

# Transit Cooperative Research Program

FY 2012

## Announcement of Transit Research Projects November 2011

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) established the Transit Cooperative Research Program (TCRP), and the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) and the Safe, Accountable, Flexible, and Efficient Transportation Equity Act—A Legacy for Users (SAFETEA-LU) reauthorized it through 2011. 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 2012 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 March 2012.

**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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**Transit Cooperative Research Program  
Projects in the Fiscal Year 2012 Program**

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## Summary of Approved Research Projects

### ■ Project A-38

#### *Pedestrian Safety at Rail Transit Grade Crossings*

Research Field: Operations  
Allocation: \$315,000  
TCRP Staff: Dianne Schwager

Safety considerations for pedestrian rail grade crossing improvements require consistent industry design criteria and operating procedures. Current industry safety design standards for light rail and commuter rail grade crossings are inconsistent, variable, and sometimes absent, depending on which standards or guidelines are followed. Governmental agencies and private railroads approach grade crossing design and safety with different standards and philosophies. FRA, FTA, FHWA, APTA, MUTCD, and Class 1 railroads have different guidelines or standards. In addition, the NEPA process may result in recommendations that conflict with safety standards. The research and guidelines developed by *TCRP Report 69, Light Rail Service: Pedestrian and Vehicular Safety*, and *Report 137, Improving Pedestrian and Motorist Safety Along Light Rail Alignments* are sources of pedestrian safety information and recommendations. Transit agencies attempt to synthesize industry's approach and existing research into their own agency specific design criteria with different approaches taken across the country. Additionally, grade crossing oversight agencies may take a different approach to design requirements.

The transit industry needs well thought out pedestrian-specific grade crossing design standards and operating procedures that can be adopted by transit agencies to provide consistency for the agencies and public across the country.

The objectives of this research are to: (1) review the breadth of current pedestrian grade crossing safety research, (2) catalog the wide variety of current approaches to providing safe pedestrian crossings, (3) analyze the different pedestrian crossing treatments and procedures to ascertain the best performing approaches, (4) review analysis standards and recommend a consistent

approach, (5) recommend pedestrian crossing design standards, and (6) recommend pedestrian crossing operating procedures.

The research may include the following tasks:

- (1) Review *TCRP Reports 69* and *137*. Review other research or papers on pedestrian crossing safety. Use the results as a basis for the following work.
- (2) Document current published industry pedestrian grade crossing guidelines, standards and operating procedures from FTA, FRA, APTA, MUTCD, AREMA, Class 1 railroads, and selected transit agencies.
- (3) Contact and interview key staff involved with pedestrian grade crossing safety from FTA, FRA, APTA, Class 1 railroads, State Safety Oversight agencies from various states, and selected transit agencies to understand and catalog (a) key pedestrian safety concerns from their agency or business perspective; (b) their recommendations of what works or does not work from their experience; and (c) their recommendations on how to improve pedestrian safety through standards and best practices.
- (4) Analyze the work in Task (2) for commonalities and disparate approaches. Highlight the key safety components, similarities, and differences throughout the industry. Analysis of published standards will provide a more objective look at the what criteria and solutions are common, and what are contradictory or inconsistent. Compare this analysis with the verbal interviews from Task (3) to find the commonalities and discrepancies between published standards and industry insight of needed improvement.
- (5) Review how NEPA may result in recommendations that are not consistent with established safety standards and identify how best to address these issues.
- (6) From the tasks above, recommend a consistent set of pedestrian crossing design

standards and pedestrian crossing procedures. Contact the industry persons of Task (3) to review these recommendations and solicit comments. Work toward a consensus of standards that will be broadly accepted by the industry.

Pedestrian safety at rail transit crossings is a critically important issue. The growth of rail transit (light rail, commuter rail, and streetcar) coupled with the growing numbers of people walking and riding their bikes has created a need for more rigorous thought and consistency in safely crossing tracks. Another trend that cannot be ignored is the ubiquitous use of cell phones and entertainment devices that distract pedestrians or limit their ability to hear audible warnings. These new distractions must be countered with new safety tools at grade crossings.

The payoff from this work may be reduced injuries or fatalities. Additional benefits are reduced costs due to claims and lawsuits, improved public relations due to more focus on pedestrian safety, and more clarity to the design/construction/agency/regulatory to implement consistent and well thought out pedestrian safety solutions.

### ■ Project A-39

#### *Implementation of Transit Priority Treatments on Urban Streets*

Research Field: Operations  
Allocation: \$500,000  
TCRP Staff: Stephan Parker

With transportation demand outpacing roadway capacity expansion funds in many regions, the urban street system is facing increasing congestion. Transportation management measures that obtain more capacity out of existing resources must be explored in order to provide financially viable transportation solutions. The provision of transit priority treatments to reduce travel time, improve reliability, and provide operational cost savings is becoming increasingly important in mitigating this resource-constrained operating environment. Transit priority treatments include both intersection treatments such as transit signal priority, special signal phasing, queue

jump signals and bypass lanes and curb extensions, and roadway segment treatments include exclusive transit lanes within the travelled way, as well as exclusive transitways (typically in the median). Critical to the success of transit-priority treatment implementation is a clear understanding of the warrants, costs, and impacts of such treatments, as well as a partnering of transit and highway/traffic agencies through the project development process.

