

# Summary of Approved FY 2019 TCRP Research Projects

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■ <b>Project A-44</b>	<i>Mitigation Strategies for Deterring Trespassing on Transit Rail Rights of Way</i>
Research Field:	Operations
Allocation:	\$250,000
TCRP Staff:	Mariela Garcia-Colberg

In response to the Moving Ahead for Progress in the 21st Century Act (MAP-21) and its successor, the Fixing America's Surface Transportation (FAST) Act, the Federal Transit Administration (FTA) has established the Safety Management Systems (SMS) framework as the basis for its National Public Transportation Safety Program. According to the FTA, a key aspect of the SMS approach is for transit agencies to build on their existing safety foundation to detect and correct safety problems earlier, and to analyze safety data in a holistic manner to ensure resources are applied effectively to mitigate risks. One such risk that the transit industry is facing is related to a growing problem with the number of trespassing events occurring on many transit rail systems throughout the United States. Trespassers are at great risk for being struck and severely hurt or fatally injured due to the speed and frequency of trains in the locations where many of the trespassing events occur. The National Transportation Safety Board (NTSB) has recognized the dangers associated with rail trespassers and has issued recommendations to the Federal Railroad Administration (FRA) dating back to 1972.

An analysis of the National Transit Database (NTD) Safety & Security 40 Form data reveals that between 2008 and 2015, there were nearly 200 major incidents involving trespassers on transit rail lines. The nearly 200 major incidents resulted in 110 fatalities and 80 non-fatal injuries sustained by trespassers, or pedestrians walking along transit rail tracks.

Mitigations for denying entry into the right of way at unauthorized locations would help to better address the issue of trespassing. Traditionally, fencing has been the only solution to attempt to mitigate the risks associated with trespassers on rail rights of way. While certain types of fencing can be effective, it is not a viable option in locations where the installation of fencing is cost prohibitive, too difficult to install, or continually get vandalized to the point where repairing it becomes prohibitive due to maintenance resources.

The objective of this research is to produce an industry guidebook that includes strategies to reduce the number of trespassing events on railroad rights of way. The guidance will include risk mitigation strategies such as different types of fencing, monitoring systems, design considerations, and strategies to combine risk mitigation efforts. Alternative variations of fencing will be useful for agencies that have challenges associated with repetitive vandalism. Monitoring systems alert train operators of trespassers in the right of way. Design recommendations for new rail systems and recommendations for adapting to land use changes around exiting rail system rights of way when changes create more desire to trespass due to housing and adjacent services, will assist public transit agencies to design out the risk associated with trespassers. This guidance may be useful to designers of new rail systems, existing rail transit agencies, local development firms, local municipalities, and other

stakeholder entities that influence the transit system and local land development adjacent to the railroad.

■ **Project A-45**      *Analysis of Fare Evasion Implications and Enforcement Approaches*

Research Field:      Operations  
Allocation:            \$150,000  
TCRP Staff:            Stephan A. Parker

Fare evasion involves travelling on public transit without purchasing or possessing the required fare media needed to travel. It is a criminal offense in most jurisdictions, though many are now examining decriminalization of the offense.

Fare evasion has been examined in the media with questions regarding how the fare evasion rate is calculated and how fare evasion is equally enforced. Fare evasion has also received the scrutiny of the Federal Transit Administration, and could have an impact on non-farebox passengers within the context of National Transit Database ridership reporting or be reflected in the appearance of declines in transit ridership.

To understand fare evasion, it is imperative to first understand the definition of fare evasion across North America, determine the method transit properties use to calculate fare evasion rates, and establish how transit property enforce fare evasion and the penalties to fare evaders.

The objective of this research is to prepare a report on the status and expected near-term initiatives in fare evasion and fare evasion enforcement. The final deliverable should assist transit agencies better understand the methods used to calculate the fare evasion rate and cost, the implications of fare evasion, and the effectiveness and impact of fare evasion policies.

■ **Project B-47**      *Mobility Inclusion for Un(der)served Population with the Emerging Technologies*

Research Field:      Service Configuration  
Allocation:            \$250,000  
TCRP Staff:            Stephan Parker

Transportation equity has long been studied by researchers focusing on people without vehicles, as well as disadvantaged groups including seniors, females, and people with disabilities. With the emergence of new technologies, new transportation equity discussion is needed about people without smartphones, without mobile internet access, or un(der)banked. The emerging technologies have significantly changed and will continue reshaping people's transit experience. For example, more people are using trip planning apps to schedule travels efficiently, using real-time tracking apps to reduce waiting time, and using mobile apps to reload and pay transit fares conveniently. In addition, people use on-demand transportations such as bike-sharing and car-sharing for short trips and first/last mile accessibility.

