Developing a Joint System of Training and Apprenticeship in American Transit: Lessons from the Experience in Other Industries

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September 29, 2007

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Introduction

Transit systems in the United States are facing unprecedented challenges in obtaining the workforce skills in maintenance departments to address pervasive technological changes, to replace an impending wave of retirements of “baby boom” workers, and to accommodate significant growth in transit ridership.

Several new technologies have been driving change in the transit industry, especially advanced electronics used in controls for engines, transmissions, or brakes and in all aspects of communications, including global positioning satellite (GPS) systems. Many technologies such as electronic fare cards, automatic vehicle location (AVL) supporting real-time information systems, and new transit rail lines have increased customer convenience and led directly to growing ridership. In addition, environmental concerns are driving adoption of new clean propulsion technologies. Earlier innovations such as compressed natural gas are being augmented by cleaner-burning diesel and hybrid gas-electric and diesel-electric propulsion systems. Prospects are for continued changes; biodiesel, hydrogen, ultra-clean diesel and fuel cell power are on the horizon.

At the same time, transit agencies will soon experience major increases retirements, resulting in significant losses of experienced mechanics. Surveys show that nationwide 40 percent of skilled transit mechanics will be eligible to retire over the next eight years. Some agencies are facing retirement of up to 70 percent of their skilled maintenance workforce in the next five years (Unpublished survey results, Community Transportation Center, 2004; Center for Urban Transportation Research, 2000).

Transit employment is growing faster in transit than any other sector in the transportation industry. The US Bureau of Labor Statistics projects a 40.6 percent growth in employment between 2000 and 2010 for a total demand of 88,400 jobs in transit maintenance. Transit rider ship has been trending upward since 1995, reversing a slow decline in prior decades. The 10 billion rides recorded in 2006 are the highest in 50 years. It is 30 percent higher than in 1995. Ever-worsening traffic congestion, rising fuel prices and growing environmental concerns are expected to drive further transit growth in the future (American Public Transportation Association, 2007).

The industry is facing this confluence of challenges with insufficient training capacity. Transit has a history of generally inadequate and often volatile funding available for training. Lack of training and career paths make the transit industry less attractive to new recruits and leave the industry without means to develop the skills needed in the present challenging environment.

This paper reviews training innovations and lessons that may be applicable to the transit industry from practices used in other industries. It draws on a rich body of experience of joint apprenticeship and training programs, as well as employer-sponsored training.

The Case for Apprenticeship in Transit Maintenance

Apprenticeship offers an appealing means of producing skilled maintenance workers to cope with technological changes, looming retirements, and the maintenance demands brought by growing ridership. The unique nature of the work performed in transit maintenance often prevents agencies from finding employees from other industries with the technical skills or knowledge required for such work. This has led transit agencies to seek more effective ways of developing their own training. The attractiveness of apprenticeship for transit lies in its long-term commitment to progressive skill acquisition through a combination of practical on-the-job training and classroom instruction. Apprenticeships offer advantages over shorter-term training in that apprenticeships are able to produce highly skilled, versatile workers with solid theoretical and practical knowledge. Developing workers with such characteristics is particularly important in transit maintenance, where the work is varied and often unpredictable.

Several features make apprenticeship attractive to employers and to workers alike. For employers, apprenticeship can offer an assured supply of “home grown” skilled workers. This is especially important in work that is unique and best learned through a combination of classroom instruction and on-the-job training. Apprenticeship provides an organized process through which older experienced workers can pass along their knowledge and skills to a new generation of workers.

Without a supply of trained workers, employers often resort to pirating their workers from one another, which only further reduces the incentives to train and can lead to inflationary pressures on wages. Apprenticeship offers increased productivity and returns to training. Although most formal training is provided to managers, training for front-line workers often

has a higher payoff in terms of real productivity gains and improved adaptability of the workforce to changes in technology or market circumstances.

For workers, apprenticeship offers the opportunity to earn while learning, according to a progressive pay scale that increases as skills improve. This feature is particularly desirable for individuals who cannot afford to leave the labor force to enter full-time training in a school or institution. The progressive pay scale — an integral feature of apprenticeship — provides workers with built-in incentives to improve their skills. Apprenticeships help establish career ladders.

By design, apprenticeship trains to industry standards. According to federal regulations, registered apprenticeships are limited to skilled trades occupations that are "clearly identified and commonly recognized throughout an industry" (Federal Register, February 18, 1977, p. 10141). An industry must be organized to develop and endorse such standards.

Apprenticeship is not short-term task training. Apprenticeship emphasizes broad training in all aspects of the trade. Broad training makes apprentice-trained workers flexible and more able to adapt to changes in technology or equipment. Apprenticeships are designed to provide a solid foundation prior to specializing. For example, plumbers and pipefitters take the same initial two years of curriculum prior to receiving instruction in their specialties, such as plumbing, pipefitting or sprinkler fitting.

As an instructional scheme combining work and study, apprenticeship offers the pedagogical advantages of blending theoretical and practical learning. Apprenticeship is a premier example of "learning-by-doing," which cognitive theorists have recognized has significant benefits. Apprentices learn to apply what they know and often gain a clearer and deeper understanding of the work. By offering training on the job supplemented by classroom instruction, apprenticeship provides an ideal unity of thought and action. By its nature, apprenticeship involves learning "how to do" a task by performing on the job and "why a task is done that way" in related instruction.

As a learning approach, apprenticeship has numerous additional attractive features. By offering applied learning in a paid on-the-job setting, apprenticeship can motivate individuals who may not respond well to traditional classroom learning. Apprenticeship also provides a natural environment to foster mentoring relationships because apprentices generally work

closely with experienced journeymen workers. Apprenticeship offers a built-in career path and well-rounded preparation for future careers. With apprenticeship's emphasis on broad training, theoretical learning along with practical knowledge, and transferability or portability of skills, apprenticeship has ideal characteristics to cope with new technologies. Furthermore, a good apprenticeship program, kept up to date, offers a fine base to build a system of continuing training to support cross-training, upgrading, and updating the skills of incumbent workers. JATCs, which administer apprenticeships for entry-level workers, nearly always sponsor continuing or journeymen upgrade training opportunities. For example, in the electrical industry, the joint apprenticeship and training committees (JATCs) offer a training course to update workers on the National Electrical Code as it becomes revised every three years. Because journeyman training is not reported in government statistics, these training activities have been widely unnoticed.

