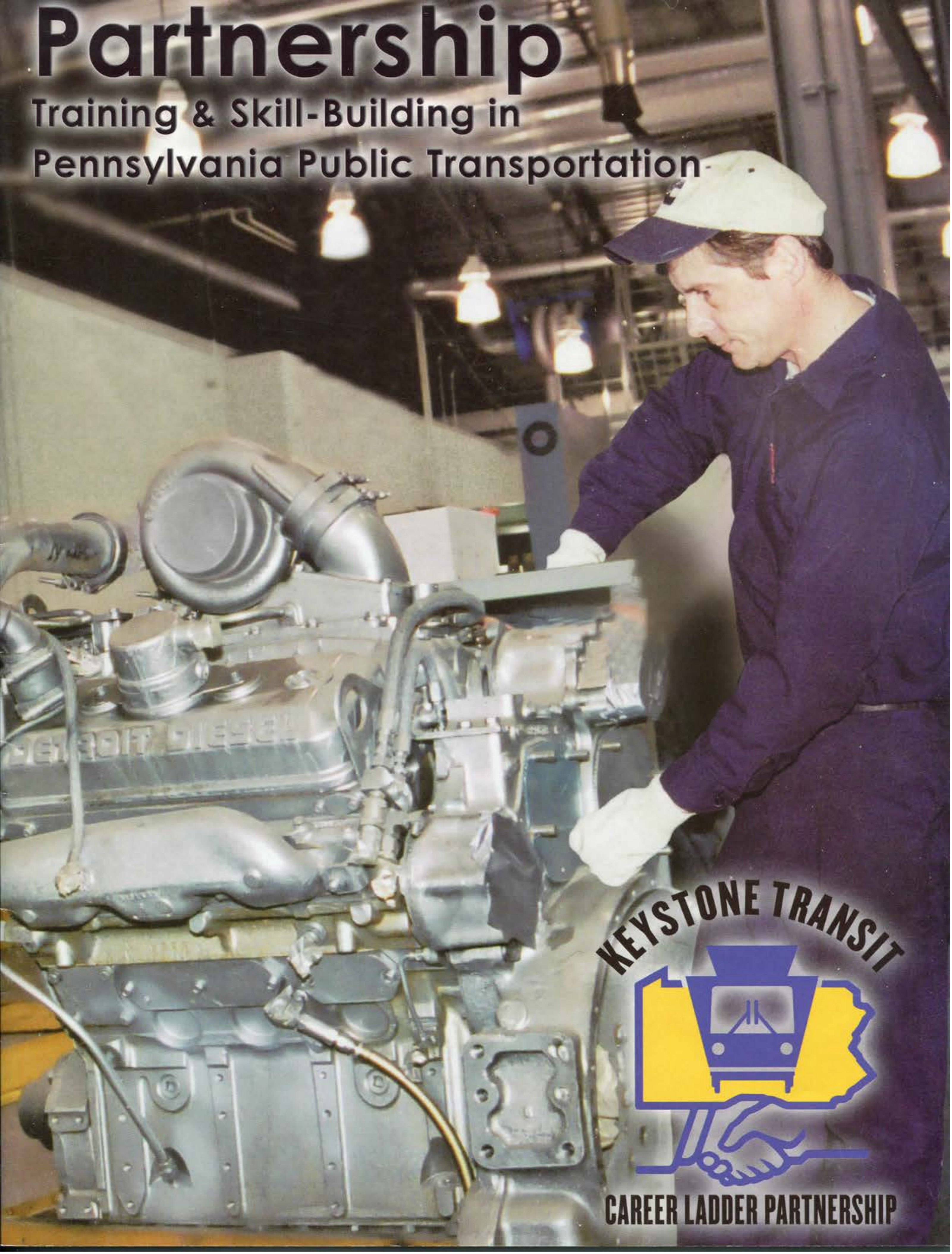
Partnership

Training & Skill-Building in Pennsylvania Public Transportation



KEYSTONE TRANSIT

CAREER LADDER PARTNERSHIP

MAJOR PARTNERS

Pennsylvania AFL-CIO

Pennsylvania Public Transportation Association

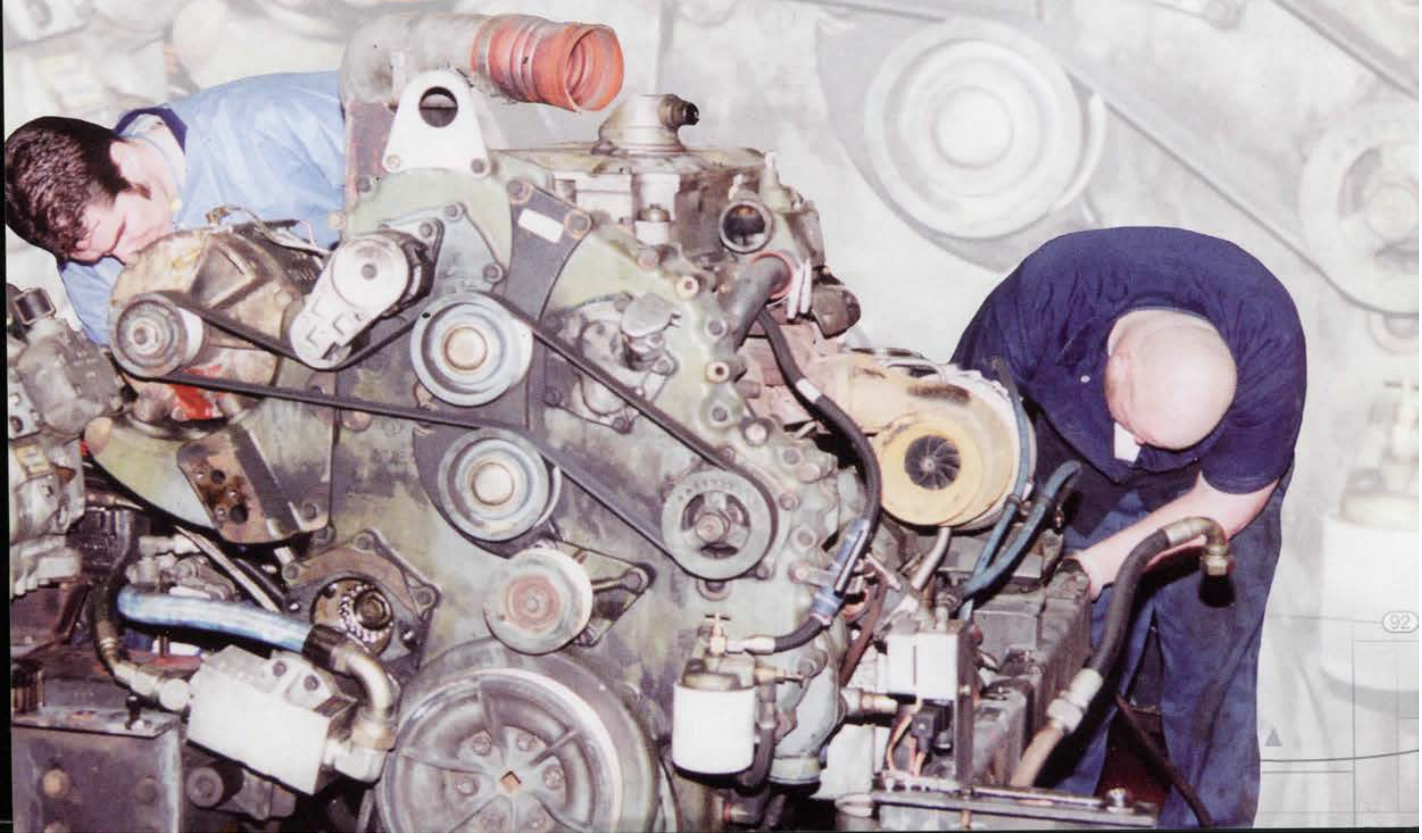
Transport Workers Union

Southeastern Pennsylvania Transportation Authority

Amalgamated Transit Union

Port Authority of Allegheny County

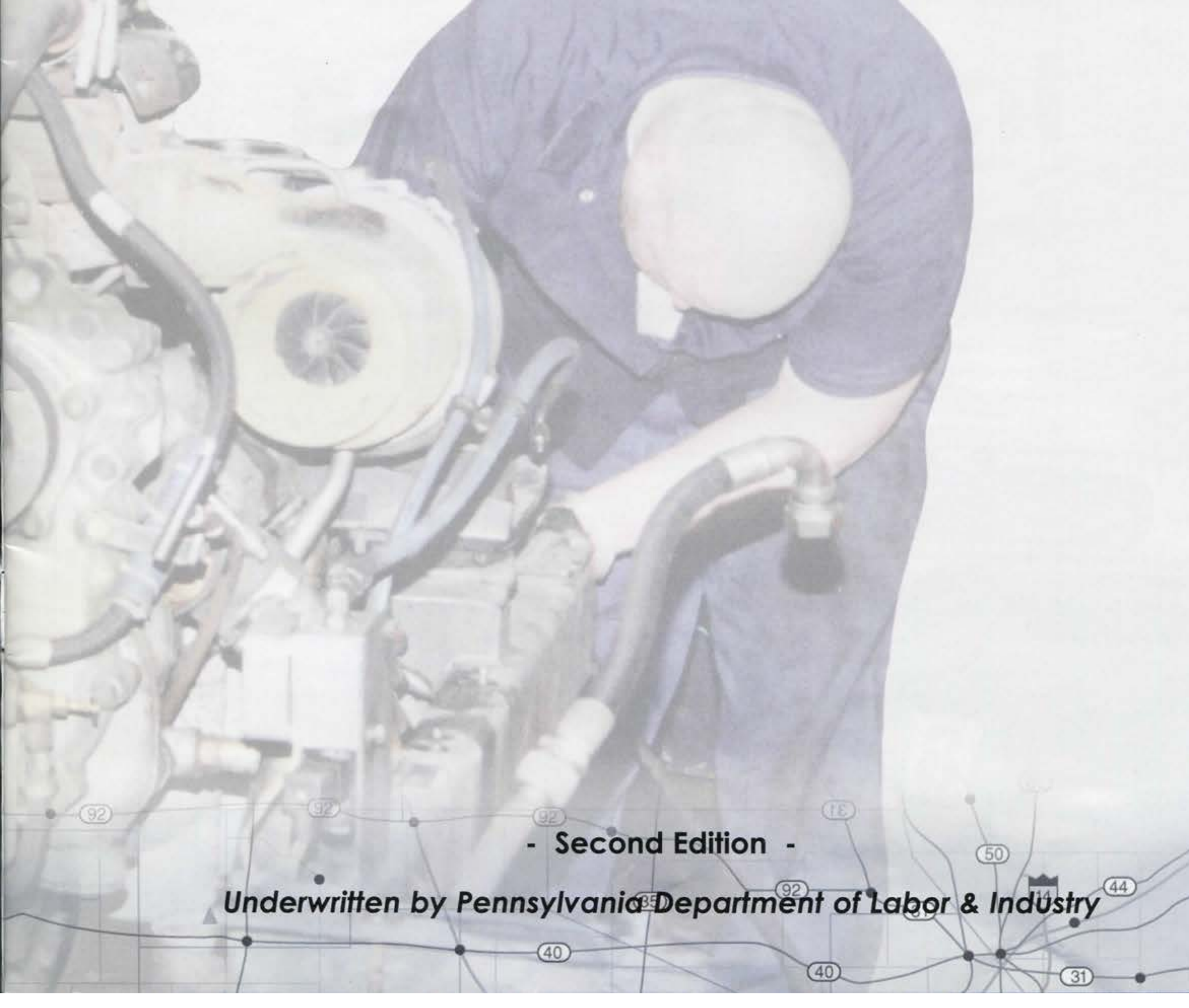
Community Transportation Development Center