The recent *TCRP Synthesis 83: Bus and Rail Preferential Treatments in Mixed Traffic*, began the process of obtaining information on the type and extent of urban street transit-priority treatment implementation in North America, including some representative examples of successful transit and highway/traffic agency partnering strategies, but identified key areas for future research. These include:

1. *Warrants for Specific Transit Priority Application* - The transit agencies responding to the survey associated with *TCRP Synthesis 83* identified “warrants” for different transit preferential treatments primarily in terms of evaluation criteria, or performance measures – and not specifically numerical warrants. *NCHRP Report 143: Bus Use of Highways—State of the Art* presented some numerical warrants for different treatments, but this report is over 30 years old and an updated assessment of warrants would be a worthy research topic.

2. *Benefits of Multiple Transit Preferential Treatment Applications* - There is little guidance on identifying the incremental benefits of packaging multiple transit preferential treatments in a corridor, such as the impact of adding transit signal priority to the provision of exclusive bus lanes, or limited stop application with transit signal priority. Conducting some research on this topic would give agencies more information on application of the most cost-effective strategy for transit preferential treatments along a corridor. This would include the tradeoffs of using simulation versus analytical modeling in conducting such assessments.

*3. Tradeoffs on Intersection-Based Transit Preferential Treatments* - There seems to be little guidance on when to apply different intersection transit preferential treatments, in particular when transit signal priority should be provided versus a queue jump lane and signal, or curb extensions. This research might involve the use of a simulation model to estimate the impacts on bus delay and general traffic operations for these different transit preferential treatments under different traffic and transit volume conditions

*4. Intergovernmental Relationships in Transit Priority Treatment Development – TCRP Synthesis 83: Bus and Rail Transit Preferential Treatments in Mixed Traffic* indicated that most transit and traffic agencies do not have formal transit preferential treatment programs, with many not having formal intergovernmental agreements with respect to planning, design, construction, operations/maintenance, and performance monitoring of treatments. Added study would be helpful to identify the process of establishing transit preferential treatment needs on a corridor and regional scale, and identifying alternate implementation strategies, including potential funding sources. This could include an assessment of the costs and impacts of alternate governmental relationships, and the development of one or more sample agreements, similar to the Speed and Reliability Partnership agreement developed by King County (WA) Metro.

An additional need is the integration of warrants and design considerations for transit priority treatments into the Manual of Uniform Traffic Control Devices (MUTCD), a reference document used widely by the traffic and roadway agencies.

The objectives of this research are to develop more specific information on warrants, costs, and impacts of transit priority treatments; identify the components of model inter-governmental agreements for successful implementation of transit priority treatments on urban streets; and identify potential changes to the MUTCD to reflect transit priority treatments. The research proposed would involve added technical assessment and use of

focus groups to address the transit priority issues previously identified. Potential work tasks could include:

- (1) Further survey of transit agencies probing specifically on warrants for transit priority treatment application.
- (2) Application of simulation modeling to compare the impact of different intersection transit priority treatments on transit and general traffic operations, and application of roadway segment versus intersection-based priority treatments along a corridor, under a number of different scenarios. This could be supplemented by a pilot in an urban area to compare certain techniques to obtain real life data.
- (3) Conveying of a set of focus groups involving transit agencies and highway/traffic agencies to obtain input on issues transit and traffic agencies have with respect to transit priority treatment application, and components of model intergovernmental agreements toward implementing transit priority treatments. This would build on an initial “Conversation Circle” on this subject held at the 2011 Institute of Transportation Engineers (ITE) Annual Meeting, and an outreach effort the ITE and FTA are sponsoring over the next year involving a series of national seminars/webinars on this subject.
- (4) Development of a guidebook on implementation of transit priority treatments, addressing more definitive warrants on priority application, a decision-making framework, and model intergovernmental agreements.
- (5) Identification of desired modifications to the MUTCD related to traffic signals, signing, and pavement marking, as it relates to design of transit priority treatments on urban streets.

This research is pivotal to developing more consensus of highway/traffic agencies toward accepting and implementing transit priority treatments on their roadway systems. This is a critical need, given the predominance of transit

operations on urban streets. The payoffs will be major and immediate, given it has been shown that transit-priority treatment applications can have a major impact on transit travel time savings, improved reliability, and reduced operations costs.

### ■ Project B-43

#### *Use of Web-Based Rider Feedback to Improve Public Transit Services*

Research Field: Market Research  
Allocation: \$250,000  
TCRP Staff: Gwen Chisholm Smith

In the day-to-day operations of a transit system, riders see and experience many facets that those managing it do not. They are often annoyances, like sticky exit doors or discourteous bus drivers, but can become dangerous, like locations of persistent puddles during rain. Typically, these issues are likely noticed by riders who use the system every day, but are often not sufficiently motivated to write letters or place calls to the transit agency to complain (although those methods remain useful). Now, with the increasing popularity of web tools designed for riders to notify transit managers of these problems and suggest solutions, with just a click or phone-tracking mechanism, riders are increasingly reporting issues and expecting both response and action.