American apprentices typically spend 90 percent of their time in training on the job; thus they come to naturally view worksites as places to learn. Conducting training on the job helps assure that training is provided on up-to-date equipment actually in use in the workplace. New technological materials and equipment are pervasive, affecting all industries and apprenticeable occupations. For example, electricians used to working with copper wires now must cope with fine optical fibers of plastic or glass that can transmit messages or digital information. Maintenance trades are faced with complex systems composed of electrical, electronic, mechanical, pneumatic, hydraulic, thermal and optical devices. Continuous learning is needed in today's workplaces. Structured properly, a modularized apprenticeship curriculum can serve the needs of both entry-level workers and incumbent workers who need to learn about new technologies affecting transit maintenance work (e.g. transit applications of electronics).

Although joint apprenticeship is a superb training concept, not all apprenticeship programs are exemplary in practice. Apprenticeship can become a victim of adversarial labor-management relations. Likewise, some programs are joint in name only. Local programs have developed in isolation through a "trial and error" process that is unnecessarily expensive and unfortunately leaves much to be desired. To help assure the best apprenticeships are produced, it is important to learn from the experience of other training programs to have the best chance of success.

Transit agencies in a few localities currently have apprenticeship programs, as confirmed by telephone interviews, visits and case studies conducted by staff of the Community Transportation Center in its efforts to document the industry's existing training capacity during 2006 and 2007. These programs have been typically developed in isolation and are quite varied in scope, character, and quality. Working through a national partnership, the industry could learn from the experience of these programs, identify best practices and share them.

Apprenticeship can be linked to school-to-career programs—With some added features, apprenticeship can be successfully linked to a school-to-career program in high schools and community colleges. Success in this endeavor requires enthusiastic support from at least one teacher familiar with transit maintenance who has support from school officials and the commitment of the transit agency maintenance staff. Someone well placed in the agency (e.g. the director of maintenance) will need to take a special interest in the school program with support from agency management. Teacher externships will be needed to familiarize teachers with the industry. The curriculum needs to be rigorous, yet relevant. The transit industry can attract student interest with opportunities for site visits, job shadowing, internships, summer jobs, and mentoring arrangements. Parents need to be engaged in the outreach effort as well because they have a strong influence on their children's career choices. By structuring its training program to offer effective career paths and opportunities for college credit, the transit industry can appeal to parents as well as youths.

Even so, in the United States, the difficulties of attracting teenagers to enter transit industry careers immediately after graduating from high school should not be underestimated. Unlike some other nations, relatively few young Americans enter apprenticeship immediately after high school. In 2006, across all trades, fewer than 5 percent of starting apprentices were less than 19 years old. Many teenagers tend to be drawn to college and "high tech" industries, rather than occupations such as transit mechanics or other craftwork that can offer good careers. Young adults who have families to support are often easier to attract. Thus, both as a result of applicant maturity and employer preference, most starting apprentices in America tend to be "mature and settled" individuals in their mid to late 20s.

A National Joint Apprenticeship and Training System for the Transit Industry

Development of National Industry Training Partnerships

The plumbing and pipefitting industry was the first to establish national Joint Apprenticeship and Training Committees (JATCs) and national fund. The initial national training activities were financed by a supplemental levy on the hours worked under nationally negotiated collective bargaining contracts. Monies from this fund were used primarily to develop and improve national curriculum and to train instructors of related training and local apprenticeship program coordinators through a contract with Purdue University beginning in 1954 (Eddy and Corcoran, 1969). Instructor training in the pipe trades subsequently was conducted at Washtenaw Community College in Michigan which more recently has been supplemented by a network of residential training facilities owned and operated directly by the industry.

Several other construction trades have followed the lead of the pipe trades in adopting national activities. Labor and management have established national joint committees and training trust funds in nearly a dozen building trades and variations of the concept have been implemented in automotive and aircraft manufacturing and in the communications industry, among others.

The experience in the sheet metal industry is instructive. Faced with the high level of geographic mobility of its workers, the industry found it difficult to cope with the wide diversity in training practices, content and quality across the country. Industry leaders reasoned that a sheet metal worker trained in Jackson, Mississippi who moved to San Francisco, California ought to be able to work productively as a sheet metal worker in both places. Thus they organized to improve training and to promote greater nationwide uniformity of training. A key principle was to try to bring all programs up to the standards of the best. The Sheet Metal Workers' International Association and the Sheet Metal and Air Conditioning Contractors' National Association founded the National Training Fund* in 1971. It was initially funded by a 2-cent contribution for every hour worked under collective bargaining contracts negotiated by participating local apprenticeship and training programs.

* The National Training Fund subsequently was renamed the International Training Institute for the Sheet Metal and Air Conditioning Industry (ITI).

The International Training Institute developed a national curriculum and associated instructional materials with input from workers, employers, and instructors in all areas of the country. To upgrade the equipment available in local programs, a loan/grant program was started to make funds available for purchasing equipment by any local affiliate program with its own training facility. Smaller local programs in rural areas without sufficient financial capacity to repay loans were offered grants for equipment. When national industry officials decided that they needed to upgrade the training offered in welding, they commissioned new instructional materials including a path-breaking series of training films demonstrating welding techniques. They also bought five mobile semi-truck trailers and filled them with the latest welding equipment. These semi-truck trailers have been scheduled year-round for special training sessions held where needed around the country to train workers to help staff large jobs, especially in remote locations.