A BRIEFING FOR POLICY MAKERS

Keystone Transit
Career Ladder Partnership

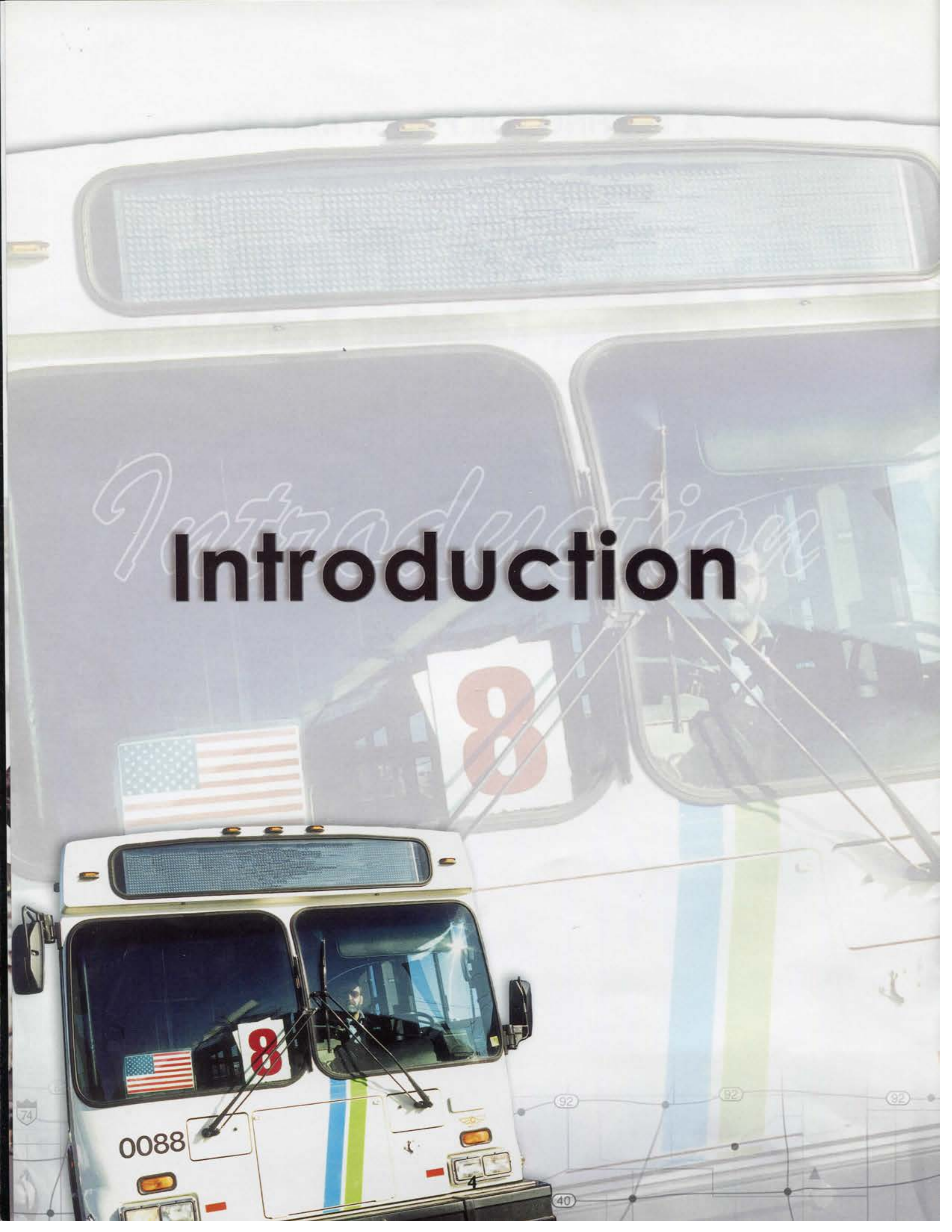
A STATEWIDE LABOR-MANAGEMENT INITIATIVE TO ENHANCE TRAINING & SKILL-BUILDING IN PUBLIC TRANSPORTATION



- Second Edition -

Underwritten by Pennsylvania Department of Labor & Industry

Introduction



GROWTH OF PUBLIC TRANSIT

Most state and federal policy makers are familiar with the advantages of public transportation in terms of its ability to move great numbers of people safely, efficiently and with a minimum impact on the environment. In terms of safety alone the record is enormously impressive, with those commuting by bus or rail being on average 35 times safer than their counterparts who drive or ride in an automobile. A major reason for this outstanding record is the professional operator who is highly trained to anticipate potential safety problems. Another reason is found in technologically advanced monitoring and communication systems that are increasingly common to mass transit vehicles. As a result of this well-deserved reputation for safety, as well as efficiency and convenience, public transportation ridership has grown a full one-fifth in the past 5 years, reaching its highest level in more than 40 years.

PENNSYLVANIA

Within our Commonwealth, this national trend has been replicated with total transit ridership approaching 430 million trips annually and these numbers are expected to increase in the future. In 2001, our state had 17,000 persons employed in 42 transit systems serving both urban and rural areas in 26 counties. Major among these systems are the Southeastern Pennsylvania Transit Authority (SEPTA) and Pittsburgh's transit system, Port Authority of Allegheny County (PAAC), who together employ over 10,000 persons. Presently, the status of mass transit as a preferred means of transportation in Pennsylvania is fourth in the nation, with only New York, Illinois and the Washington D.C. metro area operating at higher levels.

CHOICE

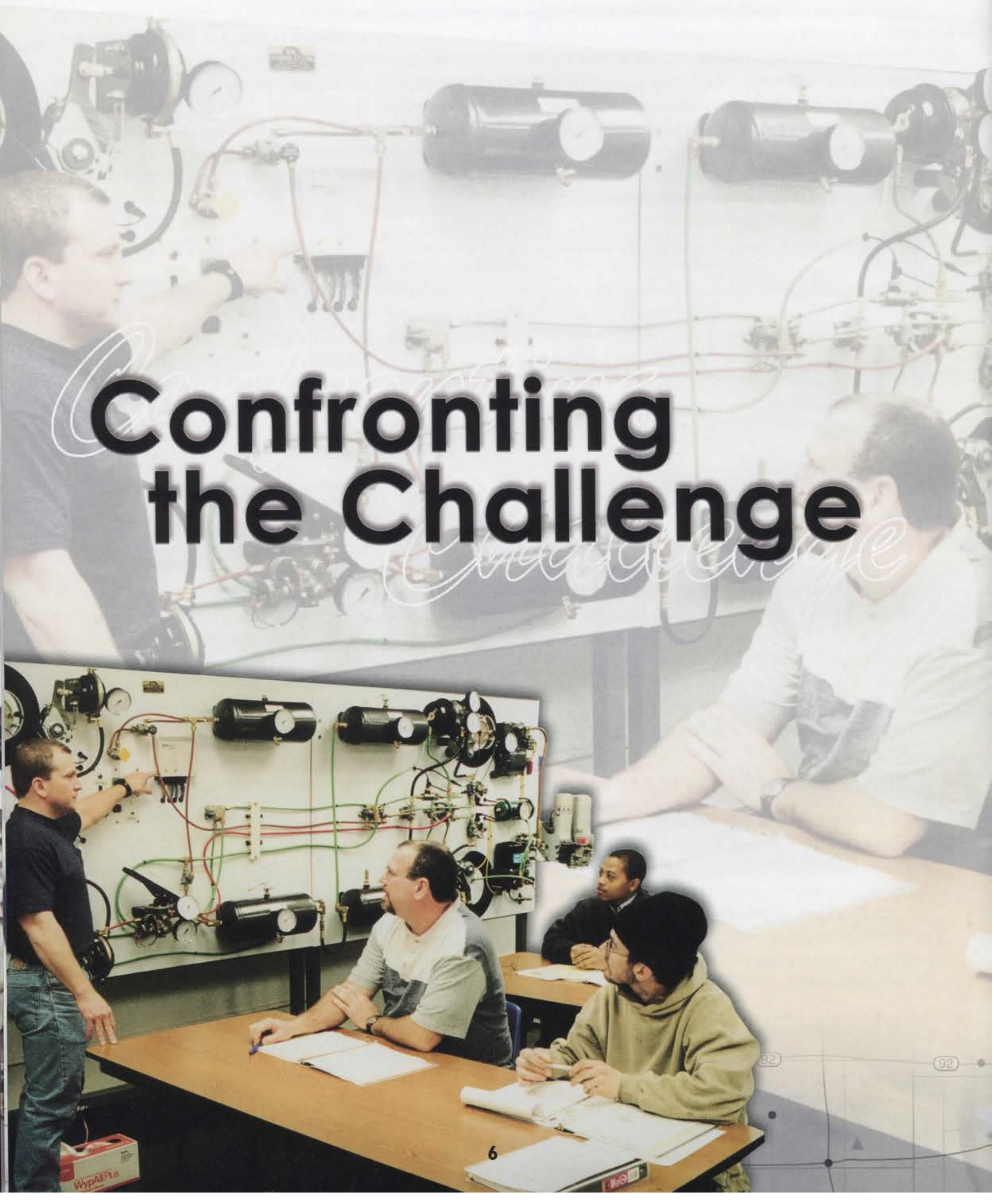
A valuable aspect of mass transit too often given insufficient attention is the vital role it can play in the future growth of business and the economic development of a city, town or region. These same advantages inherent in a well-designed modern public transportation network extend far beyond moving people each day from where they live onto where they are needed to enable industry, science and commerce to thrive and prosper. Mass transit can also be an essential element in controlling and organizing growth, as well as in managing the development of available land and natural resources. A transit system can slow and even reverse urban sprawl by dramatically improving access to the city's core. It gives planners the ability to create and direct growth, to protect farmlands, revitalize downtown areas and improve the quality of life within the community. It allows more choice in terms of where people live and work or pursue their daily business—and all of this simply by providing them with an efficient, safe and convenient means of transportation.

