

Announcement of Transit Research Projects November 2009

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) established the Transit Cooperative Research Program (TCRP), and the Transportation Equity Act for the 21st Century (TEA-21) and the Safe, Accountable, Flexible, and Efficient Transportation Equity Act—A Legacy for Users (SAFETEA-LU) reauthorized it through 2010. The TCRP undertakes research and other technical activities in response to the needs of local transit service providers and suppliers on a variety of transit problems involving operations, service configuration, engineering, maintenance, human resources, administration, policy, and planning.

A memorandum agreement outlining operating procedures for the TCRP has been executed by the cooperating organizations: the Federal Transit Administration (FTA); the National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a non-profit educational and research organization established by the American Public Transportation Association (APTA).

The TCRP Oversight and Project Selection (TOPS) Committee, the governing board for the program, recently selected projects for the Fiscal Year 2010 program. The purpose of this announcement is to inform the research community of these projects.

This announcement contains problem statements that are preliminary descriptions of the selected projects. Detailed project statements, formally soliciting proposals for these projects, are expected to be released starting in February 2010.

TCRP project statements are available only on the World Wide Web. Each

project statement will be announced by Electronic Mail. A form to register for e-mail notification of project statements is available at TCRP's website, <http://www.trb.org/tcrp>. Research project statements will be posted at the same Internet address when they are active.

The TCRP is an applied, contract research program with the objective of developing near-term solutions to problems facing transit-operating agencies. Proposals should evidence strong capabilities gained through extensive, successful experiences. Any research agency interested in submitting a proposal should first make a frank and thorough self-appraisal to determine whether or not it possesses the capability and experience necessary to ensure successful completion of the project. The specifications for preparing proposals are quite strict and are set forth in the brochure entitled *Information and Instructions for Preparing Proposals*, available on the Internet at the website referenced above. Proposals will be rejected if they are not prepared in strict conformance with the section entitled "Instructions for Preparing and Submitting Proposals."

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Summary of Approved Research Projects

■ Project A-15C

Transit Capacity and Quality of Service Manual, 3rd Edition

Research Field: Operations
Allocation: \$400,000
TCRP Staff: Dianne Schwager

The *Transit Capacity and Quality of Service Manual* (TCQSM) was initially published in 1999. The TCQSM serves as a comprehensive resource document presenting information on principles and practices of transit capacity for all transit modes, and of transit quality of service from the passenger's point-of-view. The TCQSM supplements the *Highway Capacity Manual*, which focuses on presentation of highway capacity and quality of service principles and practices. A subset of the material in the TCQSM 1st Edition serves as the basis for the transit chapters in the *Highway Capacity Manual 2000* (HCM2000).

Subsequent to the publishing of the HCM2000, a 2nd Edition of the TCQSM was published in 2003. Whereas the 1st Edition was primarily a synthesis effort of previous transit capacity research, with the quality-of-service section being its primary new contribution, the 2nd Edition focused on filling gaps in previous research, updating capacity and quality-of-service procedures, and incorporating feedback from users of the 1st Edition. The 2nd Edition, published as *TCRP Report 100*, has subsequently become one of TCRP's best-selling documents.

A 2010 edition of the *Highway Capacity Manual* is currently under development. The 2010 HCM will have a more multimodal focus than before, but given the existence of the TCQSM, the increasing page count of the HCM as a result of new research, and the difficulty of keeping the two manuals' content in sync with each other, the 2010 HCM will present a more streamlined presentation of transit. The HCM project's intent is to have a strong TCQSM continue to be the primary source for basic information on transit capacity and quality of

service. Given a new HCM 2010, there is strong feeling that an update of the TCQSM, a 3rd Edition, is required to reflect refined highway and multimodal analysis procedures, and to incorporate the substantial research related to transit capacity and quality of service that has occurred since 2003.

The TCQSM is a cornerstone of the TCRP report series. It is used by numerous universities as a basic transit education tool, was previously the subject of a National Transit Institute course, and was used by one large transit agency as an educational tool for their transit board in a series of workshops on transit quality of service, performance measurement, and service standards. An Internet search found numerous examples of usage of the TCQSM by transit agencies, metropolitan planning organizations (MPOs), and state DOTs. The manual's transit level-of-service (LOS) measures are the most commonly applied portion of the document, particularly in long-range transit plans and transit development plans, although they have also been applied to corridor studies, alternatives analyses, and environmental impact statements. The state of Florida developed a guidebook for transit agencies and MPOs on ways to apply the TCQSM's transit LOS measures. The manual's documented capacity applications have particularly focused on bus rapid transit (BRT) operations, although one example of a light rail application was also found, along with examples of the manual being used as a source of comparative modal capacities. In addition, the manual is often used as a source of transit definitions and transit capacity and quality of service concepts, even when the manual's specific procedures are not required or used for a particular application.