As a result, transit agencies must determine how they will best use these tools. They must be able to collect rider input from various channels; respond online, creating a dialogue with the public; prioritize reported problems, among the many incoming requests; and act on them in a reasonable timeframe. While many aspects of this process will not differ from traditional sources of reporting and response, web-based tools increase the simplicity of rider engagement, pace of dialogue, and accountability reported widely.

Ideally, this medium of rider feedback results in improved public transit services through enhanced safety and quality of life. To that end, this research would focus on best practices among transit agencies using tools like Twitter, Facebook, and SeeClickFix.com to engage with riders. This research would investigate those agencies throughout the U.S., and some abroad,

that are using these tools to improve transit, and will consider best uses and reporting tools that have yet to emerge.

The objectives of the research would be to: (1) create an inventory of existing and emerging platforms for rider feedback to transit agencies, and determine general demographics of users; (2) determine which transit agencies use these tools and their methods, experience, and lessons learned; (3) benchmark best practices for responding to transit rider needs and using the feedback to improve transit services; and (4) discuss opportunities for transit agencies going forward, considering emerging reporting tools and future transit technologies that may enable enhanced dialogues and transit management.

The research may largely be conducted as a survey of U.S. and international transit properties to answer the following questions:

- (1) How are transit agencies gathering data from riders? In person, online (social media), by phone/letter? Through a third party, like SeeClickFix? What are the characteristics of the users of each medium? How are transit agencies legally required to respond when learning about a problem through each of these channels?
- (2) How do transit agencies prioritize reported issues? Number of complaints, neighborhood of occurrence, ease of repair? How do Internet-based tools change prioritization, if at all? How does the digital divide play into this discussion? To what extent does media attention direct prioritization?
- (3) In what timeframe do transit agencies respond to rider complaints? What is the average time it takes to resolve the problem? Following resolution, do they notify complainants and/or gather feedback afterwards?

These questions are essential to understanding the dialogue and action occurring between transit agencies and their riders in a hyper-connected world. The best practices and lessons learned will be gleaned from the survey responses and shared, along with investigations into applicable technologies and forecasting of future developments, as the resultant report.

This research will provide guidance where none presently exists for this new form of interaction between transit agencies and their riders. The urgency lay in the fact that internet reporting tools are rapidly evolving in functions and growing in popularity, and increasingly cannot be ignored by transit agencies. By developing these case studies and guidelines, this report will help transit agencies nationwide deal with a new phenomenon; if addressed correctly, the agencies could improve their services, often with “quick wins,” and enjoy an open dialogue with riders. If ignored, the agencies may suffer from public resentment and, potentially, legal retribution for failing to address reported hazards.

A potential barrier to implementation of this research is the fast-paced growth of these reporting tools. During the course of the research, existing reporting tools may fade out of popularity, while new tools may launch quickly. It is, therefore, essential for this research to consider platform-independent guidelines for online communication, and to investigate all emerging tools.

#### ■ **Project E-10**

##### *Determining Adequate Maintenance Staffing Levels for Modern Transit Fleets*

Research Field: Maintenance  
Allocation: \$450,000  
TCRP Staff: Gwen Chisholm Smith

At one time a simple measurement that determined if a transit property had adequate maintenance technicians (mechanics) was to use a basic bus-to-mechanic ratio. If a property had 4 or 5 buses per mechanic they were considered to have an excellent “bus-to-mechanic” ratio. That formula is clearly an oversimplification from a time when engines were less complex, most fleets were using diesel fuel, and computers were not an essential mechanic tool. Today a computer is as essential as a socket wrench and the number of mechanics needed to maintain a modern fleet can be difficult to measure. The number of mechanics at a transit property is largely based on constraints, but is also influenced by fleet age, annual miles, power train, how much work is outsourced, and a multitude of other key factors. There is no text book answer for maintenance managers to determine the optimum ratio of mechanics for

their fleet size, as the number varies tremendously between public transit fleets.

Many public transit buses are in service well beyond the Federal Transit Administration minimum 12 years, 500,000 mile requirement. Transit properties replacing buses are faced with significant leaps in technology over the past 6 to 12 years and now have options between purchasing clean diesel, hybrid engines, and various alternative fuel choices – all of which require additional highly skilled technicians. In addition, today’s new engines require preventive maintenance (PM) every 3,000 miles, half the rate of the older, simpler engines. With new labor-intensive engines, various fuel types, highly sophisticated electronics, and an increase in PM frequencies, many maintenance managers realize they need to hire additional staff. Often “in theory” they have enough mechanics to maintain their fleet, however, in reality they find they are understaffed.

With the many fleet variables and some regions like southern California mandating alternative fuels, it is increasingly difficult to compare staffing levels between public transit fleets. There is no standardized guide to help maintenance managers evaluate staffing requirements to maintain an aging, high-mileage fleet, or to transition into new technology hybrid or battery-powered engines. This research would provide public transit fleet managers with a guide to determine how the adoption of new engine technology, or continuing to operate high-mileage vehicles will impact staffing requirements. Maintenance managers will be able to identify technician requirements for various fleet sizes and how new bus technology and a number of other variables including but not limited to: the number of garages, various engine types, fuel types, emission systems, annual fleet miles, miles between mechanical failures, outsourcing, mechanic work schedules, and other variables determine the optimum number of mechanics required to maintain a modern transit fleet.