URBAN PLANNING

In many cities and towns, parking is severely limited and becoming prohibitively expensive. Driven by ever increasing traffic demands, valuable land normally slated for tax-generating downtown development was instead dedicated to the building of enormous and often unsightly parking garages. In some cases, inner city freeways are built through commercial and even residential neighborhoods, degrading property values and furthering urban blight. This leaves city planners wondering if downtowns are being developed to promote commerce and community activities, or simply to manage great numbers of automobiles. At the same time, it is apparent to state planners of roads and highways that our cities can no longer build themselves out of automobile traffic.

For these and other reasons, mass transit has become central to intelligent urban planning and the future development of the broader metropolitan area. This same realization also brings with it a number of challenges in terms of the need to secure and further enhance the quality and safety of public transportation service provided to millions of Pennsylvanians.

Confronting the Challenge



PARTNERSHIP

Driven by a growth in ridership, rapid technology change and natural employee attrition, serious skill shortages and job vacancies are an increasing concern to those who manage, maintain and operate many of Pennsylvania's public transportation systems. In December 2001, a determined effort was begun to meet this challenge, when management and labor from these same transit systems came together to form the Keystone Transit Career Ladder Training Partnership.

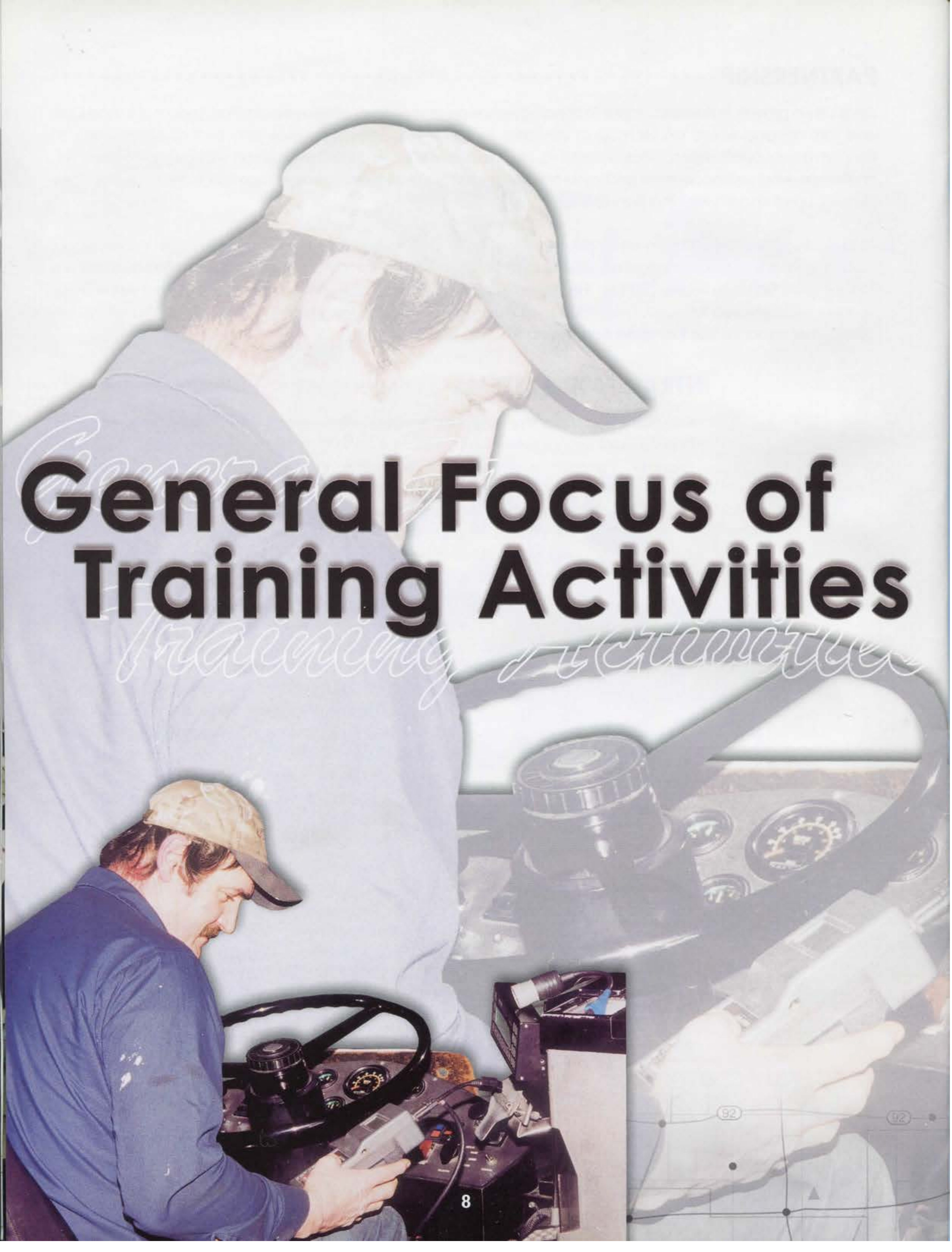
At the core of this broad team effort are the state's largest mass transit systems and unions: the Pennsylvania Public Transportation Association, representing more than 40 transit systems within the state; the Southeastern Pennsylvania Transit Authority (SEPTA); the Transport Workers Union (TWU), the Amalgamated Transit Union (ATU) and the Pennsylvania AFL-CIO. The inclusion of the Port Authority of Allegheny County (PAAC) Transit System now further expands the Keystone Partnership training activities.

INTRA-STATE SYSTEMS

Activities within these smaller public transportation systems were initiated with extensive interviews of management and labor personnel at 15 designated transit properties across Pennsylvania. The purpose was multifold: to assess the level of new technologies affecting each system; to determine the extent of training currently in progress; to identify present skill shortages and to ascertain the impact on each system's knowledge base as a result of employee attrition. Following evaluation, the information was incorporated into a graphic database on these same public transit operations serving Pennsylvania third class cities and their home counties.

In July of 2002, labor-management teams began the planning and scheduling of training sessions at four pilot locations among these cities with the assistance of the PPTA and ATU partners. Training began in October on transit bus electrical systems using curriculum and professionals associated with the proven PennTRAIN (Pennsylvania Training Resource and Information Network) program, with 50% of the participants' wages underwritten by the Keystone Partnership. Pennsylvania's class 3 transit active in the 2003-2004 series of Keystone programs include facilities in Allentown, Altoona, Beaver County, Harrisburg, Johnstown, Lancaster, Lebanon, New Castle, Reading, Scranton State College, York, Wilkes-Barre and Williamsport, as well as other class 4 and 5 facilities throught the state.

General Focus of Training Activities



GENERAL FOCUS OF TRAINING ACTIVITIES

Early in the Career Ladder workforce development program, a SEPTA-TWU joint focus group had analyzed five important areas listed below. Curriculum was developed for direct channeling and training has been ongoing:

- Bus Mechanics
- Rail Car Mechanics
- Underground Power Systems
- Elevator / Escalator Maintenance
- Basic Skills / Entry Level Jobs

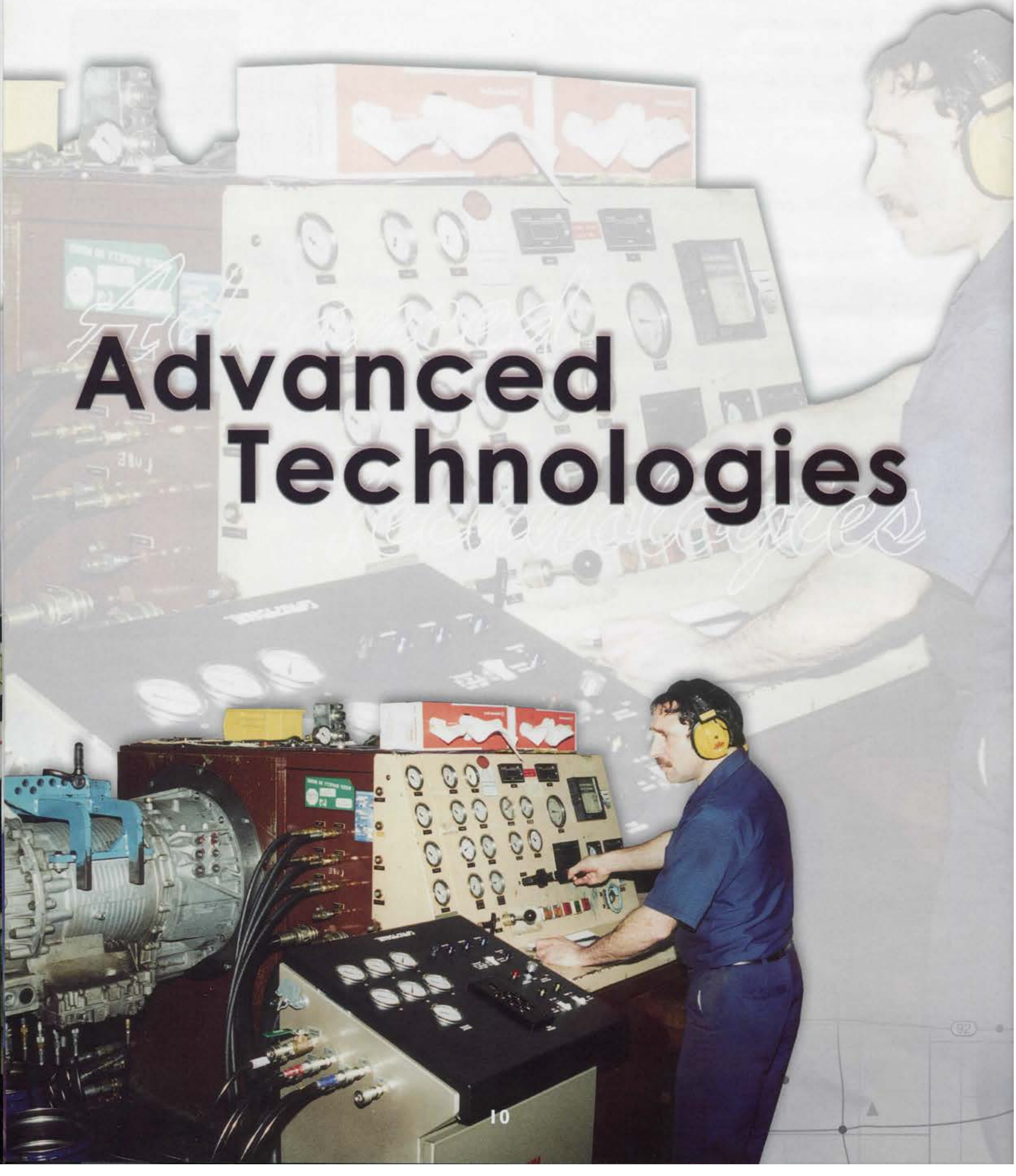
Higher skilled disciplines undergoing or targeted for training:

