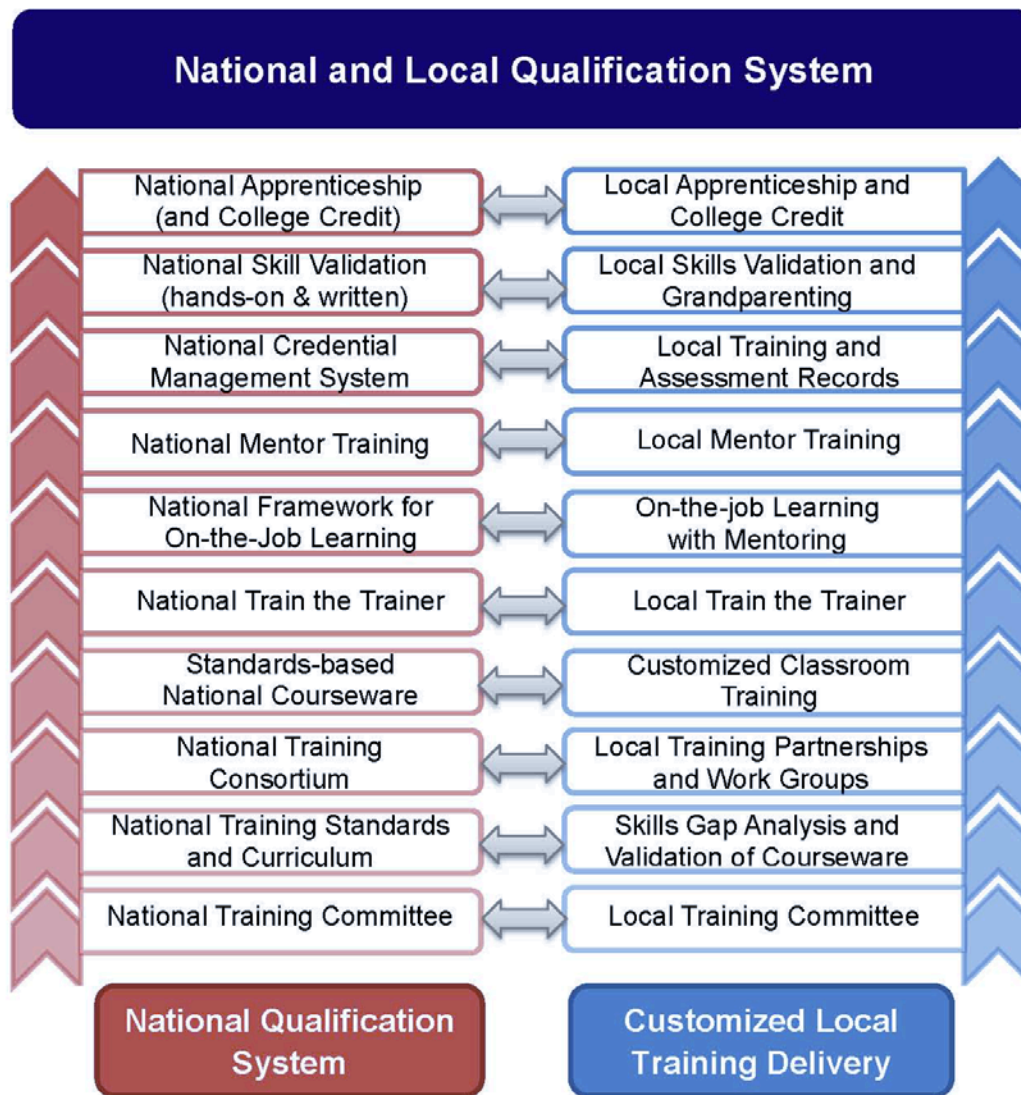


Figure 5: Standards-Based Qualification Systems

With specialized content and support systems being developed by joint committees of subject matter experts, this general framework is currently under development not only for Rail Vehicle Technicians but for training in all frontline technical occupations in transit.