Following the lead of the pipe trades, the International Training Institute identified a need to better prepare apprenticeship instructors in the sheet metal and air conditioning industry. Thus, beginning in 1973, ITI contracted with the National Center for Research in Vocational Education at the Ohio State University to design and provide training for their apprenticeship instructors. More than 3,000 instructors were trained from 1973 through 1999. Along with instruction in pedagogy, special instructor training has been offered to update technical skills and knowledge in welding, in solar energy and in testing, adjusting and balancing environmental systems, and in other areas.

Largely at the urging of the International Training Institute, many local apprenticeship program committees have begun to address training needs beyond apprenticeship. They now offer opportunities for journeymen workers to update or upgrade their skills. There is increased recognition that training is a lifelong endeavor. ITI has developed curricula for continuing training for journeymen in such subjects as welding, architectural sheet metal, food and beverage sheet metal, production shop sheet metal, energy management and other advanced studies.

National industry institutions have helped local apprenticeship sponsors become forward thinking. Several national training trust funds have financed employment forecasts, job analyses, and other studies of skill needs of the industry. For example, the International Training Institute, in response to growing concerns about energy conservation, developed and put into place a training program for energy auditors to produce technicians who can

examine the energy efficiency of existing buildings and make recommendations for retrofitting them to improve energy efficiency.

National JATCs established in many other trades have developed curricula and instructional materials and started national instructor training. They have adopted improved training methodologies, including incorporating greater emphasis on competency-based training and assessment practices and adopting new technologies such as computer-based learning.

Roles and Functions of National Training Partnerships

Some training tasks are best conducted at the national level, in order to avoid unnecessary duplication of efforts, to promote quality, and take advantage of economies of scale. It is simply most effective and efficient to accomplish these together and share the results. Such tasks include:

- Developing consensus on consistent skill standards, assessments and certifications;
- Selecting/developing curriculum and instructional materials relevant to the industry's needs;
- Training instructors;
- Arranging for college credit options for apprentices and apprentice instructors;
- Certifying competencies gained and learning on the job and providing recognized credentials, which can increase respect for the maintenance trades; and
- Incorporating third-party skill certifications, where appropriate;
- Providing technical assistance to encourage improvements;
- Sharing expensive specialized equipment;
- Advocating for training and for the transit industry nationally.

Developing, clarifying, and organizing consensus around skill standards

Skill Standards define what workers should know and be able to do. Making such standards explicit improves learning by communicating very clearly to trainees and instructors what specific subjects trainees are expected to learn to meet the standards. Explicit standards also facilitate the development of coherent instruction systems. Curricula, syllabi, instructor training, and assessment can all be aligned to specific standards. By more precisely defining

the skills and knowledge components of a craft or occupation, standards facilitate measurement which, in turn, strengthens program evaluation, the calculation of returns on investments, continuous improvement, and greater support for training (Marshall and Turner, 2007).

Obtaining consensus on skill standards and occupational definitions is a logical first step to develop a coherent instructional system, including curriculum development and instructor training.

Developing curriculum

Curriculum development is a natural follow-on task to the development of skill standards. It is a task most appropriately undertaken at the national level rather than the local level. National joint partnerships are in a superb position to access a rich pool of subject matter experts across the country. They can be responsive to needs perceived by workers in the field.

Several lessons can be learned from the experience of other industries with regard to curriculum development, including the following:

Determine the priority curriculum needs. Curriculum development activities should begin with a clear idea of what needs to be learned; skill standards are a useful input here, as are the results of knowledge gap surveys and available job analyses. The next step is a systematic review of needs and selection of priority subjects. An inventory and review of available materials used by local transit agencies can be helpful in determining priorities for the development of instructional materials.

The Carpenters International Training fund recently decided to revise all their instructional materials; they chose two priorities for their initial curriculum development efforts. Since a significant portion of UBC members work on interior systems, the carpenters revised and upgraded their instructional materials covering interior systems. Second, because few satisfactory materials were available for training millwrights, carpenters made development of materials for millwright training a priority.

Curriculum needs to be reviewed and updated frequently to keep pace with technological advances and other changes in the workplace. A national group is better positioned to conduct technology forecasting and to prepare changes that will affect transit maintenance.

Use a modular format to organize the curriculum. The curriculum in most training programs has evolved into a modular organizational format. In the most common arrangement, all apprentices begin with a set of core modules that include the basics (such as safety). Upon completion of the core, modules on various specialized topics become available to learners. Some of the building trades initially resisted modularization because they feared that it would lead to task training, thereby undermining their efforts to promote broad training across the full craft. Another concern is that modularization may present topics as unconnected specializations rather than an integrated whole. For example, transit maintenance technicians need to electronics not just as a separate subject. They must be able to apply their knowledge of electronics. To do this, technicians need to understand how electronics is integrated into the system as a whole, including mechanics, computers and control systems.[*] Working with electronics on the job emphasizes such integration.

The advantages of a modularized curriculum outweigh its potential hazards. A modular curriculum helps divide learning into manageable pieces. The same curriculum can be tailored to simultaneously accommodate both the initial training of apprentices and continuing or update training of journeymen. A modular curriculum can more easily be revised to incorporate changes in new technology. A modular curriculum may be essential in the transit industry because the scope of occupations varies by agency.

***Include on-the-job learning in the curriculum coverage*.** The curriculum should cover both classroom and on-the-job training components. Up to 90 percent of the time spent in typical apprenticeship is in learning on the job. To make the most effective use of this time, OJT should incorporate a learning plan, mentoring arrangements and regular feedback on the learners' performance, and rotation through all elements of the plan. Traditionally, most apprenticeship programs have specified the learning plans in terms of hours spent on each task. More recently, some programs have begun to detail the competencies to be gained in each assignment and to assess performance against the standards.

[*] In some American manufacturing industries, this holistic approach is becoming known as "mechatronics" —a term that is widely used across Europe and in Japan.