- Preventive maintenance inspection skills
- Computer skills: working familiarity with hardware and software
- Electronic diagnostic systems
- Digital locater systems employing GPS
- Wireless and hard-wired communications equipment
- Machinists and other technical rail network positions
- Welding: New alloys and grade progression
- Automotive and equipment mechanics
- Transit bus transmissions
- HVAC (Heating, Ventilation and Air Conditioning)
- Electrical power supply systems
- Hydraulic and Pneumatic systems and components
- Non-revenue automotive vehicles and equipment maintenance
- Underground Power Main: Millwright / Mechanics training

Overall, maintaining the transit equipment used in extensive rail operations demands a broad organizational knowledge base incorporating many work skills that are highly complex in nature. An example of this is found with SEPTA's new M4 fleet that utilizes a wide range of advanced technologies, especially in the area of electronics. Listed below are only a few of the many work tasks necessary to the efficient and safe operation of this large fleet of modern rail cars:

- Diagnosis and repair of microprocessor systems utilizing computer, software and simulators.
- Repair of multi-layered circuit boards.
- Design / testing of fixtures for printed circuit boards.
- Repair of electronic public address systems.
- Testing and calibration of power brake relays.
- Installation, testing and de-bugging of prototype electronic equipment.
- Examination and assessment of reliability and long term integrity of bearings, chutes, condensers, contactors, controller cylinders and all component parts.
- Diagnosis and repair of microprocessor-controlled inverters and converters.
- A working familiarity with all equipment and components directly related to one's specialization.

Advanced Technologies



TRANSIT OPERATING SYSTEMS

In recent years, the rapid development and application of *next-generation* technologies within public transportation has brought about dramatic advances in road and rail equipment as well as in their support facilities. While not always apparent to the riding public, many of the operating and safety innovations presently on line, or soon to be integrated within these systems, are far superior to those in use only a decade ago. These same advances are further enhancing the already excellent safety record of public transit systems.

Expectations support the continued application of new and innovative technologies within the transit industry, potentially at an accelerated pace and almost certainly for the foreseeable future. These advances promise major benefits in terms of a much more efficient scheduling in passenger service as well as improved public confidence in terms of reliability and convenience. Additional benefits include the capacity to actually reduce the already low impact of public transit operations on the environment, further improving the quality of life for those of us who live or work in urban areas.

A DRIVING NEED TO SECURE & ENHANCE THE SKILL BASE

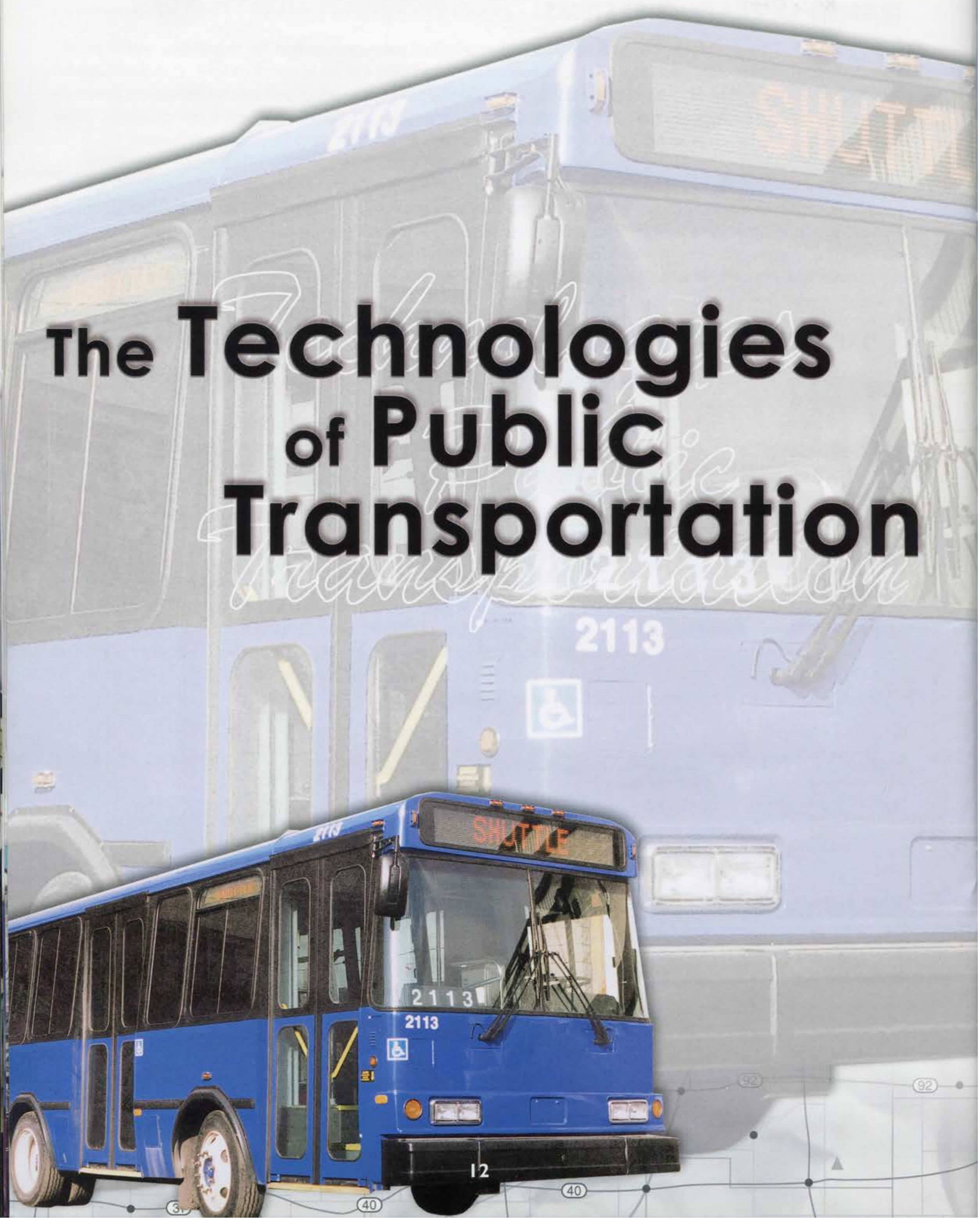
At the same time, the increasing maintenance demands of both present and state-of-the-art technologies presents significant challenges to both management and labor within Pennsylvania's transit systems. Major efforts will be necessary simply to sustain the present skill base in traditional disciplines that are consistently subject to erosion by an on-going process of natural attrition. This is a particular concern with entry-level employees who are at times in need of remedial instruction and training in the most basic proficiencies. Within some systems this less than adequate transfer of workplace knowledge and skills has imposed heavy service demands on maintenance departments forcing an increased scheduling of overtime simply to keep operating equipment out on regular runs.

Beyond these more basic needs, there exists a further urgency to aggressively enhance the existing skill base in order to meet the challenges presented by the rapid introduction of more advanced operating systems and equipment. This continued application of new operating systems will continue to make job qualifications and assignments ever more technical and complicated. The increasing use of both fixed site and on-board computers in the operation of bus and rail vehicles, along with the sophisticated diagnostic equipment necessary to maintain trouble-free performance are, by themselves, a major challenge to skill-building programs.

THE ECONOMIC ADVANTAGES

Finally, there are also sound economic reasons in support of these broad and ambitious training programs. At the present time, in part due to the accelerating pace of technology change incorporated into transit vehicles, many of Pennsylvania's transportation systems have increasingly come to rely on relatively expensive extended warranty programs available from transit vehicle manufacturers. In yet other cases, off-warranty repair work is often outsourced to the manufacturers or vendors of both electronic equipment and major propulsion or driveline components. The success of these training programs will give transit systems a renewed capacity to accomplish major road and rail equipment repair work in-house, utilizing its own employees on a more cost effective basis. Added value can also be realized by a capability to provide repair and rebuild services for other transit properties as a means to increased revenues. The advantages gained from enhancing the core competencies of a system's work organization can go beyond even these benefits. This ability to have major work performed on site by skilled in-house employees directly translates into more revenue-producing vehicles out on-line for more of the time.

The Technologies of Public Transportation



Represented are highly developed technologies already on line, presently emerging or under development

THE TRANSIT BUS

ELECTRONICS

Engine and modular transmission drive lines, anti-lock braking systems (ABS), heating, ventilation and air conditioning (HVAC), as well other major components of newer transit vehicles are increasingly harnessed to complex electronic operating controls. In turn, electronic controls are monitored by on-board master diagnostics and in some cases, include remote monitoring from a central site.

42 VOLT / ENHANCED VOLTAGE LEVELS

Electrical systems on transit buses will eventually be upgraded to a new 42 volt standard to meet increasing power demands on these systems. Later systems may be designed to operate as high as 370 volts.

EGR: EXHAUST GAS RE-CIRCULATION / VNT: VARIABLE NOZZLE TURBOCHARGER

These combined technologies allow part of a bus's diesel exhaust usually dispersed into the outside air, to be redirected (by way of electronic controls and a cooler) back into the engine's combustion chambers. These re-circulated exhaust gases reduce urban pollution while improving both engine performance and fuel economy.