### From Training to Qualification Systems

As the E-7 Panel and National Rail Vehicle Training Committee deepened their understanding of what constitutes quality training, they came to identify a number of critical components of a system of qualification. Taken together, these components constitute much more than “training” as that term is ordinarily used. In fact, they make up what most other countries identify as a much more comprehensive “system of qualification”, as shown in Figure 6.



**Figure 6: National and Local Qualification System**

This chart shows how the standards-based qualification system is built up of interconnected components developed by industry-wide SME stakeholder experts. The national qualification system

provides resources for customized implementation at the local level. National training standards provide the foundation for developing the entire system of qualification. Standards-based curriculum and courseware are developed for classroom training, which is in turn integrated with implementing on-the-job learning objectives fine tuned to local equipment, job classifications and practices. Specific training for trainers and mentors is developed so they can succeed in supporting learners in succeeding at all levels. A national credential management system can track the training of industry technicians and confirm that they are prepared to validate the skills they have developed. To assure success of the new system, incumbent technicians are held harmless through the standard process of “grandparenting”. Even as incumbents are engaged in new and better training, they are not required to pass through all the parts of the new systems being implemented for new hires. Tying all these pieces together is a national framework of apprenticeship – developed by industry stakeholders and registered with the US Department of Labor – that provides ongoing consistency and a path to future college credit academic recognition for the learning accomplished through the system of qualification.

Figure 6 shows how the national qualification framework provides resources to support customized local implementation. Each agency needs a training system that matches its own specific fleet equipment, job classifications and promotion systems. The national qualification system is designed to assure quality and consistency in workforce qualification efforts that have been optimized for the particular conditions in each location. With national qualification frameworks and resources developed by SME committees for each occupation, each transit agency can access quality materials for this progression of classroom and on-the-job learning and customize them for their specific equipment and practices, including job classifications and progressions. They can also utilize specific train-the-trainer and mentor training resources for each occupation. Individual locations are no longer left on their own to developing everything they need for quality training.

This interaction between national resources and local implementation is a two-way street. Broad local participation is what confers validity on national standards and resources, while customized local customization of national systems provides consistent, high quality training at greatly reduced cost across the industry.

The goals of these training systems across all the occupations are similar: Consistently higher skills leading to high performance operations and maintenance operations (TCRP Report 29, 1998). This should translate into increased skills, plus increased safety and reliability of equipment and service, a better State of Good Repair, reduced risk and costs and a substantially positive return on the agency’s and industry’s investment in developing human capital.

Balanced participation by both managers and frontline workers – frontline technicians, training department staff and maintenance supervisory personnel – is the best way to assure that the products developed by the SME group accurately reflect industry needs, best practices and expertise. Working together in this way also ensures that all stakeholders have an interest in the project succeeding. All parties jointly “own” the final products at both the national and the local level. In this process of developing standards-based transit qualification systems, union and management representatives have worked together as fully productive partners. In general, an outside observer would not be able to identify who was from one side or the other, as all were working together toward the same goals of developing quality technical skills.

## **The Transit Rail Car Training Committee and TCRP E-7: Developing a National Qualification System for Rail Car Maintenance Technicians**

The National Committee on Transit Rail Car Training Standards (the Committee or National Training Committee), was the forerunner to, and later an advisory partner for the Transit Cooperative Research Program E-7 Panel. The Panel, like the Committee, was made up of an equal mix of agency managers and frontline union workers. In an industry where more than 90 percent of the frontline workers are represented by unions and frontline workers make up 80 percent of the industry's workforce, frontline workers are natural stakeholders who have been recognized as full partners in developing the system of qualification.

Once established, the E-7 Panel worked closely with the Committee to further refine and implement the E-7 work plan (See Appendix C – TCRP E-7 Multi-year Work plan). Over the course of five years the project produced a comprehensive qualification system, including a nationally recognized apprenticeship for transit railcar maintenance technicians, approved by the US Department of Labor in 2013. The Research Team looked deeply into a set of related topics, including how high quality skills training is reliably developed through industry-wide programs in other countries and other industries. The resulting report, *International and Domestic Comparisons: Building Capacity for Transit Training*, includes case profiles of national frameworks for industry training in Germany, Denmark, the Netherlands, the United Kingdom, Canada and Australia and for the US building and construction crafts (See Appendix B).