The objective of this research is to identify optimum maintenance technician (mechanic) staffing requirements for small, medium, and large transit fleets. The research will identify the various factors that impact staffing levels at transit garages, including but not limited to new

engine technologies, fuel types, multiple garage locations, annual miles, fleet age, emission systems, preventative maintenance cycles, the use of real time data systems by mechanics, as well as fleet commonality. In addition to a research document, the project will develop a spreadsheet for transit managers to determine optimal mechanic staffing levels. The spreadsheet is intended to be dynamic and allow the user to insert a fleet size and a host of variable fleet attributes, resulting in updated optimal maintenance technician staffing recommendations.

The first phase of the project would potentially include interviews with maintenance managers at various transit properties to identify status of their maintenance technician staffing levels and the various factors that impact staffing. This phase would include looking at detailed analysis for the number of mechanics required to support modern day fleets, including training needs, parts availability, work shifts, the use of real time data systems by mechanics and many of the items listed above. The research would include analysis on the number of work hours required to keep fleets in compliance with Original Equipment Manufacturer (OEM) preventative maintenance requirements, defect repairs, and other maintenance related activities.

The second phase of the project would develop and test a dynamic database that when complete will provide maintenance managers with optimal mechanic staffing levels based on their specific fleet size and operating condition. Managers will be able to determine how many additional mechanics are required, for example, if a new engine technology like hybrid or battery-powered engines are adopted.

The Federal Transit Administration funds 80% of the cost of eligible transit fleets. This represents millions of dollars in federal funding for some transit properties. Adequate staffing is essential in order to maintain transit vehicles to meet FTA 500,000 mile/12 year operating life requirements and OEM maintenance requirements. Additionally, adequate staffing levels help insure the overall safety and proper maintenance of fleets.

Research that includes a dynamic spreadsheet to quickly determine staffing requirements based on

fleet age, miles, type of engine, and other factors would be extremely useful to determine how decisions regarding the adoption of new hybrid or other advanced technology would impact the maintenance department budgets and staffing requirements.

#### ■ **Project F-19**

*Establishment of a National Transit Vehicle Maintenance Instructor Training and Certification Program for the Public Transportation Industry*

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

In the past several years, the public transportation industry has made significant progress in establishing industry standards for a National Transit Bus Technician Certification, a National Apprenticeship, which eventually will also establish a National Journeyist Bus Mechanic occupation, and National Training Standards. All of this progress grew from multiple efforts in the industry, including previously funded work by TCRP. Industry training standards were developed with funding from U.S. DOL for the Joint Transit Training Standards Committee. As those training standards were being developed, TCRP Project E-6, *Transit Bus Mechanics: Building for Success — The ASE Transit Bus Maintenance Certification Test Series* established ASE as a certification for transit bus mechanics. Agencies had used ASE school bus and heavy truck tests previously. TCRP E-6 brought transit expertise to the table with ASE to develop transit-specific standards. Separate from, but running parallel with E-6, a joint labor-management committee for bus maintenance training standards began work in 2004. The joint labor-management training standards committee developed detailed learning objectives in the subject areas where ASE developed tests. The joint committee on training standards was convened by APTA. This committee also developed standards for a national apprenticeship program for bus maintenance technicians.

What is now needed is an effort to define and establish credentials for a National Certification for Transit Vehicle Maintenance Instructor. The lack of a national certification for transit vehicle maintenance instructors fails to bring recognition and credentials to one of the most important job careers in the transit industry. This research would help to establish the skills and competencies required for an individual to qualify to be a Transit Vehicle Maintenance Instructor. It would establish minimum competency levels and necessary skills so that transit agencies are not constantly “reinventing the wheel.”

The objective of the research would be to partner the transit industry with a company, organization or institution that has the capability to develop a National Transit Vehicle Maintenance Instructor Training and Certification Program. Such a program would be used to train and certify individuals who would be responsible for developing and grooming the next generation of transit vehicle maintenance mechanics and technicians.

The potential outcome or product of this research would be an “Instructor Training Program” as well as an “Instructor Certification” earned upon completion of the training program. Developing a multi-tiered instructor training and certification program would provide skilled subject matter experts with the understanding of how to deliver practical training to adults/peers and help ensure consistency and uniformity in instruction.

Ultimately this program would be distributed nationally. Initially a cohort of instructors would complete the training and become certified and then be able to provide the training to other instructors.

The goal would be broad availability of the training and central administration of the certification test to maintain quality and consistency. Some examples of established transportation-related national certifications are:

- North American Transportation Management Institute

- Certified Supervisor of Maintenance/Equipment (CSM/E);
  - Certified Director of Maintenance/Equipment (CDM/E);
  - Certified Safety Supervisor (CSS);
  - Certified Director of Safety (CDS);
  - Certified Driver Trainer (CDT).
- NAFA Fleet Management Association
    - Certified Fleet manager (CFM).