New technologies are anticipated to make transit more accessible and to enhance people's mobility. However, many of the new mobility tools require smartphone ownership or mobile bank account, and not everyone is included in this technology revolution. People who lack access to car may be excluded further away from using public transportation and become

un(der)served due to their poor economic status and the lack of smart phone or bank account. In addition, great interests are shown to use the big data collected from these new apps for future travel modellings and plans. If this group of people's travel information is missing from the data, their travel patterns and needs will not be considered and modelled, which result to a biased projection. As a result, transit agencies and researchers need to identify the potential problems to the un(der)served groups proactively while developing new tools to improve public transportation.

This research emphasizes the importance of mobility inclusion for un(der)served population, and highlights the need to provide equal access to transportation service and information. This project explores current initiatives and strategic plans on how to include the un(der)served population in mobility enhancement. It provides ideas for transit agencies when implementing new technologies for transportation services. It also forces service providers to think about the influence of new mobility tools on transit experience of un(der)served population and to develop plans to make sure they benefit from the improved transit efficiency. This research can contribute to the current research pool by studying different dimensions of transportation equity from the technological point of view.

The objective of this research is to develop guidelines for transit agencies for the inclusion of underserved, underemployed, and low-income current and potential users in the new and existing technology-enabled mobility tools implemented on smartphone and internet platforms, to improve transit access and experience to everyone.

The main focus is to explore the influence of new mobility tools on un(der)served people's transit experience with the emerging technologies, and provide recommendations for transit agencies about mobility inclusion initiatives for such population.

<b>■ Project G-18</b>	<b><i>Improving Access and Management of Transit ITS Data</i></b>
Research Field:	Administration
Allocation:	\$350,000
TCRP Staff:	Lawrence Goldstein

Archived data from bus and rail intelligent transportation systems (ITS) is an extremely valuable resource for transit service planning and management. Vehicle location and passenger activity data from automatic vehicle location (AVL), automatic passenger counter (APC), and automatic fare collection (AFC) systems are used to provide essential insight into transit operations and to inform decision making to increase the efficiency, productivity, and safety of transit service. These data sets are also key elements in the big data analytics activities needed to link transit and other modes within the broader shared mobility service sector.

There are, however, significant challenges for transit agencies in accessing and using this data. Many agencies can't get to the data at all or don't understand the data they have. Data validation and quality control, integration and matching across various data sets, and aggregating data are all difficult, as is developing the types of reports, tools, and analytics that really inform decision makers. Even when transit agencies, researchers and consultants do address these challenges, they have difficulty sharing their work with their peers in the industry because the same types of data are managed very differently among transit agencies. The result is that transit ITS data is rarely used to its full benefit.

Creating a common approach to accessing and managing archived transit ITS data would facilitate the development and exchange of data management practices, of advanced reports

and tools, and of new analytical techniques among transit agencies. Without this assistance, this effort would be too complex, too time-consuming, too costly, or even out of reach. A common definition of data structures for transit ITS data is needed.

The objective of this research is to develop a common approach to accessing and managing archived transit ITS data that:

- Can be connected to data from many different existing systems,
- Addresses current data access, data quality, and data integration challenges,
- Is flexible to meet differing needs of transit agencies and other users of transit ITS data,
- Will be continually improved, and shared across the industry, and
- Facilitates exchange of reports, tools, and analytical techniques based on transit ITS data.

■ **Project H-58**      *Transit Prioritization Scoring Methodology in Metropolitan Planning Organization Programming*

Research Field:      Policy and Planning

Allocation:          \$100,000

TCRP Staff:          Dianne Schwager

Transit projects compete for funding with highway and other modal projects in Metropolitan Planning Organization (MPO) Long Range Transportation Plans (LRPs) and Transportation Improvement Programs (TIPs). The prioritization methodology utilized for scoring projects across the different modes can have a dramatic impact on whether transit projects are programmed. There has been little published review of the current state of the practice of these MPO prioritized methodologies specifically focusing on how transit projects are scored and how it affects their competitiveness.

The objective of this research is to document best practices for multimodal prioritization methodologies in Metropolitan Planning Organization planning and programming processes focusing on the best practices of prioritizing transit versus other modal solutions.

**Project J-11/Task 35**      *Diversity and Inclusion Plans, Policies, and Best Practices in the Transportation Industry*

Allocation:          \$50,000

TCRP Staff:          Dianne Schwager

The public transportation industry is striving to be more diverse and inclusive. Many entities within the industry are being intentional about creating an inclusive culture, reevaluating the kind of ally they can be in their community, and exploring the many different aspects of diversity, beyond race and gender that make up their workforce. However, there is the realization that organizational diversity and inclusion goals are difficult to affirm and measure.