The Research Team and Panel ultimately developed a comprehensive integrated system for the qualification of Rail Car Technicians. Their work drew on best practices in other industries with successful, long-lasting institutionalized national programs for qualification of frontline technical workers. The new system of qualification is designed to be economically self-sustaining within a broader framework of training systems addressing multiple occupations within the transit industry.

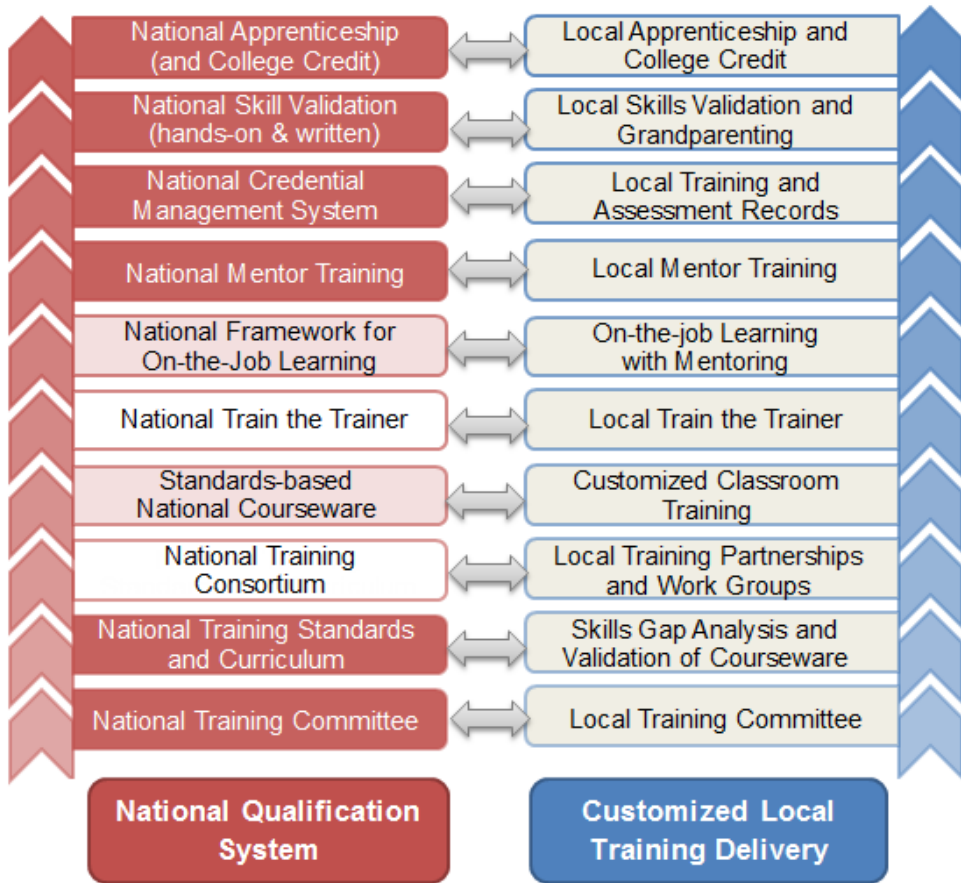
The Rail Car system of qualification developed under this TCRP project is not yet complete. As shown in Figure 7 on the following page, some components are only partially developed at this point.

# Rail Vehicle Technician National and Local Qualification System

## Chart Legend

**National Framework:** Fully Developed Under Development Future Work

**Local Implementation:** Ongoing



**Figure 7: National and Local Qualification System for Rail Vehicle Technician**

As Figure 7 shows, more work is needed on more advanced courseware development, a specific train-the-trainer program for rail vehicle instructors, and specifying the details of on-the-job learning goals and sequences for technician training. These areas of future work for training Rail Car technicians, fortunately, are being developed in parallel initiatives through the industry-wide transit rail training consortia for Signals and Elevator-Escalator maintenance. Future efforts in rail car training should therefore move more quickly and efficiently.