The research would potentially evaluate and recommend the best means to initiate and implement the program. The researcher would work with industry professionals to identify the required curriculum, training material content, reference material, qualifying tests, and achievement certificate of qualification.

The research would potentially: (1) develop national maintenance instructor training curriculum; (2) develop instructor training course materials; (3) develop instructor certification tests; and (4) implement instructor training and certification tests.

Many transit vehicle maintenance instructors, just like many of the transit vehicle mechanics, are reaching retirement age. As this group retires, the knowledge and experience that will be lost is priceless and irretrievable as the industry has not adequately provided for succession and consistency in this area. The lack of industry standards for training, certifications, testing, job definitions, and curriculum is requiring individual transit agencies to expend resources to develop the necessary criteria, programs, training, and testing. If industry standards were developed and implemented, the cost of implementing a program or certification would be manageable.

Common practice in the public transportation industry is to promote from within; maintenance training instructors often come from the ranks of the mechanics. This proposed research would enhance the “build your own” workforce development practice of the public transportation industry by providing clear required competencies and a path to becoming a maintenance instructor in the industry. In

apprenticeship training programs generally, instructors generally rise through apprenticeship training, work as journey mechanics and then move on to become instructors. For electricians, operating engineers and other highly technical trades, that career ladder has worked well. This research will include an examination of how that successful system can be translated in the transit environment.

Using the industry standards for transit training, educational institutions could develop training curriculums specifically for the transit industry. The National Labor College has specific experience in developing curriculum related to joint apprenticeship programs that can be adapted by local post-secondary educational institutions, and its capacity needs to be explored as part of this research. Any post-secondary educational institution seeking to establish a certification for transit maintenance instructors needs to demonstrate its capacity to coordinate with existing transit joint apprenticeship and training programs. The establishment of a National Transit Vehicle Maintenance Instructor Training and Certification Program would promote additional interest from the external job market, technical schools, and colleges. With national standards established, transit vehicle mechanics would be able to seek out new career paths once they were able to learn or acquire the identified qualifications and skill competencies. Transit agencies would be able to establish resources for qualified personnel to fill vacant positions.

With a well-staffed and qualified instructor workforce to support and maintain qualified mechanics and technicians, vehicle availability would be increased, vehicle downtime reduced, maintenance costs reduced, and passenger safety enhanced.

The establishment of a national training and certification program would promote individual pride and ownership in the occupation. This would relate to individual recognition in the form of salary increases, bonuses, or promotions based on increased knowledge and skill competencies.

The return on the investment from all of the above cannot be calculated at this time, but the research could include development of metrics for return on investment (ROI). The qualification of the transit vehicle maintenance instructor equates directly to improved reliability of the equipment and the overall safety of the customers that use the transit service. Considering the potential for reducing operating costs and improving service and safety, the cost savings realized from a national transit vehicle maintenance instructor training and certification program could be significant

#### ■ Project F-20

*Benefits, Barriers, and Enablers of Transit Labor-Management Partnerships: What Makes Them Work? What Makes Them Last?*

Research Field: Human Resources  
Allocation: \$300,000  
TCRP Staff: Dianne Schwager

Labor-management partnerships have often been hailed as a source of strength in the transit industry, but they have been little studied, little analyzed, and little supported for replication and sustainability. If they are considered a source of strength for public transportation, the industry needs to understand the factors and circumstances that lead to their establishment, replication and sustainability over time.

A large number of TCRP reports and projects have called for labor-management partnerships as integral to high-quality and cost-effective operations across a range of priority areas in transit operations and maintenance: managing transit systems and the transit workforce in the 21<sup>st</sup> century (TCRP Report 77), making transit agencies employers of choice (TCRP Report 103), building effective front-line workforce training systems (TCRP Reports 29, 44 and 96), instituting effective systems for quality improvement (TCRP Reports 3 and 8), for safety (TCRP Projects F-17 and A-35) and for high-performance partnerships that emphasize collaborative problem solving and continuous improvement (TCRP Report 29). The finding in TCRP Report 96 on determining training for

new technologies is representative: “A successful program must involve partnering with the employees being trained and with labor unions whose members are affected.” More fundamentally, these TCRP report findings on the importance of productive labor-management collaborative efforts for the transit industry are rooted in a broad body of workplace practice in transit and other industries as well as research about the importance of human capital and workforce engagement. All these findings from broader practice and research about the value-added of labor-management partnerships are especially salient in the transit industry, where upwards of 90 percent of nonsupervisory employees are represented by labor unions.

The missing element for this topic in prior TCRP research is a systematic overview and analysis of (1) the actual effects of successful labor-management partnerships in the transit industry and (2) the practical factors and circumstances that lead to success in creating and sustaining such joint collaborative efforts within the transit industry.