MULTIPLEX

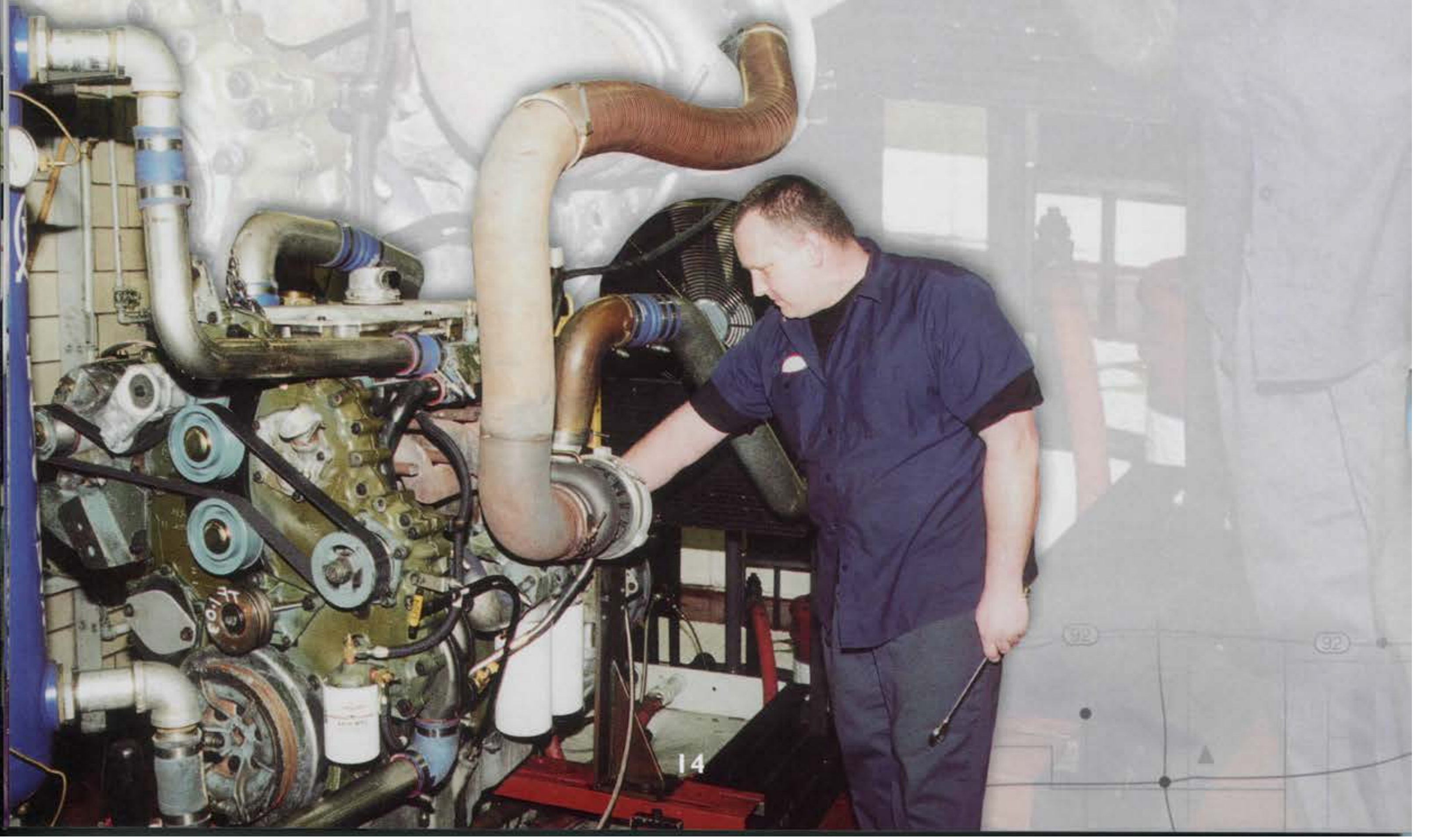
Compact and LED-monitored electronic networking is fast replacing the traditional tangled maze of wires that were common to older hard-wired designs of relays and switches. *Multiplex* is both easier to service and much more reliable. At the same time, diagnostic skills are required to service these advanced systems.

AVL AUTOMATIC VEHICLE LOCATION

This system takes advantage of on-board *GPS and two-way radio, as well as computer hardware and software that allow for constant navigational tracking of the individual bus and instant communications with the transit property's dispatch center. The AVL System dramatically improves bus scheduling and passenger safety and security, while providing performance monitoring for needed maintenance. AVL can also give the rider-customers public access to *real time* information on any particular bus in operation.

*Global Positioning System

The Technologies of Public Transportation



ALTERNATIVE POWER SYSTEMS

CNG

Buses fueled by **Compressed Natural Gas** are already a common sight in urban areas. While expensive to fuel, these buses are significantly less polluting. Well over 100 of these low emission vehicles are currently operated in Pennsylvania.

LNG

Less common are those buses fueled by **Liquid Natural Gas.** Although these vehicles are cleaner to operate than those powered by diesel fuel and are capable of increased fuel economy, the liquid natural gas does require expensive storage facilities. LNG fueled buses are more common to transit operations in the Western U.S.

HYBRID DIESEL-ELECTRIC

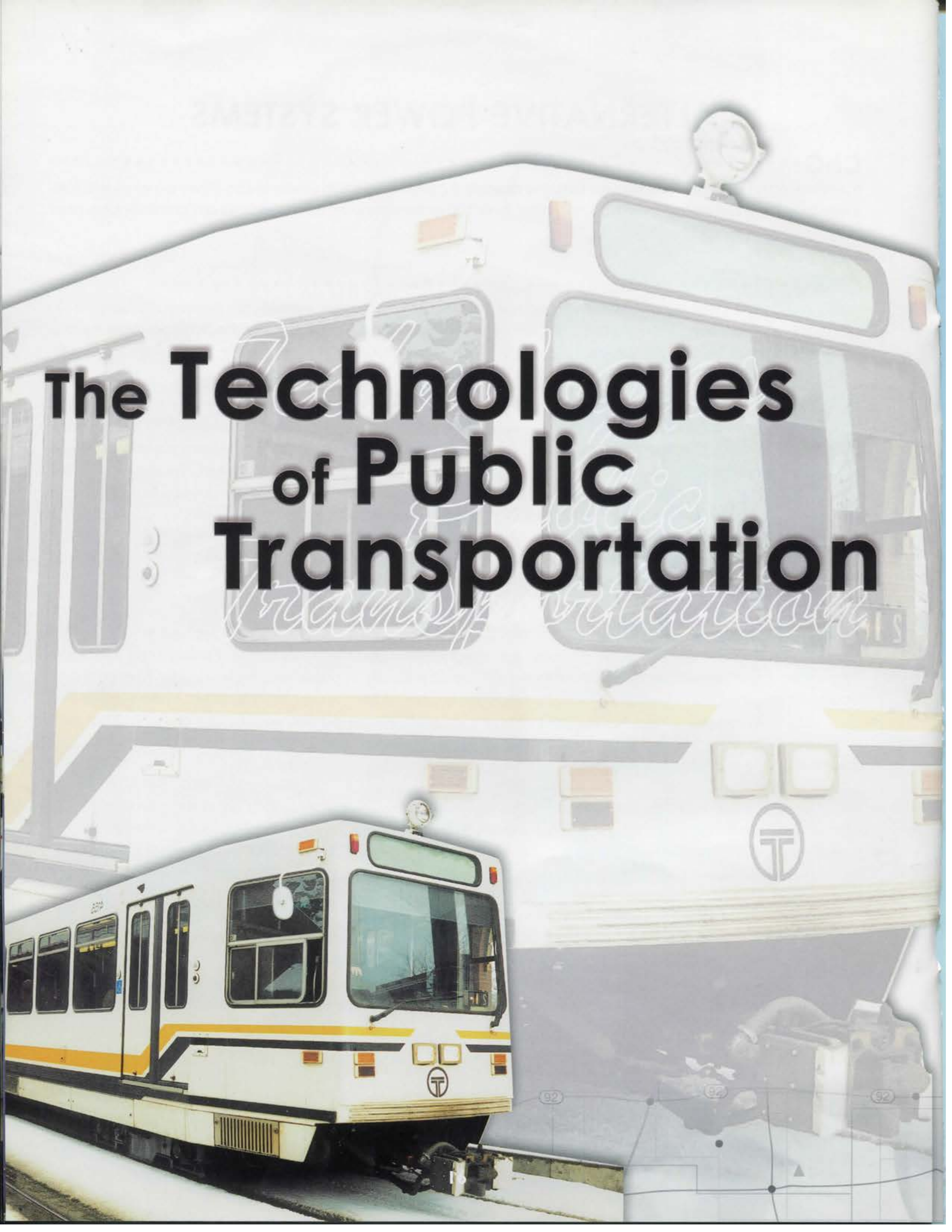
The more recent application of this automotive technology to transit buses is considered to be of major importance in terms of present technology. In Pennsylvania, hybrid diesel-electric buses are already in service within the Philadelphia area SEPTA system and are going on line within Pittsburgh's PAAC system in the latter part of 2004. These advanced power systems improve fuel economy by 50% and cut emissions up to 90%. These systems are somewhat similar to the gasoline-electric hybrid power systems successfully developed and marketed by automobile manufacturers. All hybrid systems use *regenerative braking* to recharge the vehicle's storage batteries. This power conservation feature is especially ideal for use in urban transit buses as these vehicles are commonly operated in stop-and-go traffic.

FUEL CELLS

Promising in terms of the future is the already well-advanced research into fuel cell technology. The successful application of hydrogen fuel cells as a motive power source for urban buses would allow public transportation systems to actually deliver on the present unreachable goal of zero emissions. This power system generates electricity from self-contained hydrogen fuel and oxygen from the outside air, discharging only heat and harmless water vapor. Based on research continuing at its current pace, fuel cell motive power should be available to the manufacturers of public transit vehicles within the next 10 years.

The impact of these new urban bus technologies on our Commonwealth's public transportation systems is a major challenge in terms of immediate and future skill demands. Transit properties across the state are forced to retire older equipment and bring new buses on line every year, including in southeast Pennsylvania, where SEPTA has recently ordered 400 new buses, all of them incorporating many of these same state-of-the-art-mechanical and electronic systems.

The Technologies of Public Transportation



THE TRANSIT RAILCAR

ELECTRONICS

In the electronics area, many of the advanced technologies found on newer transit buses are also common to rail-based public transportation. These include communication systems, GPS locator devices and on-board diagnostics.

CBTC: COMMUNICATION-BASED TRAIN CONTROL

These systems employ computers, communications and control technologies to expand the number of trains capable of operating together on the same transit system. While this gives the rider superior reliability and safety, it also results in a reduced need for public investment in infrastructure.

LIGHTWEIGHT COMPOSITE CONSTRUCTION

The Federal Transit Administration (FTA) is currently conducting research into new light rail construction using new lightweight composite materials. The use of composites will dramatically reduce the amount of weight centered on a rail car's wheels, thus lessening the impact on the steel rails and in turn, the constant impact that reverberates back up through the entire structure of the rail car. Such lighter weight cars would have a significantly longer service life.