Make decisions about distribution of instructional materials. Some trades make their curriculum available for purchase by anyone; industries with a large potential market are even able to subcontract to make materials available through a publisher. A few programs initially tried to support their national activities through sales of instructional materials, but sales have always yielded insufficient revenue. Some programs perceive their instructional materials to offer a competitive advantage and thus restrict the availability of their materials to affiliated training programs only. In any case, national partnerships make the materials available to affiliated local programs either free or at cost.

Providing professional development, certification and support to instructors

A third logical function of national partnerships is to provide professional development and support for instructors**.** Curriculum development and instructor training go hand-in hand. A special focus is devoted to training on new curriculum developed to meet industry needs. Working with instructors also provides opportunities for direct feedback on the effectiveness of the curriculum materials.

Instructor training typically includes several types of subjects, such as safety training, technical update training, computer training, and instruction in how to teach (pedagogical training). Generally the instructors are master craft workers, technicians or mechanics, who are still working in the trade. Nearly all industries have found it easier to teach individuals who know the trade to teach than to train teachers in the trade.

Training effective instructors is neither a haphazard or quick endeavor. In a common pattern used in several trades, instructors achieve certification through a 200-hour course provided at a national location in one-week blocks over five summers.

The best instructor training includes follow up and support for instructors in the field. Instructors can call for help from their fellow instructors met in national training. Instructional aides can be developed for use in the classroom. For example, the Carpenter International Training Center provides the instructor with a Compact Disk (CD) containing instructional aides for each apprentice course that an instructor is to teach. The materials for each course are arranged in a standardized format with the following components:

- Administrative Package
- Sequence of Instruction

- Equipment Lists
- Related Training Exercises
- Forms
- PowerPoint Slides (annotated with note pages)
- Resource Materials
- Tests

As part of these packages, staff of the Carpenters' International Training Center prepares PowerPoint presentations for instructors to use in classes. PowerPoint slides are perceived to offer two key benefits: (1) they put ideas in appropriate and consistent order and (2) they help assure that instructors do not miss covering anything important.

In the semiconductor industry, the Maricopa Advanced Technology Education Center (MATEC) offers another example of instructor development and support (http://www.matec.org/). MATEC is part of the Maricopa County Community College System located in Tempe, Arizona. The Center was begun under funding from the National Science Foundation Advanced Technology Program. MATEC provides professional development and support to community college faculty nationwide who teach in the field of Semiconductor Manufacturing Technology. In addition to sponsoring an annual conference and specialized workshops, MATEC makes extensive use of the Internet to support instructors. MATEC has grown and diversified so that it now offers a variety of materials in related topics. A course offering on the Internet that may be of interest to the transit industry is "Work Ready Electronics" (http://www.work-readyelectronics.org/).

Selectively partnering with vendors can be an effective strategy for improving the quality of instructor training and reducing costs. Any major gathering of instructors can attract attention from relevant equipment vendors. For example, at national training sessions of pipe trades instructors, manufacturers of welding equipment gladly make available an exhibition of their most recent equipment for "hands on" tryouts and instruction. Vendors can be especially helpful to introduce new technology or materials. But care should be taken to make certain the joint partnership remains in control of the training so that general principles are included rather than limited specific training on only a single vendor's products.

Promote sharing of experience. National instructor training provides a ideal setting to enable and encourage individuals from isolated local programs to share best practices and learn from one another.

Offering specialized or advanced training

A national partnership can arrange for advanced or specialized training that is too expensive or uneconomical for individual programs to provide at the local level. For example, the Carpenters conduct advanced millwright training at their international center in Las Vegas because this training requires extensive large and expensive equipment. The equipment at the national center includes two full-scale gas turbines and a steam turbine. To become eligible for advanced training, millwrights must take and pass nine days of basic millwright training in their local area.

The Boilermaker trade operates a national training facility in Kansas City. Unlike some other building trades, the Boilermakers tend to have national collective bargaining contracts with employers who build large-scale power plants across the country.

Beginning boilermaker apprentices learn the basics at the local level in classes or through self-study using distance learning courses on the Internet. During each year of their apprenticeship, boilermakers spend three weeks of intensive training in Kansas City. Most locals send their apprentices to the national center.

Anticipating and preparing for upcoming technological changes in the workplace

A national partnership provides an excellent platform for exploring innovations in the industry and for previewing anticipated advances in technology and materials. The national joint partnership organization also becomes a point of contact for international exchanges in the global economy. The partnership can monitor promising developments and build them into the curriculum and instructor preparation as appropriate. For example, the International Masonry Institute identifies promising new building materials, such as autoclaved aerated concrete, then trains and certifies masons in installation and coatings.

Arranging college credit for learning in apprenticeship

A national partnership provides leverage in negotiating arrangements for college credit for learning in apprenticeship. Such negotiations can be accomplished more effectively and efficiently on a national basis rather than relying on the time-consuming process of multiple, one-on-one negotiations that depend on relationships and initiative at the local level.

Providing college credit for workforce learning is not a new idea. It originated in 1945 when the American Council of Education began assessing and certifying military training programs for college credit. In 1974, the process used to certify military programs was expanded to civilian training programs. In 1978, policies and procedures for evaluating apprenticeship programs were adopted. Today the program has become the College Credit Recommendation Service, operated by American Council of Education (http://www.acenet.edu/nationalguide). Several private employers and joint apprenticeship programs use this service, including joint training for electrical workers, sheet metal workers, ironworkers, laborers, and autoworkers. (In the transit industry, SEPTA uses the ACE College Credit Recommendation Service, but only for management training courses.) The ACE program evaluates training to determine if it is suitable for college credit, then makes recommendations for how many college credits the learning is worth. Follow up evaluations are made to assure that the training continues to meet standards. Decisions to accept or reject the recommendations are left to individual colleges.

During the past decade, the practice of accessing college credit has gained considerable momentum so that national initiatives are underway in nearly all of the building trades. The AFL-CIO's George Meany Center established the National Labor College, an accredited, degree-granting postsecondary institution which offers a Bachelor's degree programs in Labor Education and Labor Studies. Several trades, including the sheet metal workers, structural steel workers, and the laborers, have negotiated college credit arrangements for their apprentices through the National Labor College in Washington, D.C.