Among the few transit cases in which there is quantitative evidence of the effects of joint labor-management programs, there is ample evidence that when labor and management can find a way to work together in a data-driven problem-solving partnership, significant benefits accrue to the agencies, their employees and to the riding (and tax-paying) public. Benefits usually attributed to the agencies include increased cost-effectiveness, quality and safety, along with the beginnings of a culture shift toward data-driven collaborative problem-solving and continuous improvement based in ongoing skill development and mutual respect. Transit employees can benefit from all these benefits plus increased job satisfaction, skill level, and employment security. The riding public and the communities served by transit see benefits including improved safety, service quality, reliability of service, and lower costs in a more positive organizational environment. There is also evidence within transit that effective data-driven partnerships can support a change toward a more modern workplace culture for transit – a culture based on mutual respect, fact-based dialogue, learning,

collaborative problem solving, and continuous improvement. If partnerships can support transit organizations in making this cultural transition, they would bring a second level of value added to the industry. The importance of disciplined, reliable analysis of these effects is important to the future of public transportation.

The importance of this list of reported positive impacts also underscores how little reliable documentation and analysis is currently available about how such partnerships work and the conditions and factors that lead to their successful formation, development and durability. Clearly if the results can be worthwhile, then the industry has an important interest in understanding and expanding the conditions for their success, including what steps agencies, transit unions or the industry might take that could contribute to expanded success in creating and sustaining effective labor-management partnerships. Such causal factors are likely to include quality technical skills training, work process skills training (including problem solving skills), the organization of work on a more horizontal, collaborative basis involving broader communication of operations and quality data to support success in collaborative problem solving for a wide range of workplace issues. Essential elements of organizational culture such as trust and mutual respect have to be developed and built up over time with sustained support from top leadership on both sides. Processes that can work in creating sustained partnerships can be identified from experience in transit and other industries.

In a time of ongoing pressure on transit budgets, expanding replication of joint approaches that can increase cost-effectiveness, safety and service quality should be an urgent priority. Increasing transit’s market share in local transportation markets depends on positive rider experiences. Support for transit investments among public officials likewise depends on an understanding that transit systems are utilizing all their workforce resources to produce the most cost-effective, highest quality transportation service. Expanding the transit industry’s capacity to build and sustain productive labor-management partnerships is a

vital element in reaching those goals.

The objective of this research would be to (1) document, (2) analyze, and (3) communicate effects and the institutional barriers and enablers to the different types of labor-management partnerships that have succeeded in the transit industry. To be most successful, the work should be undertaken in a way that actively engages transit leaders who have created successful partnerships and systematizes the insights from their experiences. The research objective should include analyzing their achievements along with the barriers overcome and the enabling factors or conditions that contributed to their success.

Outcomes corresponding to these objectives would be a series of summary case studies of successful partnerships, analysis of factors supporting and impeding success of joint efforts and their sustainability over time, and presentation of these findings in ways that can be readily accessible to transit executives and labor leaders for potential implementation in transit systems of all sizes and modes throughout the industry.

In order to fully achieve these objectives, the proposed research would need to consist of several layers of documentation and analysis.

- (1) A review of the relevant existing literature within the transit industry. This review would synthesize the results of prior TCRP studies and analyses by university transportation centers and others.
- (2) A broad survey to identify examples of joint labor-management projects generally, including those known from prior reports and industry presentations regarding data-driven labor-management partnerships for training, safety, employee health, health care cost reduction, service quality, dependent care, and other subjects.
- (3) Case studies of up to a dozen of the most important, readily accessible examples of successful labor-management partnerships, including leadership interviews and

identification of data on effects, enablers and barriers to successful partnerships.

- (4) Analysis of the common features required for successful development and ongoing effectiveness of transit labor-management partnerships.
- (5) Development of communications materials on transit partnerships, tiered from leadership overviews to a tool kit and supportive materials for practical implementation by local practitioners. The ultimate product will combine practical tools, case studies, and programmatic guides that can support application in transit locations of all sizes and modes.

In an industry where the overwhelming majority of operations and maintenance personnel are represented by labor unions, the ability to expand effective joint problem-solving efforts is absolutely critical. Labor-management partnerships have been shown to make very significant contributions in addressing vital transit goals ranging from safety to cost effectiveness, quality, customer service and employee health, among others. If the transit industry could undertake a project likely to significantly improve any one of these outcomes, it would be a wise investment. If there is an approach that offers the potential to improve all of them with a reach across the entire industry, as in this case, the urgency and payoff to the industry would be difficult to overestimate.

Benefits to the transit systems have been analyzed quantitatively for successful labor-management training partnerships and safety partnerships. Data-driven training partnerships have demonstrated a return on investment (ROI) of at least 500 percent after 3 years of operation. They have been associated with greatly improved efficiencies in maintenance and operations, increased vehicle reliability, and resulted in further savings by bringing in-house work that had previously been contracted out. The joint safety culture initiative at New York City Transit developed after two separate incidents of track worker deaths in early 2007

resulted in the longest period without track fatalities in 50 years of transit operations in New York City. The broader experience of other industries indicates that similar positive results and industry payoffs should be expected in other areas of successful joint initiatives.