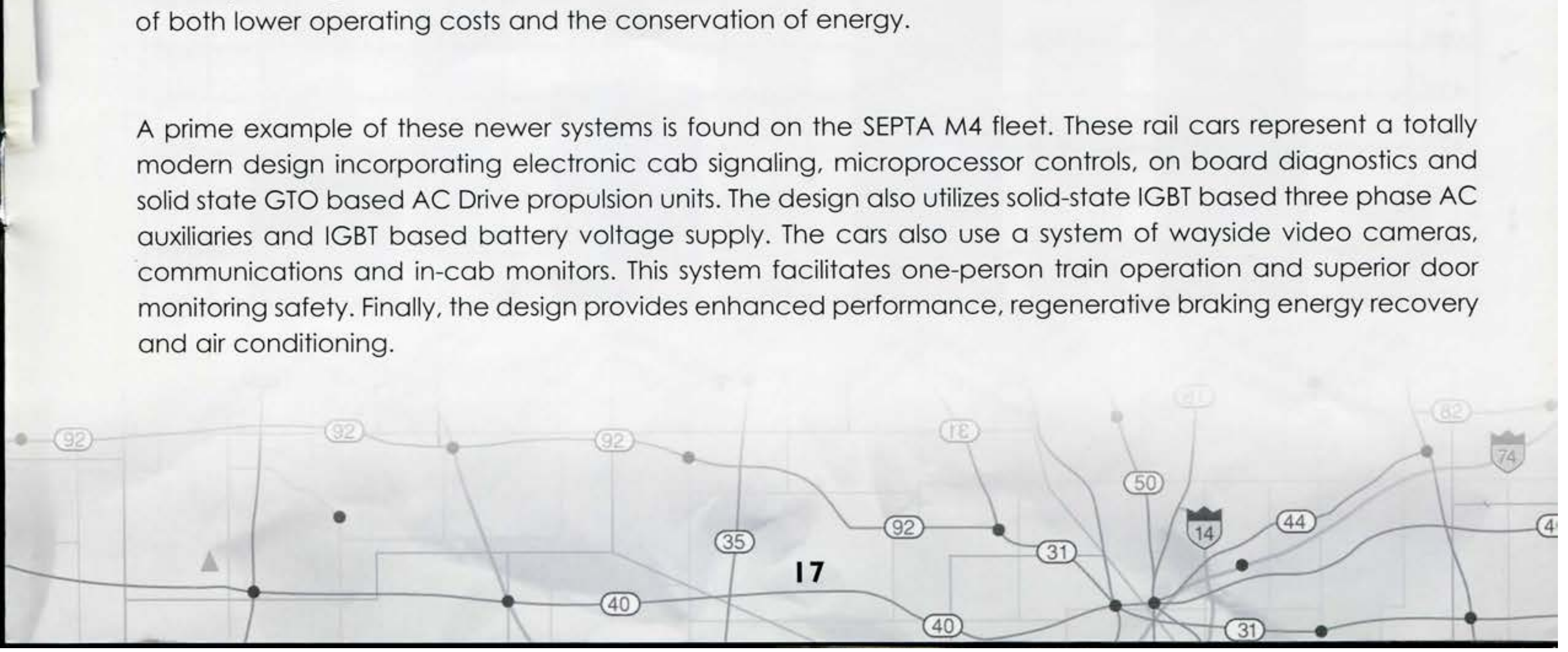
ASES: ADVANCED SPEED ENFORCEMENT SYSTEM

Integrating transponders, radio communication and on-board computers this system, currently in development, allows trains to maintain safe speeds through curves and work zones, as well as insuring positive train stops in the event of an emergency. The FTA plans to test the system at several sites over the next 5 years. Among the candidate cities is Philadelphia.

RECYCLED ENERGY

Electrical energy needed to power subway trains can be "recovered" by technology now being tested by New York City's MTA. Ten large flywheels are sited by trackside to store the equivalent of one million watts. These flywheels are designed to operate on the energy gained from subway trains that utilize regenerative braking systems. The electricity produced by the flywheels is fed into the subway's third rail power source to assist in powering the subway system itself. This emerging technology is expected to yield dual benefits in terms of both lower operating costs and the conservation of energy.

A prime example of these newer systems is found on the SEPTA M4 fleet. These rail cars represent a totally modern design incorporating electronic cab signaling, microprocessor controls, on board diagnostics and solid state GTO based AC Drive propulsion units. The design also utilizes solid-state IGBT based three phase AC auxiliaries and IGBT based battery voltage supply. The cars also use a system of wayside video cameras, communications and in-cab monitors. This system facilitates one-person train operation and superior door monitoring safety. Finally, the design provides enhanced performance, regenerative braking energy recovery and air conditioning.



BENCHMARKING...
WORK SKILLS AND TECHNOLOGIES
October 2003 - January 2004

In the spring of 2002, Keystone representatives conducted personal interviews with key Union and Management personnel at 15 Pennsylvania transit properties as a means to achieve a preliminary fix on maintenance training needs.

To further document these initial findings, beginning in October of 2003, the Keystone Partnership's outreach staff organized and coordinated detailed work skill assessments of more than 100 experienced mechanics, completing these on-site at 18 transit maintenance facilities across the state outside Philadelphia. These 34 page-long assessments include 39 skill sets integrated within 8 major maintenance responsibilities factoring a total of 787 individual work tasks.

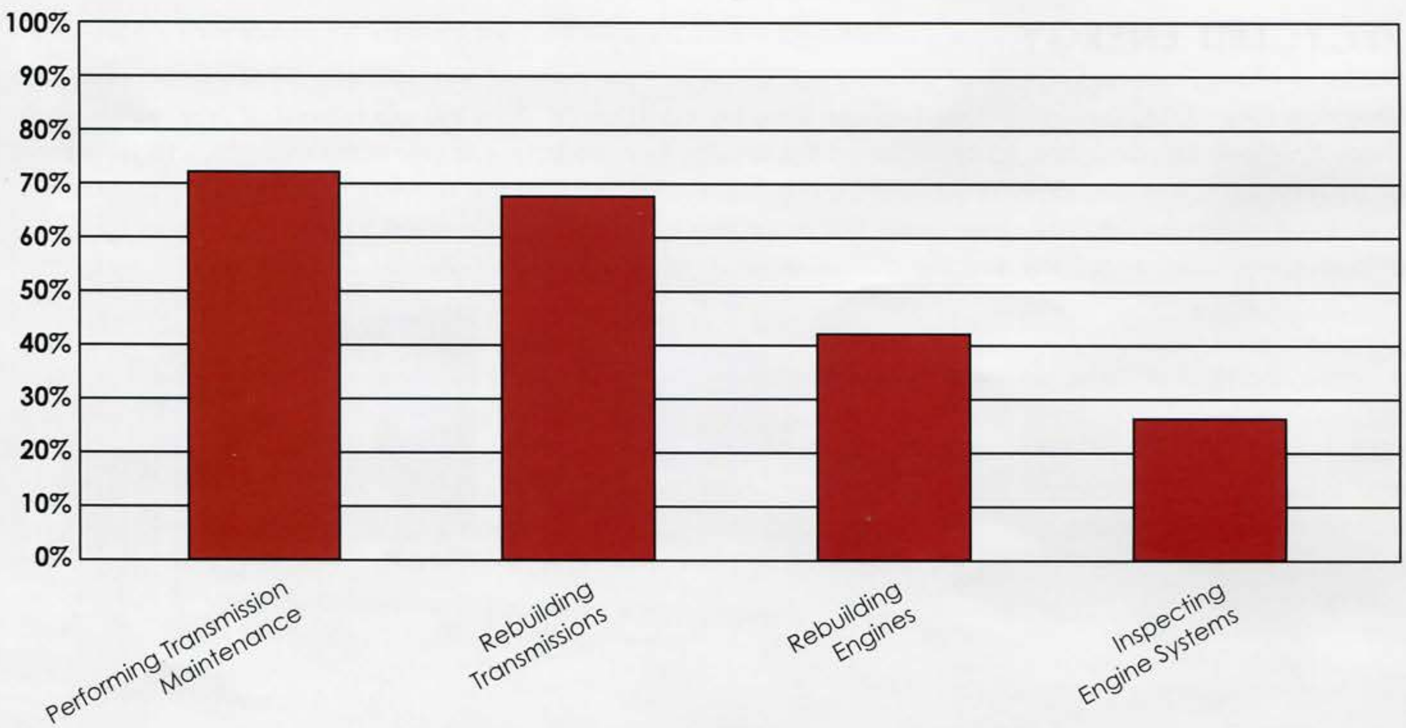
During these same visits a detailed analysis was completed on each transit property, focusing on current and future training needs, as well as providing an evaluation of the maintenance facility, its equipment, state of technology and level of work organization.

The following bar charts incorporate these individual findings on skill needs at Class 3, 4 and 5 transit operations across the Commonwealth. Included are work skills specific to engine and transmission, electronic systems, HVAC (heating and air conditioning systems), brake and suspension systems as well as general mechanical, which includes welding technologies, fuel systems, body parts and accessories, wheel chair lifts and general safety procedures.

This specialized data is essential to the design of training programs that will meet the present and future needs of Pennsylvania's public transportation system.