The National JATC for the electrical industry has collaborated with Middle Tennessee State University to develop a Bachelor's degree in Construction Management with a specialty in electrical construction. First offered in Fall 2003, the program is designed for students who already have completed 50 transferable semester hours of college credit from an accredited institution. An evaluation of the applicant's work experience and apprenticeship by the college may yield up to 20 additional units of upper division credit. Thirty-three semester hours of courses must be completed at Middle Tennessee State University, many of which can be completed on-line. Finally the program requires the student to spend one week each summer on campus, participating in presentations, hands-on projects and examinations.

Sheet metal apprentices can receive college credit toward an associate's degree through Ivy Tech in Indiana. The National Training Institute negotiated special rates on tuition so that by taking five addition general education courses at about $200 per course, a completing apprentice can obtain an associate degree. Individual apprentices commonly pay the tuition for these added courses.

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In the approach used in the pipe trades, programs leading to an Associate's or a Bachelor's degree are available to members of the pipe trades union, the United Association. College credits are earned through the completion of apprenticeship, supplemented with the on-line/Internet classes taken by apprentices, combined with college courses taken in local postsecondary institutions. The various educational elements are combined and then evaluated by Eastern Michigan University to assure that each individual meets all the criteria for the awarding of specific degrees. These degrees options include a two-year Associate's degree in Construction Supervision or a four-year Bachelor of Science degree in Construction Management.

The focus on college credit for apprentices has stimulated interest among apprenticeship instructors to obtain college credentials. Most states require instructors teaching college credit courses to have a degree at least at the level that they are teaching. Often instructor training is combined with college credit. In the pipe trades, completion of an apprenticeship as well as the 200 hours of instruction in the Instructor Training summer program over five summers earns an instructor 45 units of college credit at Washtenaw Community College which is three-quarters of the way to an Associate degree in Industrial Training. Individuals who wish to go further can enter the Bachelor's programs at Eastern Michigan University.

Since 1992, the Carpenters have collaborated with the College of Education Continuing Education Program at Pennsylvania State University to offer a series of customized workforce courses for apprenticeship directors and instructors. Each course currently involves three days of instruction at the Carpenters International Training Center in Las Vegas, followed by computer-based exercises taken at home during the following weeks. Upon successful completion, each course confers three units of college credit.

In the sheet metal industry, collaboration between the International Training Institute and the National Labor College allows an apprentice instructor to obtain a Bachelor's degree in

Labor Education and Labor Studies with a small amount of continuing education beyond the industry's instructor training program.

Four new aspects characterize this vitalised interest in college credit by apprenticeship sponsors: (1) the credit arrangements are negotiated nationally rather than by individual local apprenticeship programs on college-by-college basis; (2) some course offerings are available on-line through the Internet; (3) the new efforts go beyond Associates (two-year) degrees, making available to apprentices a variety of college degrees, including Bachelor's (four-year), and Master's (postgraduate) degrees in technical and non-technical majors; (4) opportunities to earn college credentials are being organized for apprentice instructors as well as for apprentices.

Apprenticeship sponsors often provide discounts on tuition, scholarships, and other forms of subsidies. These arrangements, together with the built-in "earning while learning" feature of apprenticeship, make postsecondary education more affordable and accessible to craft workers and technicians.

Augmenting apprenticeship with college learning and educational credentials benefits individual workers as well as the industry as a whole. College degrees provide apprentices access to opportunities to move ahead in their careers, including being promoted into supervisory responsibilities. At the same time, college credit adds status to the maintenance trades, which can facilitate recruitment of new applicants to the transit industry. For the nation, this practice is also beneficial because it fosters a more seamless education and training system.

Tapping outside expertise

National JATCs have commissioned studies from academics and other experts on various topics, such as technology assessments and labor market forecasting. For example, the IBEW-NECA in the electrical industry used outside expertise to study of training implications of fuel cells. In addition, NECA's Electri International foundation has provided grants for studies of trends and issues affecting the electrical industry (e.g. progress of wind energy, impact of wireless on the electrical industry, etc.). In the sheet metal and air conditioning industry, the International Training Institute contracted for a study their future labor market

outlook, including ideas for attracting and retaining underutilized groups (women and minorities) to fulfill their workforce needs.

Facilitating arrangements for credentials including external certifications and certification of learning gained in the workplace

Skill certification provides documentation of competence, using exams geared to demonstrate proficiency. When certification is based on written as well as performance examinations and issued by respected third-party organizations, it helps to further validate the competence of those trained as well as the effectiveness of the training program.

Apprenticeship programs have strengthened their internal exam and certification procedures and arranged for external certifications to improve the credentials of completing apprentices. For example, skill certifications now available in the pipe trades include valve repair, medical gas installation, welding, removal of and replacement of refrigerants including CFCs (chlorofluorocarbons), and instrumentation. Certification in instrumentation is conducted in cooperation with the National JATC of the Electrical industry on behalf of the IBEW. The testing and evaluation process, which is monitored by the Electric Power Research Institute, provides a formal, independent assessment of knowledge and skills.

Providing technical assistance to local programs

Most national apprenticeship and training partnerships have experienced technical staff who provide assistance and advice, troubleshoot problems, assess the performance of local programs and make suggestions for improvements. Through their contact with local programs, national technical assistants become knowledgeable about promising innovations and best practices across the country, which puts them in a good position to share and promote these practices.

Staff of the United Association (UA) Training Department has developed an internal accreditation program, based on the findings of site visits to all of its 300 local programs. Local programs that meet all of the standards and requirements of the United Association receive full accreditation, with access to additional training equipment and grants.