The TCQSM has also become known and applied throughout the world, with the Chinese and French governments already having translated the 2nd Edition. Research papers presented at TRB Annual Meetings on the usage of, and proposed improvements to, the TCQSM have come from Ireland, Netherlands, Brazil,

Mexico, South Korea, and India, among other countries. Because of its international usage at this time, there is interest to have the TCQSM expanded to include data on transit capacity characteristics outside North America, and truly become an international document. Needed improvements that have been identified for the TCQSM include:

- An assessment of the acceptability to the transit industry of the A-F level-of-service (LOS) system used to describe quality of service and, if necessary, refinements to the LOS system. Although the quality of service concept itself seems to be well received, anecdotal evidence suggests that agencies are reluctant to use the letter grades because of their perceived link to school grades and/or because of a belief that transit is fundamentally different from the auto mode and should not have a similar type of measurement scale.
- Expanded guidance on using quality of service measurement techniques in real-world applications.
- Substantial expansion of the section on bus rapid transit, drawing from recent FTA and TCRP reports, along with various papers in the literature.
- Expansion of the “Ferry Transit” and “Stops, Stations, and Terminals” chapters, which were assembled based on limited data and provide no guidance on alternative analysis tools that can supplement the TCQSM’s procedures.
- An evaluation of enhanced TCQSM analysis techniques and performance measures from the literature and, if appropriate, incorporating the findings into the 3rd Edition.
- Updating transit capacity statistics to current values.

The objective of this research is to develop a 3rd Edition of the TCQSM, to reflect the latest transit capacity and quality of service applications and research, the new multimodal focus and procedures in the 2010 Highway Capacity Manual, and interest in the international community to expand the manual

to reflect transit conditions outside North America.

The specific research proposed may include:

- Outreach to the transit industry on TCQSM usage and desired improvements and/or changes;
- A detailed review of transit capacity and quality of service research and applications produced since the 2nd Edition;
- A series of mini research projects to address identified gaps or needed content updates;
- Collection and synthesis of updated transit capacity data for different transit modes, both within and outside North America; and
- Production of the 3rd Edition of the TCQSM.

■ **Project A-35**

Defining and Implementing a Transit Safety Culture

Research Field: Operations
Allocation: \$500,000
TCRP Staff: Dianne Schwager

The news of transit accidents in the last 2 years has been significant and made national headlines, in part because of the human errors that resulted in the accidents and in some cases, fatalities. In at least two of these major accidents, transit operators/transit workers and passengers were either seriously injured or killed.

One of the questions to be answered is what is the culture of the working environment where serious accidents occur? Another question is what truly constitutes a culture of safety in a transit agency? “Safety Culture” belies the concept that a culture of safety exists in the transit community. There is some evidence to suggest that safety culture that is ingrained from the boardroom to the rail platform may not exist. There are many different safety programs, some of which are mandated by government organizations and/or groups outside of the immediate transit community. Even where there are collective representative worker

organizations, safety programs exist, but not a culture of safety since accidents occur in these situations as well.

Is it a legitimate statement to say that a safety culture is defined by top management in the organization, or is it equally legitimate to say the front-line worker defines the safety culture? Although there has been serious discussion about safety, there has not emerged a concept of how transit organizations design, develop, and implement a “safety culture” resulting in no or few accidents.

To define the “ingredients” of an effective transit safety culture, the objective of this research would be to establish the necessary protocols, communication requirements, and best practices for how transit organizations would go about implementing a true safety culture and committing to the willingness of establishing metrics as part of a program.

The research may include a review of relevant literature, on a global scale, to identify key elements of what a transit safety culture could “look like”; a survey of selected American transit organizations to aid in identifying key elements of information about transit culture as well as transit safety issues; identification of a policy on safety culture; and a means to track aspects of the safety issues involved with the program to see if the metrics will aid in building the culture, thus reducing the accidents. The research will also identify and evaluate different safety culture and leadership styles.

This project is a necessary step in the development of an overall review of what a transit safety culture is and what it means to agencies. The research results would provide guidance for transit agencies in order to build an effective safety culture with metrics to measure its performance and thus minimize accidents.

■ Project A-36

Command-Level Decision Making for Transit Emergency Managers

Research Field: Operations
Allocation: \$435,000
TCRP Staff: Stephan Parker

The recent 2009 Security Update Report published by the TCRP stated, “The lack of ample security training sources and materials for and delivery to transit managers above the supervisory level is a concern that needs to be addressed.” Additionally, TCRP identified that “Transit agencies demonstrate wide variation in the levels of preparedness, including provision of security awareness training, National Incident Management System (NIMS) and Incident Command System (ICS).”

Command-level decision-making is a critical factor in the success of management and mitigation efforts of critical incidents. Emergency and law enforcement personnel need a safe and realistic environment in which to hone their decision-making skills. Research has shown that the more experience emergency responders have with critical incidents, the more “workable,” “timely,” and “cost-effective” their decisions become.