#### ■ Project H-47

##### *Transit at the Land Use Decision-Making Table*

Research Field: Policy and Planning  
Allocation: \$400,000  
TCRP Staff: Dianne Schwager

Transit agencies often are not involved in decision-making on land use issues that can significantly affect ridership and operations. New developments are typically planned and constructed without thoughtful consideration of how transit would serve them. In some cases, developers have an “anti-transit” attitude and deliberately relegate bus stops to remote and less visible locations. Often developments are planned without sidewalks or have street patterns that do not allow buses to circulate efficiently. Transit agencies are generally ill-equipped to negotiate with developers or municipalities, and there is no structured forum for ongoing coordination between transit agencies and the development community. Similarly, transit planners are not trained in the local jurisdiction planning and zoning process and often lack important basic knowledge about procedures followed by localities in the land use planning and regulatory process that would improve their negotiating ability.

This research would produce a guidebook on what transit agencies should know about the land use planning, regulatory, and development process and how they can become involved in land use decisions by both local governments and private developers that impact ridership, operations, and the ability of the transit agency to serve the community. The guidebook would include information on typical planning and zoning approval processes; a set of recommended physical guidelines for incorporating transit perspectives, services, and facilities into the planning and development process; information on how the transit agency should be involved in the land use planning and

zoning process; and a description of the technical, staffing and budgetary resources that would be needed to support a transit agency’s involvement. In addition, the guidebook would include procedures for effective transit agency partnership with the private sector, including examples of instances in which transit agencies have negotiated agreements with developers and tenants, or found other ways to subsidize new facilities and services.

The research would produce a guidebook to assist transit agencies become more adept at incorporating transit into future land use plans and new developments. Tasks could include:

(1) Contact a cross-section of local government planners, private developers representing a range of area, and development types to obtain their experiences in working with transit agencies to consider transit services in the development of land use plans and supporting zoning/subdivision regulations, as well as in the design of new developments. Identify challenges associated with incorporating transit from both the local government and developer’s perspectives, and also identify processes that encourage more comprehensive and effective coordination between localities and transit agencies, including participation of transit agencies in the local planning and zoning process. Describe examples where the local government and transit agency established a strong planning partnership, as well as projects that private developers thought were successful. Identify the strategies and processes felt to be instrumental in those successes. As part of this research, contact the local transit agencies for their perspectives and insights.

(2) Identify and document case studies demonstrating successful as well as unsuccessful examples of transit agencies becoming involved in the land use planning and zoning process. Illustrate the relationship between transit agencies and developers, the resources needed to participate in the process and support new services, the actions taken to overcome challenges, and the processes used to work successfully with local planning and zoning boards to obtain approvals for new transit facilities.

(3) Develop a set of success factors associated with effective coordination between localities, developers, and transit agencies. The factors would include both organizational and institutional arrangements for effective coordination, as well as recommended planning and development design guidelines representing best practices that transit agencies could adapt for their individual circumstance. A number of agencies have produced useful documents such as design guidelines and standards that are used to guide the construction of physical facilities needed for efficient transit provision. The research team would collect and review these documents and would prepare a set of recommended guidelines that represent best practices.

(4) Produce a primer on land use planning to fill gaps in transit agency knowledge. Outline the general development process with typical constraints encountered by developers and include descriptions of zoning processes, implications of tax-increment financing (TIF) districts and other financing mechanisms. Document typical planning and zoning approval processes focusing on those aspects that transit agencies need to know in order to coordinate effectively with the development process.

(5) Describe the technical, staffing and budgetary resources that are needed to support transit agency involvement in the land use planning and development process.

There are significant imminent changes that add to the urgency of this project. The currently stalled development market is likely to turn around within the next couple of years. Reauthorization of the surface transportation act is likely to require increased coordination between transit investments and land use planning. Increased demands will be placed on the transit industry to increase service as a means to improve livability and sustainability of our communities. The transit industry needs to prepare for these changes. By improving the ability of transit agencies to participate in the land use planning process it will be possible to increase ridership and improve operations.

## ■ Project H-48

### *Value Capture for Financing Transit*

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

Communities across the nation are undertaking public transportation improvements to promote local economic development. Recognizing the linkage between public transportation and economic development, private investors and local governments are capitalizing on transit improvements.

The public transportation agency may not benefit from the economic prosperity for which its investment is largely responsible. At a time when the demand for transit, and transit-induced development, is increasing, public funding for transit improvements is becoming more scarce at all levels of government.

Research on the appropriate mechanisms or instruments by which the public transportation agency can “capture” economic benefits is limited. There is a need to learn how value capture strategies might help pay for system construction, expansion, modernization, and operations.

The objectives of this research project would be to:

- (1) Identify value capture strategies and mechanisms for transit agencies.
- (2) Identify challenges to transit agencies measuring and sharing in the economic benefits of transit investments.
- (3) Create a typology of local regulatory (zoning) frameworks in which value capture for transit purposes is most effective.

The research would potentially (1) examine the extent to which public transportation is directly supported by the economic development it generates; (2) identify optimal methods for (a) measuring economic benefits that a transit investment generates, (b) establishing the basis

for the transit agency's share, (c) equitably distributing captured revenues, and (d) designing acceptable mechanisms for generating revenues from economic impacts; (3) identify most supportive zoning and other land use regulations and most-effective developer incentives; and (4) identify the types of institutional relations among the transit agencies, local jurisdictions, and the development community that are most conducive to value capture strategies. Products would include a report detailing the strategies that have been most effective, and least effective, in generating revenues that are shared by transit agencies.