Conversely, the in-depth work in this TCRP project has developed a number of components for the Rail Car system of qualification that are also directly applicable to qualification systems for other transit technical occupations. In particular, the work on mentor training, the development of hands-on skill assessments, the integration of the overall system of qualification, and in particular the national credential

management systems are all available to advance the development of qualification systems in other technical occupations in transit. The foundation of a national system for training highly qualified frontline technicians in all public transportation technical occupations has been significantly improved by the work put in through the E-7 project to build the railcar maintenance technician qualification program.

## Next Steps

### **Beyond Development to Implementation of the System of Qualification for Rail Car Technicians**

The next major step in this ongoing project for the Rail Car Technician System of Qualification will be to promote and support implementation of E-7's standards-based qualification broadly within the transit rail industry. All the transit rail agencies participating in the E-7 Panel or the Transit Rail Car Training Committee have already taken steps towards implementing major parts of the qualification system. Implementation in the industry needs to be broadened and deepened.

As of late 2013 there are at least six medium-sized and large transit systems with a commitment to formal implementation of the Rail Car Technician qualification framework (see chapter 4 and 5). An early step for these agencies will be the formal registration of their new or existing Rail Car apprenticeship programs under the framework developed through this project and formally recognized by the US Department of Labor in June 2013. The new DOL framework includes coordinated classroom and hands-on learning, local joint apprenticeship and training committees, mentoring and other elements of the overall system of qualification. Other locations may move forward in partial steps by implementing different parts of the qualification framework.

Further momentum in implementing the standards-based system of qualification will be gained by engaging transit agencies and transit labor in organizing a Transit Rail Car Training Consortium as first discussed among transit leaders in late 2013. With a similar structure to the existing Elevator-Escalator and Signals Training Consortia, the proposed Transit Rail Car Consortium will fill in the remaining blanks in the system, with a focus on an instructor training course and further courseware development that will prepare industry instructors to use the curriculum, classroom courseware and on-the-job learning modules.

In the longer run, the complete Transit Rail Car system of Qualification will be integrated into a broader framework of standards-based systems of qualification across all the technical occupations.

### **Developing a Comprehensive System of Training across all Technical Occupations**

With development of comprehensive national systems of qualification underway for three critical technical occupations, the industry is within sight of developing a complete system of technical training resources that can be used throughout the industry for more effective training. The immediate next steps will be to extend the Transit Training Consortium model to completing the qualification system for Rail Vehicle Technicians and then to work toward new Consortia for rail Traction Power systems and for Bus Maintenance, the other technical occupations for which national training standards have already been developed (see Figure 8).