A review of training courses provided by transit or emergency response agencies confirms that the majority of available training is designed for front-line transit workers and first responders. Live, inter-agency exercises are performed annually, at most. For rail workers, such training is required bi-annually, as defined in 49 CFR Part 239, *Passenger Train Emergency Preparedness*. Therefore, frequency and depth of training is negatively affected by availability, travel costs, time required for attendance and personnel replacement, and the high cost of executing live exercises. These conditions limit the opportunities for transit emergency managers to improve their skills.

The objective of the research will be to develop an automated, functional exercise simulation system to provide on-demand emergency response training compliant with NIMS and in conformance with transit regulations and standards. The system should allow individual training, team training, and multi-agency training within one framework. It should also address all levels of learning and provide foundational concepts in a knowledge-level system for prerequisite study prior to team exercises, thus moving the learner from novice to expert.

The system must be cost-effective, scalable, easy to setup and use, have readily available support, provide a measured assessment, and allow participants to exercise the resources and policies they use in everyday life.

The system should include automated assessments based on measurable actions that can be used to gauge individual and team comprehension and effectiveness, and a clear mechanism to meet specific compliance activities defined by the DHS/FEMA NIMS Integration Center in accordance with Homeland Security Presidential Directive 5.

One such system is the Think-Under-Fire Decisions simulation (TUFD). TUFD was initially sponsored by the National Guard Bureau and has been extended through funding by the Airport Cooperative Research Program (ACRP Project 4-04). By leveraging TUFD, transit objectives can be realized with maximum return on investment.

TUFD is a complete training solution with capabilities for basic knowledge-level training through a scenario-based simulation and exercise for increasing expertise and decision-making capability. The system runs over the web using any browser and provides a broad collection of emergency scenarios. TUFD provides individual training and both tabletop and functional exercise capability, and offers an automated, unbiased assessment of participant actions both individually and as a team.

This research would create a tailored version of TUFD (i.e., TUFD Transit) that provides transit-specific scenarios for both natural and terror-related hazards. The recent 2009 Security Update Report revealed that the terrorist threats of primary concern to multimodal, rail-only, and ferry systems were explosives, chemical and biological threats; hijackings and shootings; and sabotage. The terrorist threats of primary concern to bus agencies were hijackings, shootings, explosives, and sabotage. Natural hazards include weather-related events such as hurricanes and floods.

Participant roles for functional sections and typical transit agencies would be modified to

reflect transit needs. Areas for which it is consistently difficult to train personnel would be identified by working with transit emergency personnel, law enforcement, and subject matter experts. TUFD would be updated to effectively address these issues. Tools to customize TUFD to meet specific transit needs and geographic areas would also be developed. Finally, a web-based system would be developed to deliver training and exercise options and to track training requirements fulfillment for individual employees and teams.

Each weekday, 34 million people board public transportation. Public transportation ridership continues to rise as a consequence of high gas prices, economic hardship, and awareness of global warming. Public transportation systems serve the largest economic and financial centers in the nation. Transit systems operate alongside or near our largest business and government buildings, intermodal transportation centers, and many of our nation's most visible icons. These facts make transit a high-value target for terrorist attack.

Despite significant improvements since 9/11, and large educational investments, such as the Federal Transit Administration's (FTA) on-site Security and Emergency Management Technical Assistance Program for the 50 largest transit agencies (Top 50 SEMTAP), critical gaps remain in the state of emergency management and response.

In a study conducted by the FTA's Security and Emergency Management Technical Assistance Program, "wide variation is evident in the levels of security preparedness among the 50 transit agencies studied. ... Areas needing improvement also exist, which, if left unattended, may leave these transit agencies vulnerable to terrorist or criminal activity." Although that study was conducted in 2007, the picture remains largely unchanged, for the following reasons:

- Transit security and emergency management professionals now have more courses than ever available to them, but often such training has been reported as generic, or disjointed. Standards of performance are inconsistent. A unified

framework is needed to ensure that training is consistent.

- Because training is disjointed, a comprehensive program is needed that can be used by the individual, small teams, the organization, or across organizations. Such a program should accommodate novice transit employees, as well as highly-experienced and managerial levels.
- Although new employees receive security training, ongoing training has proven difficult to achieve. A system should be provided to allow individuals to refresh their training on demand, at no additional cost.
- Insufficient understanding of Incident Command Systems (ICS) and National Incident Management Systems (NIMS) remains prevalent in the transit industry.

Finally, even given comprehensive, evolving, consistent, and highly available courseware, higher order skills such as critical thinking, analysis, and problem solving occur more naturally through application and practice. Live exercises, though optimal for this purpose, are undoubtedly the most costly type of training, and cannot be successfully replicated.