Similarly, the Ironworkers Apprenticeship and Training Department has adopted a certification program designed to accredit their local programs. The aim is improve the

quality of training offered through local programs. The initiative aims to assure that programs meet or exceed established standards in areas such as implementing the core curriculum, ensuring that instructors have appropriate credentials, providing access to appropriate tools and equipment and training facilities, ensuring safety of apprentices and providing on-the-job training to prepare skilled ironworkers to meet the needs of employers. (http://www.ironworkers.org/files/IACPPoliciesandProcedures.pdf)

Providing specialized equipment where needed

A national partnership can help make more efficient use of expensive training equipment by making it available on a shared basis. When specific projects or jobs require specialized training or certifications, the International Training Institute of the Sheet Metal Industry has dispatched fully equipped mobile trailers to local jobsites to provide short-term intensive training. These trailers have been used to provide specialized training for members on large projects in remote locations. Also, the Institute offers grants and loans to its local programs for equipment purchases to help bring all programs up to the standards of the best. The UA has programs with mobile training trailers to provide short-term intensive training and it also provides equipment to local programs. Similarly, the IAM/Boeing Health and Safety Institute built and equipped a 48-foot mobile training lab, which travels from manufacturing site to site, providing safety training to meet required re-certifications.

For specialized training not commonly offered, the Carpenters International Training Fund sends requesting local programs large “gang boxes” filled with the equipment and consumable materials needed to conduct training in specialized topics on an irregular basis. This practice saves local programs the expense of buying needed--but rarely used--equipment and materials on their own.

Measuring results of training

Funding can be raised for training through organized regional and national collaborations. Good proposals are successful when they clearly identify important problems to be addressed, outline effective solutions, and demonstrate creditability to implement the solutions. Pilot projects can prove feasibility. However, maintaining funding from discretionary sources or through legislative set-aside arrangements requires credible documentation of performance. The only way to achieve such documentation is through measuring performance.

National partnerships are in the best position to develop appropriate measures of results. A national partnership can secure broad input and agreement on the appropriate metrics to measure the results of training. Through monitoring demonstration projects with cooperative regional partners, it can develop and build in techniques to measure performance improvement and isolate the impacts of training. Tangible and intangible benefits and costs can be tabulated and returns on investment (ROI) calculated.

Isolating the impacts of training offers challenges. Numerous factors at play can have an influence on outcomes achieved (such as improvements in productivity). Training is often implemented with accompanying initiatives such as the introduction of new technologies or improved procedures. Disentangling the impact of training from these other factors can be challenging, especially since training often helps enable the other factors to be effective.

Studies of the return on investment in training can be developed from three different three perspectives–from the point of view of the individuals trained, or the employer, or the taxpayer. While all three perspectives are important, ROI studies need to be clear about the perspective being addressed.

Studies of the effects of short-term training are easier to conduct than are studies of long-term training that may have impacts over several years. Even so, some ROI studies of apprenticeship are available. An example is a study undertaken for the Canadian Apprenticeship Forum from the perspective of employers. The research covered apprenticeship across 15 trades and found that employers receive a $1.38 return for every dollar they invest in apprenticeship training (Canadian Apprenticeship Forum, June 2006).

Advocating for training and for the transit industry

A national labor-management partnership can speak with a more effective voice to advocate for training funds and to promote the industry nationally.
A national organization can maintain contact with the numerous advocacy groups and associations related to the transit industry. For a partial listing of advocacy organizations, see http://www.transportcenter.org/linkst.html).

Following the example of national programs in other industries, the national partnership can lead and support a recruiting campaign to attract talent to the transit industry. It can

develop recruiting materials for use by local transit agencies. It can also share effective recruiting and selection strategies used by local agencies.

Advantages of National Joint Training Partnerships

As the experiences of national joint training partnerships in other industries demonstrates, numerous advantages can be gained from establishing a national joint training partnership, including the following:

Increases the quality and quantity of training for the industry while reducing costs

National Partnerships offer mechanisms to share best practices, encouraging local programs to learn from the experience of others. They also make use of the knowledge and experience gained by front-line workers. National partnerships reduce costs by eliminating duplication of efforts, by taking advantage of economics of scale, and by undertaking activities that are best accomplished at the national level and shared (e.g. instructor training, curriculum development). They promote arrange for sharing of expensive equipment and resources for training.

Increases the visibility and influence of training within the industry

Offers greater durability of training efforts

Healthy labor-management relationships and strong training programs are mutually reinforcing.

Increases worker trust and engagement

A national joint training partnership can facilitate the development of career ladders, providing means to upgrade workers who otherwise are stuck in “dead-end” jobs.

Improves worker recognition and morale

A well organized national apprenticeship and training system conveys credentials and recognition to front-line workers.

Strengthens the industry's ability to work with key external parties to improve training

A national joint training partnership can work effectively with funding agencies, secondary and postsecondary institutions and other external training providers and researchers.

Institutional Arrangements

Employers can implement training unilaterally without participation of unions. However, in the union sector, apprenticeship programs are generally co-sponsored by the employer and a union and administered by Joint Apprenticeship and Training Committees. The membership of these committees is always composed of 50 percent management representatives and 50 percent worker representatives. Thus in either unilateral or joint apprenticeship programs, employers are involved in sponsoring the programs.

Joint Apprenticeship and Training Committee are generally composed of 3 worker representatives and 3 management representatives. Some committees are larger but whatever the number, the balance between labor and management is always 50-50.

National—local relations

National partnership organizations do not control or administer individual local programs; rather they set standard of training to guide local programs. They provide technical assistance and serve in supportive roles to local programs to help improve the quality of training. National Partnerships encourage sharing of best practices. They facilitate the development of consensus skill standards. They develop curriculum and instructional materials and offer instructor training that can be shared with all. They encourage smaller local programs to join with larger programs in regional training arrangements.