# National Qualification System Across Transit Technical Occupations

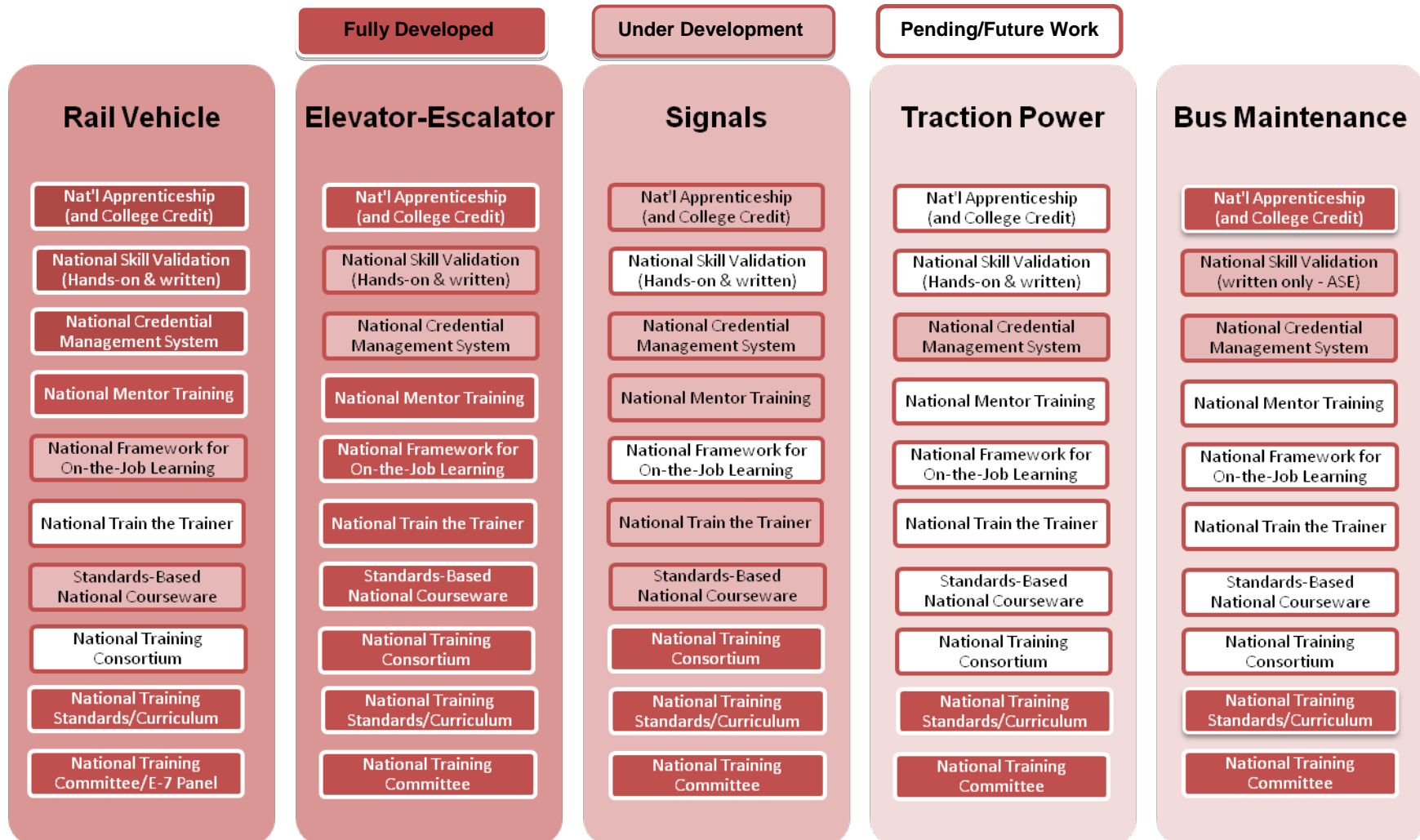


Figure 8: All-Occupations Chart of Qualification System and Components



Important elements still to be addressed for Rail Car Technicians can be adapted from related tools already developed through the Transit Elevator-Escalator Training Consortium started in 2010 and being further developed through other related projects, including the industry-wide Signals Training Consortium.

The Traction Power industry-wide training standards were developed by the Traction Power Training Standards Committee between 2006 and 2009 and adopted as recommended practices by APTA in 2010. Traction power is necessary for reliable service and safety, and it is an area of critical skill shortages in the industry, with many transit rail agencies having a large number of vacancies they cannot fill. And with the continuing rapid growth of transit rail ridership, the industry has no alternative but to develop its own supply of skilled technicians for these jobs.

The need for extending a quality system of qualification to cover transit bus maintenance technicians is arguably even more urgent than transit's training needs on the rail side. Most of transit's existing training capacity is concentrated in larger agencies, and the larger agencies (with few exceptions) include rail as well as bus transportation. Training capacity is generally very limited in medium sized transit agencies – almost exclusively bus transit agencies. And there exists almost no training capacity for smaller bus transit agencies and paratransit services. APTA adopted recommended practices for training bus maintenance technicians in their standards process in 2010, alongside the rail training standards. But the rest of a full system of qualification for Bus technicians remains undeveloped – with the notable exception of the written tests for the ASE transit bus technician certification system. A Bus Training Consortium developed on the model of the Training Consortia for the rail technical occupations would provide important benefits to the industry and the riding public.

Further in the future are additional technical occupations whose training needs have yet to be addressed. Developing training standards and then standards-based systems of training/qualification for track workers and facilities maintenance technicians – two important occupations in rail transit – would help complete a full system of transit rail workforce qualification.