TUFD addresses the above-listed weaknesses and can fulfill all of the following requirements:

- Unified framework
- Consistent standards of performance tied to learning objectives
- Scalable training from individual to multi-agency
- Learning effectiveness, taking trainees from novice to expert through classic online learning to practice through functional simulations
- On-demand training, any time, any place, free to the transit community
- NIMS compliant, and customizable.

With widely varying terrain, resources, personnel, and identified vulnerabilities, it is important to customize training to the needs of the local agency. TUFD provides a Scenario Builder

capability that allows users to create their own scenarios or modify existing scenarios.

By increasing the effectiveness of training through TUFD Transit, transit agencies will be better prepared to manage critical incidents. TUFD Transit provides the opportunity to standardize training and exercise requirements mandated in compliance with NIMS. TUFD Transit will not only provide more effective training, but will also meet and exceed certain DHS mandates, squeezing every drop of utility out of a limited training budget.

Implementing TUFD Transit throughout the community requires no new equipment, IT support, or special software. TUFD runs in any browser and uses Adobe PDF and the Flash player, which are typically installed in any PC by default.

■ Project A-37

Paratransit Emergency Operations and Preparedness Handbook

Research Field: Operations
Allocation: \$350,000
TCRP Staff: Stephan Parker

ADA paratransit operators face special challenges in responding to natural disasters and other emergencies. Not only do these systems transport a particularly vulnerable population, most systems are operated by contract providers so that drivers are not employees of the transit agency and are not under direct control of the transit agency. Response issues to emergencies can be divided according to whether the emergency is one that can be predicted (such as hurricanes) and ones that occur suddenly with no warning (earthquakes, major electrical blackouts, terrorism).

In the case of emergencies that can be predicted, paratransit systems may be called upon to assist in evacuation or to bring people with disabilities to shelters. *TRB Special Report 294: The Role of Transit in Emergency Evacuation*, released in July 2008, generally found that transit (defined to include bus, rail, and paratransit) is not sufficiently integrated into emergency response planning. In addition, the report notes:

“The type of transit service—whether publicly owned and operated or contracted out—can also affect the extent to which transit drivers and equipment will be available in an emergency. In many urban areas, for example, paratransit service is contracted out, and control over drivers and equipment can be an issue during an emergency. Special arrangements must be made in advance in contract agreements to help ensure continuity of service during an emergency evacuation.”

Where paratransit contractors are not solely dedicated to the transit agency contract, additional concerns arise. The TRB report notes:

“Transit agencies are likely to be hard pressed to accommodate those who need special assistance because these services are often contracted out to smaller paratransit operators or demand-responsive service providers. In an emergency evacuation, these specialized providers often face competing demands for their services and have limited drivers and equipment that may not be available to provide the necessary emergency service.”

In the case of sudden, unpredictable emergencies, evacuation is often not an option. When a sudden emergency strikes, paratransit operators need to make decisions about the passengers currently on-board their vehicles, such as whether to attempt to bring them to their destinations or to return them home, and then what to do if conditions at the destination or home do not allow the passenger to be dropped off. Paratransit operators may also be called upon to assist passengers who have been delivered to programs earlier in the day. Drivers need guidance about how to proceed, particularly in the event that communication with dispatchers is disrupted or if roads are impassable.

In the event of a declared emergency, county and regional emergency operations centers will

begin operating. Transit systems are represented at some but not all of these centers. However, the individuals who staff these centers (including transit agency liaisons to them) are often not familiar with paratransit operations and the special set of issues that paratransit providers will face following a major regional disaster. Paratransit resources may go unused and the needs of paratransit customers may not be adequately considered. In the case of a sudden emergency, many hours or even days may go by before an emergency operations center issues guidance for use of paratransit resources.

Paratransit operations depend on the continued availability of databases and software systems for management of trips and customer information. Protecting these databases and systems is of critical importance. Similarly, because of the demand-responsive nature of paratransit, operations depend on continuous communication between control centers and drivers. Paratransit systems need to better understand and prepare for likely disruption to communications systems, including establishing backup communications methods and protocols for use if communications are unavailable.

The databases maintained by paratransit operators contain sensitive personal information about customers. In addition to names and address, the databases often include information about disabilities and medical conditions, as well as frequent travel destinations. Operators are under an obligation to safeguard their passengers’ privacy. In an emergency, operators may be called on to share this information with first responders or others. They need guidance about procedures and legal concerns surrounding sharing of passenger information.

Many paratransit customers travel to and from programs operated by public and community agencies. In principle, these agencies should have their own emergency plans and be prepared to respond to sudden disasters. However, many of them most likely intend to rely on paratransit to return their clients to safe locations. Ideally, some of these agencies would serve as safe dropoff locations in the

event that passengers on-board vehicles cannot be returned to their homes. Paratransit operators need guidelines for communicating with these community partners, including social service agencies, medical facilities, and dialysis centers, regarding expectations about preparing for emergencies and what they can expect from paratransit.