A national labor-management organization can promote regional partnerships for training. The Community Transportation Center has encouraged the development of regional collaborations in Pennsylvania, upper state New York, Utah, and in Northern California around Sacramento. By linking smaller transit agencies with larger agencies in regional training arrangements,

In another recent regional initiative, a group of thirty transit agencies and community colleges formed the Southern California Regional Transit Training Consortium (SCRTTC)-–a training resource network focused on the development of the transportation industry workforce. Begun in 2004, the consortium has already secured several grants to increase training capacity for its transit maintenance technicians. The effort has attracted inquiries from other regions in California interested in developing a regional approach. The Consortium aims to optimize educational resources and eliminate duplication. Its courses to date are focused on "Intelligent Transportation Systems," which includes applications of electronics and multi-plex control systems. However, its training seems to be getting off to a slow start. Over a two-year period in 2005-2006, 171 trainees each attended an average of just over 14 hours of classes. To date, the Consortium has not included transportation unions as members.

Collaboration in apprenticeship and training is usually only one element of broader management-labor cooperation. Collaboration in training and labor-management cooperation are mutually reinforcing. Joint training in apprenticeship is now commonly accompanied by safety and health initiatives and other forms management-labor cooperation. A good example can be found in the relationships between Boeing and the International Association of Machinists. Boeing-IAM apprenticeship programs begun 1942 have evolved today into a variety of joint programs, including the Health and Safety Institute, the Quality through Training Program (QTTP), and Vocational Solutions. The Health and Safety Institute promotes safe and healthy workplaces. QTTP offers a variety of programs for training, retraining and personal growth to support Boeing's continuous improvement process. Begun in 1989, QTTP assists employees impacted by technology change, job combinations, redeployments, or layoffs. The program also offers customized training in specific skills for factory production workers, along with career counseling, computer skills training, and other classes in skills development and personal development. Vocational Solutions helps with training and accommodations for workers who are injured or sick to stay at work or return to work.

The goals and objectives of joint activities at IAM-Boeing are instructive:

- "To promote union and management working together
- To provide employees opportunities to identify and pursue career, personal, and quality of life development goals
- To develop processes and programs that contribute to the continuous improvement of our production processes

- In a timely and efficient manner, to develop, provide and/or deliver high quality training and services that meet our customers' requirements [and foster] continuous improvements in health, safety and lifelong learning." (http://www.iam-boeing.com/about_goals.cfm)

Note especially the focus of these goals and objectives on customer needs and on continuous improvement in production. Both are key elements of a high performance workplace.

Joint programs in manufacturing such as Boeing tend to promote learning of all kinds. Apprenticeship is just a part of the mix of learning offered. The IAM-Boeing programs include tuition reimbursement for college attendance, safety training, job-related learning of all kinds, and personal enrichment learning. By contrast, programs in the building trades tend to be more narrowly focused on job-related learning through apprenticeship and journeyman upgrade training.

In order to identify training needs for IAM employees, QTTP has been leading groups of hourly workers and first-line supervisors who work together to identify technical and personal training needs of employees. These labor-management advisory committees analyze specific situations to determine if training is an appropriate solution. An evaluation takes place to see what training is in place and to identify gaps. Options are discussed and a solution is proposed.

IAM-Boeing offers specialized training to help production workers adjust to technological changes and to job combination. In order to identify training needs for IAM employees, QTTP has been leading groups of hourly workers and first-line supervisors who work together to identify technical and personal training needs of employees. These labor-management advisory committees analyze specific situations to determine if training is an appropriate solution. An evaluation takes place to see what training is in place and to identify gaps. Options are discussed and a solution is proposed.

IAM-Boeing also offers training to workers requesting transfers to other Boeing units. IAM-Boeing also provides career counseling and re-training to workers who are being laid off.

The International Masonry Institute (IMI) is another example of broad labor-management cooperation that grew from collaboration in apprenticeship. IMI describes itself as "a strategic alliance between the International Union of Bricklayers and Allied Craftworkers and their signatory contractors that promotes quality construction in all masonry trades"

(http://www.imiweb.org/). IMI has initiatives to sponsor masonry craft training, instructor training, and training in health and safety, to provide technical assistance in design and construction, and efforts to promote labor-management cooperation. Through its one-week "Masonry Camp" each summer, IMI invites architecture students to team with apprentices to work together on a series of projects. The experience provides both groups a better understanding of one another and of the uses of masonry materials.

Financing Options for National Training Partnerships

Labor-management partnerships are financed by a wide array of public and private sources. The Working in America Institute recently profiled a dozen labor-management partnerships, providing information on their sources of funding. A matrix summarizing nearly 50 sources of funding used by one or more of the twelve is presented (Work in America Institute, 2005, Matrix 2). In addition to the 50 sources mentioned, federal and state transportation legislation offer potential sources for the transit industry.

Many well-established joint apprenticeship programs operate on funding negotiated through collective bargaining and maintained in a dedicated trust fund administered by JATCs. Even at the rate of pennies per hour worked, this approach offers the advantage of growing automatically with increases in employment. It also provides a core of funding which can be supplemented by government grants. Some programs use industry funds very effectively to leverage public funding. For example, the national Laborers-AGC Education and Training Fund has been able to obtain government grants for as much as ten times the amount of training contributions it collects through collective bargaining. The Laborers-AGC has received funds from a wide variety of government agencies, ranging from the Superfund at the Environmental Protection Agency to develop and implement curriculum development and training in environmental abatement to the U.S. Department of Education to teach English to their Spanish-speaking members.

In seeking grants, it is important to be both selective and innovative. Avoid the all too common approach of chasing funding in requests for proposals (RFPs) that do not match the industry's needs or priorities. First, determine what the industry wants/needs through a highly participative strategic planning process, then seek ways to fund it. For example, the International Masonry Institute used their Job Corps training contracts with the U.S. Department of Labor to develop curriculum and training techniques that were subsequently

widely applied in their masonry apprenticeship programs. The Job Corps funding also enabled masonry instructors funded by the Labor Department to attend the national instructor training sessions, which helped IMI to begin its national instructor training program. Likewise, when the International Masonry Institute wanted to translate their instruction materials into Spanish, they developed contracts with the U.S. Agency for International Development (AID) to train Central American workers. The contract gave them resources to translate their curriculum materials into Spanish, which were also used with Spanish-speaking workers in the US.