Integration of land use and transportation is an urgent need. Interests compete over the benefits of this integration within all communities. Convenient and reliable transit service, however, is the backbone for sustainable community development. Public funds available for development and maintenance of transit infrastructure are dwindling when there is the greatest need. It is critical to create increased opportunities for private participation in transit investment, for local communities to foster this collaboration through committed partnerships, and for transit agencies to recoup economic development revenues to sustain services.

#### ■ **Project H-49**

##### *Improving Transit Integration Among Multiple Transit Providers*

Research Field: Policy and Planning  
Allocation: \$400,000  
TCRP Staff: Lawrence Goldstein

Improved integration of transit services, particularly in regions where multiple providers are involved, can be one of the most cost effective and significant methods of increasing transit usage and market share. As the United States grows by 140 million persons in the next 40 years and most of this growth occurs in expanding metropolitan areas or mega-regions, comprehensive integration of transit services in those regions will grow in importance.

More than 90% of U.S. transit riders are served by transit systems that interface with at least one other transit agency. This especially occurs in larger urban areas, but also is true in smaller communities where integration of the local services with those of the regional provider would offer better opportunities to travelers. Individual travel needs often extend beyond the service area of a single transit agency, yet full coordination of transit services to meet those rider travel needs is the exception in the United States. This is in contrast to the seamlessness that exists in our street and road systems, where every city, county and state government is responsible for portions of the system yet the connected system, allows an individual to drive from any point to any point, oblivious of the multiple agencies involved.

There is a consensus that public transportation should also be seamless, and some specific efforts to improve integration have reaped significant increases in transit ridership. However those efforts have tended to be piecemeal, generally focused on only one element of integration, such as fares; and not the comprehensive or universal integration that is common in other developed countries. Integration of public transport services to meet travel needs without regard to service areas, in a manner analogous to travel on the highway system, could reap dramatic increases in transit use and improve the overall stature and image of transit in many communities.

While each region has its unique characteristics and history, both the barriers to successful integration and the benefits that can accrue from integration tend to be common. Identifying how those known challenges to integration have been successfully addressed in other countries and in some places in the United States; and then measuring the benefits that have resulted from integration can be enormously helpful. This will assist areas that have partial integration of transit services implement the additional elements needed for total integration. (For example a region may have a universal fare instrument, but limited schedule and route integration.). As regions grow, new transit systems may be created or existing systems that currently do not connect with each other may

expand their service area to the point that they do. With a better understanding of how to address challenges; and how to measure the benefits; comprehensive integration can be in place when the linkages are established.

The best approach to integrate transit services provided by multiple transit operators may vary from region to region, however the challenges and benefits of achieving successful integration tend to be universal. This research would examine approaches to successful integration of transit service, particularly among multiple providers. Each approach would be evaluated to determine the effectiveness in addressing institutional concerns; balancing local and regional perspectives in fare integration; service design and schedule coordination; promotion and public information; design and location of transfer facilities (including bicycle integration and automobile parking); distribution of fare revenues and funding; consolidating overlapping special services often provided by non-transit agencies; and any other issue that inhibits or enhances true transit integration. The problem of providing service to persons with disabilities whose travel needs span several providers is especially acute. The research will examine the journey to implementation as this can highlight how to overcome existing barriers to optimum public transport integration. It will also identify and measure the benefits that have been achieved from integration. The final report will provide information that can be used by decision makers to determine which approach is most appropriate for a particular region, how to address the challenges and the steps needed to achieve optimum transit integration and the benefits that will accrue from successful integration.

The research would potentially (1) review all aspects of transit integration (institutional, fares, service planning and scheduling, marketing and

public information, funding, capital planning, etc.) in a representative cross section of large and small urban areas; (2) identify the challenges that need to be overcome prior to implementation; (3) the benefits, disbenefits, and outcomes of each approach would be identified; (4) reasons for success or failure toward achieving transit integration would be examined; (5) the benefits of true transit integration would be measured; and (6) from the most successful models of transit integration identified, articulate information that can assist decision makers in determining which model is most appropriate for a particular region, how challenges were overcome, the steps needed to achieve full transit integration and the benefits that result from integration. The “*Verkehrs Verbunds*” or transit federations common in German regions in particular should be researched for applicability in the U.S.

Improving public transport integration could be one of the most cost-effective strategies to increase transit usage. Travel patterns are not dictated by transit agency service boundaries. In many urban areas, both large and small, lack of transit service integration results in inferior service to the customer. In other cases duplicative services by multiple organizations wastes resources that could be more effectively deployed. Despite consensus that transit integration or seamlessness is needed to make transit more competitive with the auto and consequently increase transit market share; progress is spotty. A document that can articulate the benefits of integration, the models that work and the steps needed to implement an effective model will be a tremendous tool for bringing about true transit integration. The results would be increased transit market share and more cost-effective delivery of service with existing resources.