Many paratransit customers require life sustaining treatments such as dialysis and rely on paratransit for transportation to and from these treatments. In the event of predictable emergencies, procedures such as those developed by many transit systems in Florida can ensure that these customers receive their treatments immediately prior to evacuation and upon return. In the case of a sudden, unpredictable disaster, guidelines and procedures are needed for identifying these customers, providing continuing service to the extent possible, and coordinating with dialysis centers to determine which ones are operating and alternative locations to the extent possible.

Because most paratransit systems are operated by contractors, it is important for these contractors to develop methods to maintain contact with their employees, know how to keep appropriate records to assure reimbursement for extraordinary expenses, and help their employees be personally prepared for emergencies in order to increase the likelihood that they can assist during an emergency and can be assured about the safety of their families. Many paratransit providers are small local companies that may have limited financial resources. Extraordinary expenses in an emergency or disruption of normal payment mechanisms could result in business failures, which could cause service disruption and place transit systems in the position of needing to conduct an emergency procurement. Transit systems need models for provisions that they can include in paratransit service contracts, and how they should work with contract providers to assure emergency preparedness.

ADA paratransit systems operate within a regulatory framework based on civil rights of people with disabilities. These systems need to ensure that they continue to observe these

requirements as much as possible, to the extent that they continue to apply during an emergency. Operators need guidance about the extent to which normal ADA regulatory requirements continue to apply in extraordinary circumstances. Issues include providing paratransit service that is comparable in hours and coverage to fixed-route transit services, accommodating all trip requests from eligible individuals, and prioritizing trips for life-sustaining treatments or urgent needs during an emergency.

In small urban and rural areas, paratransit is often the sole form of public transportation and transit agency employees the only full-time personal transportation professionals in the community. The research project should investigate unique issues (if any) where paratransit is the only available form of transportation.

The objective of the research is to create a handbook that provides guidance to public transportation agencies with responsibility for paratransit services about how to prepare for all types of emergencies, including (a) predictable natural events such as hurricanes or blizzards, and (b) sudden, unpredictable disasters, including those that may cause regional disruptions, such as earthquakes, power blackouts, and acts of terrorism. The guidelines should be designed to address passenger safety, continuity of operations to the extent possible during the emergency, and preservations of resources and contractor business viability for post-emergency recovery.

The research may include the tasks below:

- (1) Determine the extent of existing paratransit emergency operations resources based on review of the literature and interviews with key informants with knowledge of paratransit operations and planning. This process should include consultation with people with disabilities and organizations that advocate for them.
- (2) Conduct a survey of paratransit operators to determine their current state of emergency

preparedness and their priority concerns with respect to emergency response.

(3) Summarize the information from Tasks 1 and 2 to show the extent of current resources, gaps in knowledge and established practices, and the most critical issues that need to be addressed.

(4) Prepare a detailed outline for a Paratransit Emergency Operations and Preparedness Handbook for review and approval by the project panel.

(5) Prepare the handbook. Likely topics may include:

- Planning and communicating with community and partners;
- Connecting and coordinating with county and regional emergency planning, including emergency operations centers;
- Response to requests for transportation assistance;
- Ensuring contractor preparedness and business continuity;
- Immediate response to a sudden emergency;
- Extended emergency operations;
- Operational communications;
- Protecting databases and computer systems
- Sharing customer information;
- Inventories of necessary equipment and supplies;
- Registries;
- Civil rights issues; and
- Unique issues in rural areas.

The handbook should provide practical and detailed guidance and models to assist paratransit operators in each of the topics addressed.

The research will help paratransit operators be ready to respond during an emergency. It will help them to provide essential life-sustaining service during an emergency, to assist during a general evacuation or evacuation of threatened facilities involving concentrations of people with disabilities, and to recover as quickly as possible following an emergency. By promoting coordination with regional and

county emergency planning, the research will help emergency managers by providing them with resources to assist people with disabilities during an emergency.

■ **Project D-15**

Research Support for Transit Industrial Control Systems and Cyber Security

Research Field: Engineering of Fixed Facilities
Allocation: \$200,000
TCRP Staff: Stephan Parker

APTA is recognized by both the U.S. Federal Government and the American National Standards Institute as a Standards Development Organization and the APTA Standards Program that began in 1996 now has over nine specific areas of standards development. Within this Program, APTA began to develop security standards for the industry in 2006 with the creation of three particular working groups on Infrastructure Security, Security Risk Management, and Emergency Management. These three working groups, comprised of representation from all stakeholders, continue to be very active in their production of standards and recommended practices.

With the support of the APTA Security Standards Policy & Planning Committee, the Security Standards Program has been approved to form a fourth Working Group; the formation of the Cyber Security Standards Working Group is targeted for November 2009. Of central concern are the industrial control systems that monitor and control physical activities on transit rail systems. It is anticipated that in early 2010 transit rail systems will need to respond to industrial control systems guidance (now in final revision) developed by the National Institute of Standards and Technology (NIST). That guidance is likely to point to the need for continuous (rather than periodic) certification of industrial control systems.