Some states make available special funding dedicated to supporting related training in apprenticeship programs. The level and extent of financial support varies considerably from state to state. Some states fund most of the cost of related and supplemental training. Some states provide limited funding to support related training, which helps offset the costs of instructors and consumable supplies used in training. Others states provide little or no special funding for apprenticeship.

Community colleges are excellent resources in some areas; but problems can arise, such as inconvenient locations and/or scheduling that become barriers to training, inadequate instructors, and/or refusal to use relevant curriculum materials chosen by industry. Also, enrollment numbers drive community college course and courses are not offered if they cannot draw a minimum number of students. While community colleges can be a good provider of basic level courses, advanced training specialized to the industry's needs is often best provided in industry-sponsored classes or through on-the-job training. Working through a regional consortium affiliated with a national partnership gives the industry greater leverage to influence community colleges.

Conclusions

The nature of joint apprenticeship and training programs varies with labor market circumstances. Building trades programs in the unionized sector have developed training institutions to cope with the challenges posed by construction markets, where jobs and job sites are ever changing, attachment between workers and individual employers is casual, and employment is subject to cyclical and seasonal fluctuations. In this environment, individual employers tend to under-invest in training for fear of losing their investment as workers move to other employers. Multi-employer sponsorship of apprentices and training trust funds mitigate the problems by offering a means to share the benefits and costs of training.

National partnerships guided and administered by Joint Apprenticeship and Training Committees have developed to undertake functions most effectively and efficiently conducted at the national level. The overarching mission of these national training partnerships is to support local programs to improve the quality and quantity of training while lowering average costs of training delivery. In part, national partnerships have achieved this through negotiating consensus on skill standards, developing common curricular materials, arranging instructor training and development, monitoring the quality of local apprenticeship programs, and providing special training assistance or equipment where it is needed.

In industrial sectors such as manufacturing, joint apprenticeship programs have been established between unions(s) and an individual firm. Even when the company has multiple plant locations, such as does Boeing or the Ford Motor Company, common apprenticeship and training programs and policies apply across the country because it is efficient to avoid duplication of efforts at each plant.

In nearly all cases, apprenticeships are part of a larger package of jointly sponsored training programs. Yet apprenticeship-trained workers who have a broad range of skills form the core of the skilled workforce. Special training is initiated to help workers adjust to changes in technology, new materials, or other changes in the workplace. Special efforts are made to worker input on the training needed. In some industrial settings, joint training programs

include educational assistance programs, self-improvement training, and even career counselling and training for laid off workers.

In learning from the experience of apprenticeship and training in other industries, the transit industry needs to consider its own labor market needs and circumstances. Since the transit industry is in danger of losing many of its core skilled maintenance workers to retirement, apprenticeship programs featuring an emphasis on mentoring relationships offer an attractive means to develop a core of skilled workers. Significant changes in technology such as conversion to digital electronics and control systems calls for update training for incumbent workers.

To the extent that the skills needed are unique or specialized to transit agencies, classes, instructional materials, and on-the-job training will need to be developed and taught by the industry. Community colleges can be helpful resources for classes in basic subjects (e.g. AC-DC Electricity), but will be less helpful in teaching knowledge and competencies specific to the industry.

A national partnership working with strong regional coalitions offers the most efficient approach to developing the maintenance skills the transit industry needs to meet its challenges of growth, increased retirements, and technological change.

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Websites of Selected Joint Apprenticeship and Training Programs

United Brotherhood of Carpenters (UBC) and Associated General Contractors (AGC)
Education Partners: George Meany Center and Pennsylvania State University
http://www.carpenters.org/apprenticeship/
http://www.carpenters.org/training/

United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industries of the United States and Canada (UA) –Mechanical Contractors Association of America (MCA)
Education Partners: Washtenaw Community College, Michigan, Eastern Michigan University
http://www.ua.org/training.asp
http://www.ua.org/videos.asp

International Training Institute (IMI)
Sheet Metal Workers and the Sheet Metal and Air Conditioning Contractors Association (SMACNA)
Education Partners: Ivy Tech Community College of Indiana
http://www.sheetmetal-iti.org/

International Masonry Institute (IMI) Bricklayers – Masonry Contractors Association
Education Partners: National Labor College, George Meany Center
http://www.imiweb.org/

International Association of Bridge, Structural Ornamental and Reinforcing Ironworkers
Education Partners: University of San Diego (for instructor training)
Education Partners: National Labor College, Ivy Tech (for college credit)
http://www.ironworkers.org/becoming/apprenticeship.aspx

Ironworker Apprenticeship Instructor Certification Program
http://www.ironworkers.org/ht/d/sp/i/1711/pid/1711

National Joint Apprenticeship and Training Committee (NJATC)
for the Electrical Industry

International Brotherhood of Electrical Workers (IBEW)–National Electrical Contractors Association (NECA)
Education Partners: University of Tennessee
http://www.njatc.org/

Boilermaker National Apprenticeship Program
International Brotherhood of Boilermakers–Boilermaker Employers
http://www.bnap.com/

Laborers International Union of North America (LIUNA)- Associated General Contractors Education and Training Fund (Laborers–(AGC)
Education Partners: National Labor College, George Meany Center
http://www.laborers-agc.org/

Quality Through Training Program (QTTP)
IAM/Boeing Health and Safety Institute
International Association of Machinists (IAM) and Boeing Company
http://www.iam-boeing.com/

PATHWAYS
Communications Workers of America (CWA) and Quest
www.pathways-tpi.org

National Advisory Coalition for Telecommunications Education and Learning (NACTEL)
Communications Workers of America (CWA) International Brotherhood of Electrical Workers (IBEW) and AT&T, Verizon, Quest and Frontier/Citizens Telecommunications
Education partners: PACE University and New England College of Finance
www.nactel.org

United Auto Workers (UAW)-Chrysler National Training Center
http://www.uaw-chrysler.com/training/home.cfm