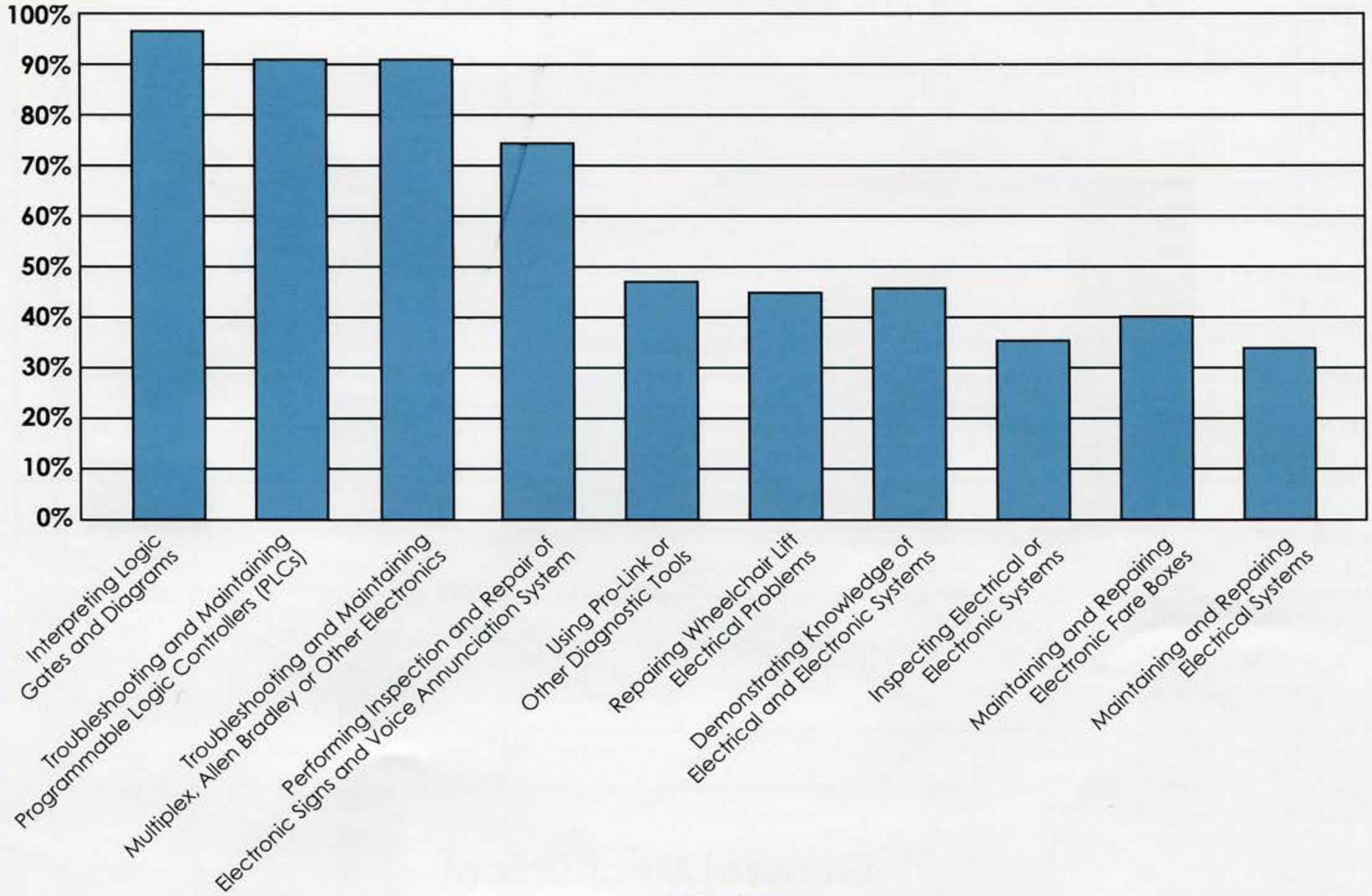
Engine & Transmission

Need for Training by Percentage



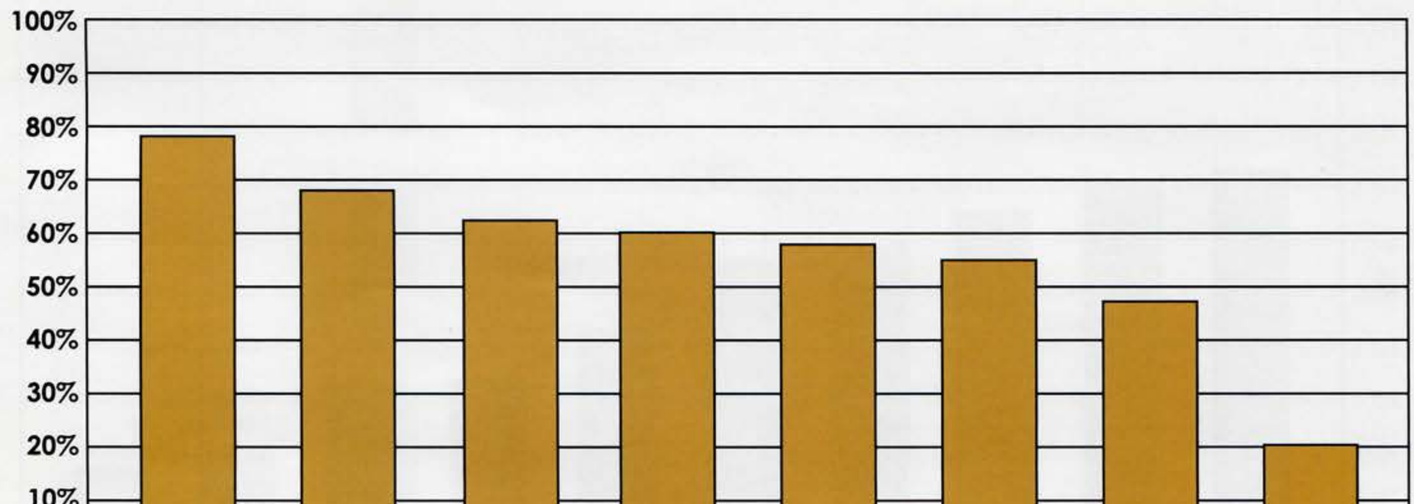
Electronic Tasks

Need for Training by Percentage



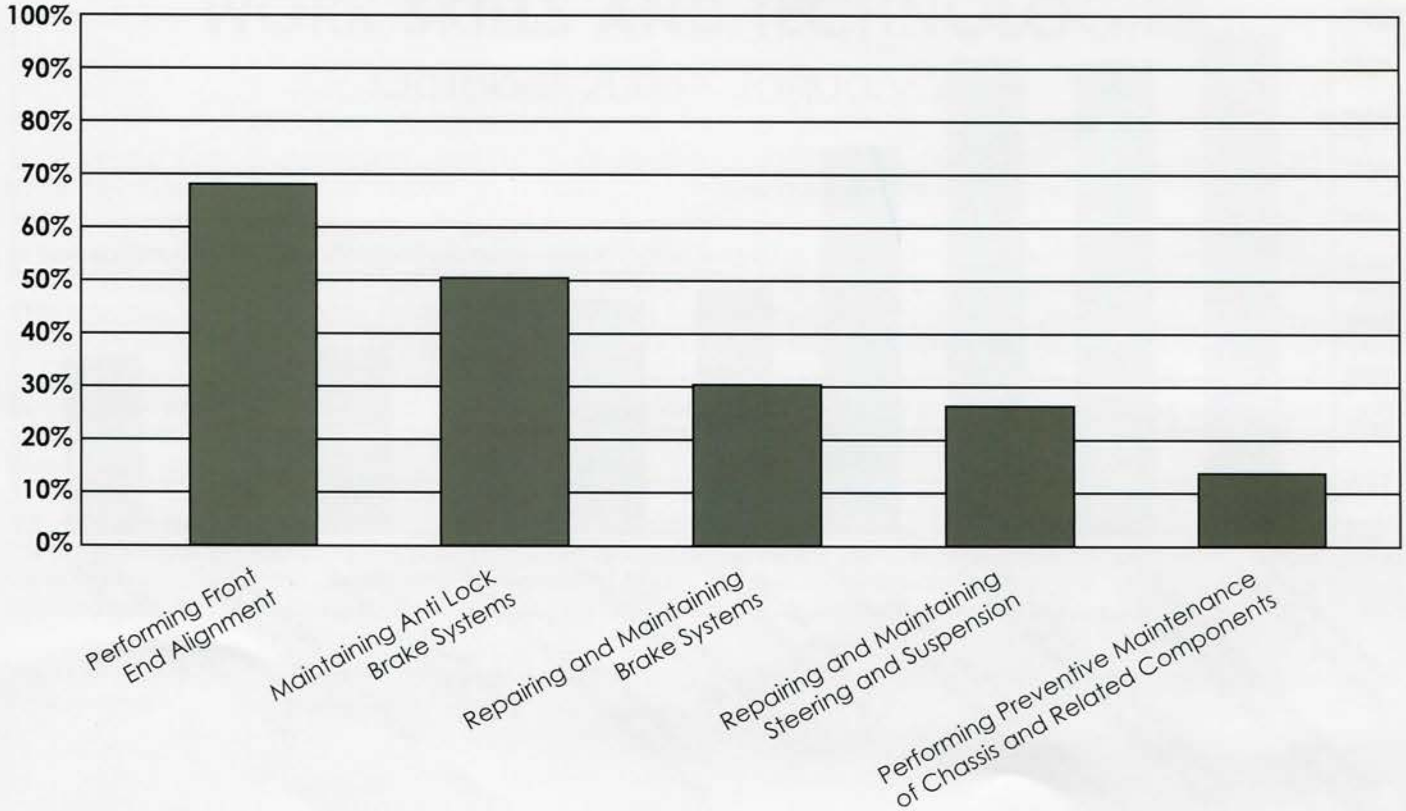
HVAC

Need for Training by Percentage



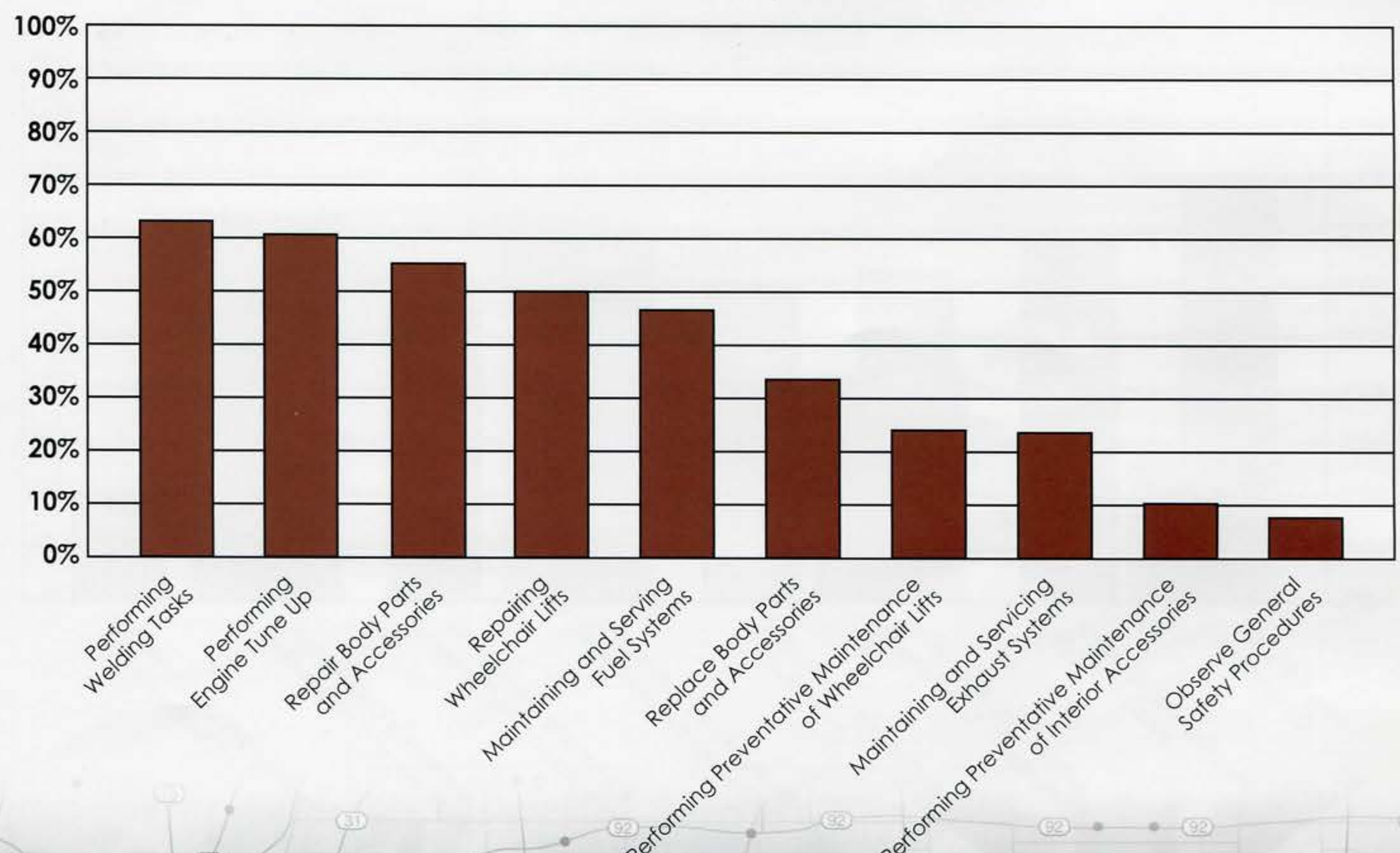
Brakes & Suspension

Need for Training by Percentage



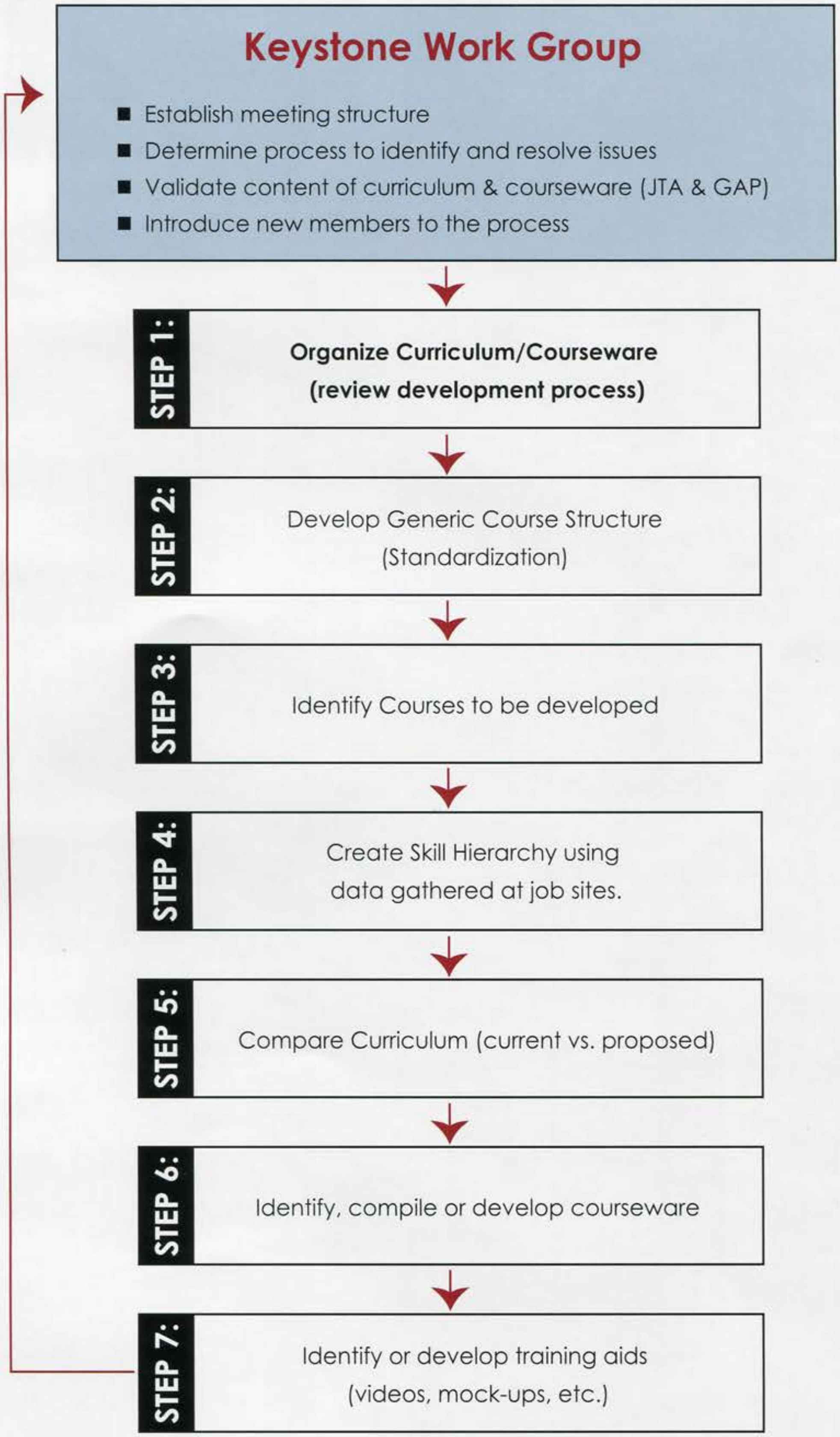
General Mechanical

Need for Training by Percentage

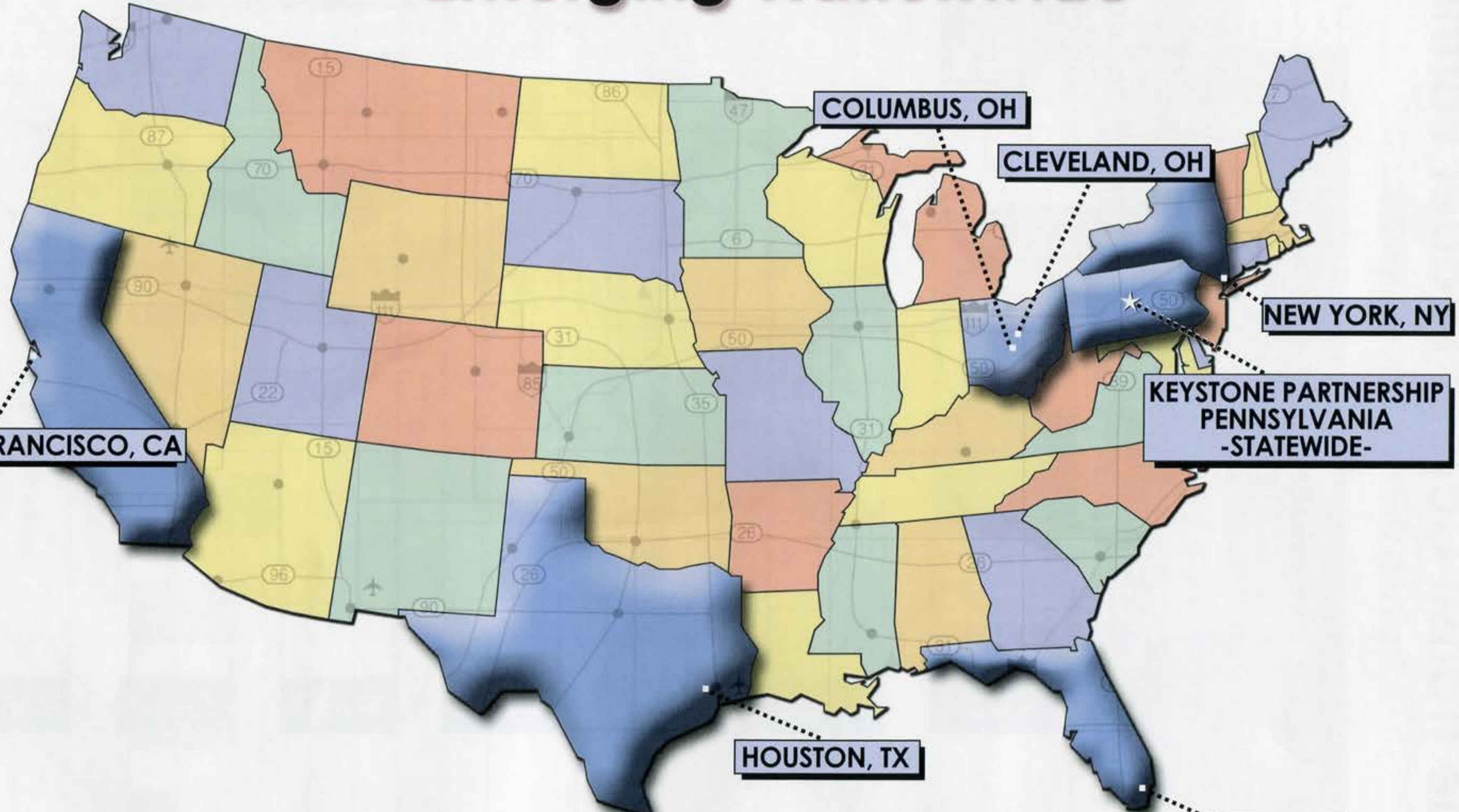


Keystone Transit Career Ladder Partnership

Training Delivery Process Model



Transit Career Ladder Partnerships Emerging Nationwide



PARTICIPANTS IN THE CAREER LADDER PARTNERSHIP

A Training Partnership
Designed for Replication...

Pennsylvania's Keystone Transit Career Ladder Partnership is the pilot for a broader nationwide effort to enhance and expand the knowledge and skills of those workers who service and maintain America's public transportation systems.

Led by Keystone, further Labor-Management transit training partnerships have been created within the metropolitan areas of New York City, Cleveland, Columbus, San Francisco, Miami and Houston.

This national effort is being driven by the Community Transportation Development Center. This Washington, DC-based research and development center provides support that is central to expanding this network of training partnerships in public transportation.

In addition to these nationwide outreach activities, the Center is presently building an internet-accessible database on shared training and skill needs information, as well as on new technologies, that are both current and emerging within the transit industry.

For further information, contact
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