TCRP Project J-6/Task 77 has begun to bring together transit rail systems, initially in response to the National Transportation Safety Board (NTSB) urgent recommendations made to the FTA dated July 13, 2009, NTSB Reference R-

09-07. Additional NTSB recommendations of September 22, 2009, References R-09-17 and -18 (Urgent) and R-09-19, point to the need for research support for development of recommended practices and standards for industrial control systems and cyber security. The APTA Cyber Security Standards Working Group will support facilitation of volunteer participation (including travel support), which is necessary but not sufficient; research in depth is needed as well.

The objective of this research is to provide support for the development of recommended practices and standards for transit industrial control systems and cyber security. This work will build upon the previous TCRP-sponsored research to draft recommended practices and standards. Initial topics to be addressed include signal systems, track circuits, and train controls.

■ Project E-9

State of Good Repair: Evaluating the Implications for Transit

Research Field: Maintenance
Allocation: \$150,000
TCRP Staff: Dianne Schwager

Public transportation is a backbone of regional accessibility, and mature transit systems continue to be important in shaping regional growth. Keeping these mature systems in a state of good repair is essential to sustaining the existing transportation benefits. Transit agencies find that reliability and on-time performance—which are sustained by keeping transit systems in a state of good repair—are fundamental to maintaining, and expanding, transit’s market share. There are however significant funding constraints. The Federal Transit Administration’s (FTA) Rail Modernization Study Report to Congress (April 2009) evaluated the nation’s seven largest rail operators and found a backlog over \$50 billion.

If transportation-funding agencies are not able to adequately keep transit systems in a state of good repair, what would be the impacts on the transportation system? If transit service deteriorates, what other key transportation measures (such as an increase in passenger vehicle

hours of delay or criteria pollutants) would be affected?

The objective of the research would be to synthesize available information on transit state of good repair, frame the issues associated with transit state of good repair, and develop a detailed research agenda needed in this important topic area.

Several of the nation’s largest rail transit systems have been in service for a century, and even systems like BART and Washington, DC Metro are over 35 years old. Ridership growth is straining existing system capacity in many key segments, and the infrastructure is aging—in many cases beyond the useful life. Keeping transit infrastructure in a state of good repair is essential to sustain on-time performance, as reliability is a critical factor in traveler’s decision to choose transit. Reliability is key to maintain existing ridership, and to increase transit’s mode share in coming decades.

■ Project F-16

The Public Transportation Industry’s Professional Development/Human Capital Needs to Build a Sustainable Workforce

Research Field: Human Resources
Allocation: \$500,000
TCRP Staff: Gwen Chisholm-Smith

There is consensus on significant workforce challenges facing transit leaders across North America—retirement of baby-boom era employees, a generally tight labor market, increasing technological requirements across job functions, and growing diversity of the workforce. The transit industry faces a critical shortage of skilled and seasoned employment as thousands of workers from the baby-boom generation near retirement over the next 5 to 10 years. There have been recent studies conducted by the industry, including Leadership APTA program participants, on strategies for attracting Generation X, Y, and Millennium to jobs and careers in public transportation, particularly “green collar” jobs. The research has shown that having proactive and systematic approaches to address future workforce development needs is critical as the industry is faced with a competitive job seekers’ market.

Building on the success of implementing recommendations outlined in APTA's 2001 report, *“Workforce Development: Public Transportation's Blue Print for the 21st Century,”* a 1-year blue ribbon panel was established on workforce development representing the public and private sectors of the transit industry, key stakeholders, and partners, including labor, academia and the next generation of leaders in the industry. The panel was charged with (1) reviewing the research and recommendations of the earlier workforce development initiative; (2) identifying gaps, new opportunities, programs, and services geared to helping to create and sustain a vibrant, efficient, and effective workforce; and (3) defining APTA's role in providing ongoing support to members and the industry on these issues.

In 2008, APTA created a long-term vision of public transportation's role in the fabric of the nation's surface transportation system over the next several decades: “In 2050, America's energy efficient, multimodal, environmentally sustainable transportation system powers the greatest nation on earth.” Across the North American continent, trends in population, urban growth, energy, environment, and economics all point favorably to a ripe, robust future for public transportation. As part of this vision, the public transportation industry has career appeal to a new, diverse population of the best and brightest. Growth challenges since 2009 have required an intense effort to attract, train, and develop a new workforce on the scale of the U.S. space program of the 1960s. The many individuals who want to work in “green collar” jobs will recognize public transportation as an “employer of choice.”

A unified work plan for the next 5 years was presented at APTA's October 2009 annual meeting, and development of the association's 2010–2014 Strategic Plan is underway. Recommendations of the blue ribbon panel will require implementation of activities emerging from the panel's strategic vision and plan. These projects may include new programs, projects, and services to address the following: image and branding; higher education issues, including the role of colleges, universities, community colleges

and technical/vocational schools; youth outreach and awareness programs; partnerships and collaborations, including labor-management partnerships; development of performance metrics to determine the return on investment (ROI); and the impact of authorization of the federal public transportation law and other legislative proposals on workforce development. Moving forward toward implementation of these recommendations, there will be a need to conduct a comprehensive workforce development assessment for the public transportation industry. This assessment will provide a thorough overview of the evolving challenges and opportunities faced by the transit industry and the related implications for its workforce.

The objectives of this research would be to (1) assess the current and future business environment of the public transportation industry as it relates to workforce development and human capital issues and resources; (2) develop industry models that could measure the ROI for training strategies and other human capital resources, and establish a framework for regular benchmarking; (3) identify “best practices” and new business models with respect to key issues recognized by the industry, including the impact of labor-management partnerships; and (4) assess the current perception of the public transportation industry as an “employer of choice,” and identify how these perceptions might be addressed through image and branding strategies, including an emphasis on “green collar” jobs.

The research would identify the complex influences that continue to present challenges that require the industry to adapt, innovate, and invest, particularly in relation to its human capital. The findings will assist in the development of a forward-thinking and sustainable human capital and resources strategy applicable to the next decade. One of the key deliverables would be a guide outlining a framework for workforce development planning for the decades ahead. The following is a possible research approach:

- Assess the current and future business environment for public transportation.
- Examine current and future workforce planning and development activities and

recommend recruitment, retention, and ROI metrics for training strategies.

- Identify “best practices” within and outside the public transportation industry with respect to the key issues.
- Develop an encompassing vision and recommendations to create a targeted sustainable human capital/resource strategy for the public transportation industry.

The following are potential tasks and research activities to potentially support this approach:

- (1) Conduct web surveys of a representative sampling of transit employees, stakeholders and employers from other industries.
- (2) Conduct consultation, and brain-storming sessions with industry employers and employees, labor, associations, educational institutions, and governmental partners.
- (3) Conduct extensive in-person and telephone interviews with transit employers and employees, stakeholders, and employers from other industries.
- (4) Conduct a comprehensive review of “best practices” in performance measurements/metrics to develop an industry-wide model that could be used to determine the ROI on training and workforce development initiatives.
- (5) Identify best practices in attracting young people to transit as a career choice.

For business and industries today, no competition is greater than the global race for talent to fill these gaps. In every industry, employers are asking the same question: “How are we going to find, train, and retain the best workers?” Given the quickening pace of change in workplace technology and the growing demand for flexible, highly-skilled employees in all sectors of the economy, including transportation, not even the most experienced workers can rely on existing skills. To remain competitive, the public transportation industry must invest not only in the preparation and recruitment of new talent, but also the continuing development of employees in all stages of their careers. The proposed research

will help the public transportation industry continue to design effective and forward-thinking workforce development plans.

The proposed research supports the focus on “green collar” jobs as a strategy to advance climate change and environmentally friendly initiatives by building a sustainable workforce. As a high-demand growth industry, public transportation plays a key role in accomplishing these goals and objectives.

■ Project H-42

An Evaluation of Warrants for Major Capital Investment Projects: An Update of “Urban Rail in America”

Research Field: Policy and Planning
Allocation: \$500,000
TCRP Staff: Larry Goldstein

The Federal Transit Administration, the American Public Transportation Association, the New Starts Working Group, and various other advocacy groups (e.g., Smart Growth America) have held a number of working sessions to re-think how New Starts projects are evaluated and rated. One proposal that is likely to be enacted during the SAFETEA-LU reauthorization is a requirement that FTA apply a “warrants-based” approach to project evaluation and rating. A warrants-based approach would provide that, if a specific project or corridor meets specific population density, employment density, existing transit use, congestion levels, or other criteria, the project would be warranted and a “medium” rating would be assigned. Currently, there is little available research to determine the potential “warrants” for various transit modes and corridor conditions, based on the characteristics of existing, successful transit systems.

In November 1980, UMTA (now FTA) published a landmark report titled “Urban Rail in America: An Exploration of Criteria for Fixed-Guideway Transit,” which was authored by Boris Pushkarev and Jeffrey Zupan. The purposes of that study were to explore what range of travel volume is sufficient to warrant a certain level of fixed-guideway investment; to indicate the location of urban corridors where such travel volumes may be found; to offer a rough, tentative assessment of the national market for fixed-guideway facilities; and to aid in focusing local

planning on the most promising locations. Based on operating experience with existing systems at the time, functions were developed relating variables such as population density, development density, service frequency and speed to travel volumes, and minimum travel volume criteria or thresholds for fixed-guideway were formulated.

An update of “Urban Rail in America” would contribute substantially to this discussion, and provide a framework for warrants for project evaluation. The update would offer new criteria for fixed-guideway transit using current data for the many such major transit projects that have been put into operation in the past 25 years. The update would add bus rapid transit (BRT) to the modes considered, and might drop downtown people movers, a technology whose popularity has waned.

The objective of this research would be to evaluate and develop appropriate warrants for major transit capital investment projects and update “Urban Rail in America.” This would provide an analytical framework for simplifying the evaluation of transit projects by analyzing the characteristics of the setting, the operation, the cost, and the performance of existing fixed-guideway transit lines.

The research may include the following tasks:

(1) Determine the criteria or warrants most likely to simplify the evaluation of proposed major transit projects by reviewing the original “Urban Rail in America,” the procedures used by the World Bank and by other major transit investment decisions, and any other past research on this subject.

(2) Gather data on cost, performance, surrounding land use, socio-economic characteristics of surrounding communities, transit operations, and any other data needed to develop and test the criteria or warrants identified in Task 1 on existing fixed-guideway transit lines or systems in the United States. The objective is to come up with general criteria or warrants applicable across the country, so very precise data on cost, ridership, population density, and other variables should not be necessary. Reasonable estimates may suffice in most cases.

(3) Analyze the data to determine if criteria or warrants or threshold conditions for investment in various transit modes can be established.

(4) Prepare a report on the results, and identify criteria or warrants or threshold conditions that would be useful in major transit investment decisions.

■ Project H-43

Public Transit in the 21st Century: Changing Institutional and Business Models

Research Field: Policy and Planning
Allocation: \$300,000
TCRP Staff: Larry Goldstein

Transit systems of all sizes throughout the United States and North America are being fundamentally challenged to strategically think, plan, operate (alternative business and financial models), and manage in different ways, including expectations for greater efficiency/effectiveness, increased transparency and public accountability.

Today, many transit systems are embarking on this “transformation” process with very few concrete guideposts. While not necessarily to a level of “best practice”, there are very useful industry examples and case studies that should be thoughtfully documented and potentially replicable initiatives identified and made readily available to the industry. This information would be immensely useful to transit managers and policymakers in transit systems of all sizes and complexity.

The forces of change were well documented in the New Paradigms work completed for the transit industry in the late 1990s. At that time, the study team recognized a bigger mobility management role; profound demographic shifts and consumer expectations; the riveting impact of new technology; and the multi-jurisdictional/regional context of the challenges facing communities—well beyond the traditional silos and institutional structures of existing transit agencies and their partners/key stakeholders.

The objective of this research would be to compile information with a focus on documenting concrete examples of new or

changed institutional structures/arrangements and business models implemented at public transit systems particularly in response to regional and multi-jurisdictional challenges/opportunities. Such information may come from the following areas:

- (1) Notably successful multi-jurisdictional visioning and planning initiatives (i.e., Envision Utah, the Sacramento Blueprint
- (2) The institutional context
 - a. Agency authority(ies)
 - b. Board composition, size, appointment authority and process, terms, meeting requirements, voting provisions
 - c. Alternative service and business arrangements and relationships [e.g., service & transfer agreements, cost allocation models & sharing agreements, system expansion & contraction provisions, proportional representation and voting arrangements, differential pricing (handling customers outside of the transit service area)]
 - d. Federal, MPO & state /regional partner arrangements
- (3) Transit project prioritization criteria (multi-jurisdictional setting)
- (4) Performance management and reporting
- (5) Public-Private Partnership arrangements (e.g., CIDs, TADs, TMAs)
- (6) Labor-Management initiatives
- (7) Transit supportive state legislation and regional/local initiatives

This effort would identify “who/where” is doing “what”, “why”, and “how” – with “what reported results”. The research would be accomplished utilizing the following approaches: (a) start

upfront with “known” industry examples, available reports (secondary information scrub); (b) canvass and survey Transit CEOs, Transit Board Members, BMBG Board of Governors, the APTA Legal Affairs Committee, and Transit Labor (ATU and TWU Internationals); and (c) solicit information from FTA Regional offices and MPOs. A report with supporting documentation would be prepared based on results of this review – including perspectives on lessons learned.

Depending upon the extent of information found in this research, a potential follow-up effort could be the development of a “Transit Transformation Toolkit”.

Increasingly, transit systems are being challenged today to “think” and “act” differently. There is little readily available information on institutional and business arrangements/models. It simply doesn’t make sense to replicate this type of information multiple times or unnecessarily reinvent the wheel.

At a minimum, the following events are setting the stage for more radical re-thinking of how we fundamentally organize and do our business: the increasing emphasis on metro areas, regions, and mega-regions; the growing linkage of transportation/transit with other core policy considerations and beginning erosion of longstanding bureaucratic silos; demands for greater governmental efficiency and effectiveness; and the focus on public-private partnerships and alternative business models.