For purposes of this research, the public transportation industry includes (1) public transportation providers (i.e., transit agencies, local and state DOTs), (2) private transportation providers (e.g., TNCs, taxis, carshare and bikeshare providers), and (3) businesses and organizations that provide services and products for public transportation (e.g., planning, engineering, consulting, and technology). These diverse transportation organizations often lack the tools, guidance, and resources to effectuate a comprehensive Diversity and Inclusion program.

Public transportation organizations need a central resource where they can learn from their peers about existing diversity and inclusion practices, policies and plans as well as obtain guidance on how to create and update their own successful Diversity and Inclusion programs.

Drawing on experience industry-wide experience, this project will:

- Make the business case for diversity and inclusion in the public transportation industry;
- Conduct a broad industry scan identifying and articulating existing best and next practices on diversity and inclusion,
- Provide a central place where organizations can learn about existing Diversity and Inclusion issues and how they are being addressed in the industry, and
- Provide a framework for how to create/update Diversity and Inclusion plans and policies.

**The objectives of this research are to:**

- Evaluate Diversity and Inclusion plans and policies within the public transportation;
- Develop a reference guide that may be used various public transportation entities who are looking to improve or create Diversity and Inclusion plans and policies.

- **Project J-11/Task 36**      *An Update on Public Transportation's Impacts on Greenhouse Gas Emissions*  
Allocation:                      \$90,000  
TCRP Staff:                      Dianne Schwager

The focus on climate change and sustainability is intensifying. Past research has indicated that public transportation plays an important role in reducing greenhouse gas (GHG) emissions, and updated findings could be even more significant.

In 2007 and 2008, [The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction](#) and [Public Transportation's Contribution to U.S. Greenhouse Gas Reduction](#) were released, respectively. These two works attempt to quantify the reduction in carbon dioxide emissions due to public transportation services, though they differ in method and ultimately, in conclusion. This research is expected to compliment current studies in development, including J-11/Task 32, *Public Transportation Sustainability Guidelines and Metrics*.

The objective of this research is to update previous research on public transportation's role in reducing GHG emissions.

- **Task J-11/Task 37**      *Transit and Micro-Mobility (Bikeshare, Scooter-share, etc.)*  
Allocation:                      \$91,000  
TCRP Staff:                      Mariela Garcia-Colberg

Increasingly, cities across the country are investing in bike share systems. Since 2010, station-based bike share in the United States has grown from a handful of systems to over

50,000 bikes in more than 50 cities nationwide. Several private operators began offering non-station-based or “dockless” bike share systems in around 10 cities nationwide.<sup>1</sup>

Public transportation is the backbone of a multimodal lifestyle, and additional options like bike share help support a multimodal lifestyle as well. This symbiotic relationship means bike share has the potential to both replace transit trips for existing transit users, but also increase the number of transit trips by expanding the reach of multimodal lifestyles.

Bike share ridership grew to a record 35 million bike share trips nationwide in 2017. The majority of this ridership (74%) takes place in four transit-rich cities: New York; Chicago; Washington, DC; and Boston. Prior research on the system in Washington, DC indicated a complementary relationship between rail transit ridership and bike share ridership.<sup>2</sup> The question of bike share ridership impact on bus systems and in smaller cities remains unanswered.

Some newer bike share systems have indicated an interest in increasing the cooperation between transit and bike sharing. LA Metro opened its own bike share system in 2016. Ford GoBike in San Francisco accepts Clipper Card, the regional transit smart card. The ridership impact of these integrations has not been studied.

The objective of this research is to investigate the connection between bike share and public transportation. Some questions that may be addressed include:

- What are the transit ridership implications of bike share systems?
- Do bike share systems have different transit ridership impacts depending on system size?
- Do bike share programs targeted at low-income residents affect transit ridership differently?
- How are transit agencies and bike share providers partnering to make connections between the two systems more seamless?
- Are the profiles of dockless bike system users different than docked bicycles?

▪ **Project J-11/Task 38**      *An Analysis of Green Bond Financing in the Public Transportation Industry*  
Allocation:                      \$91,000  
TCRP Staff:                      Mariela Garcia-Colberg

According to the Climate Bonds Initiative, the 2017 issuance of green bonds in the United States was \$157 billion, over four times the amount issued in 2014.<sup>3</sup> In short, green bonds are bonds that are earmarked toward positive environmental purposes, such as conservation, renewable energy, energy efficiency, and clean transportation. As climate issues continue to gain attention and provoke action plans among public and private organizations, green bonds have been receiving additional attention in the financial market.

In 2015, Sound Transit became the first U.S. transit agency to issue a green bond.<sup>4</sup> Since then, numerous agencies have followed as outside parties have come to see public transportation as an important actor in reducing greenhouse gas emissions and addressing climate change. While green bonds carry additional transaction costs (issuers must track and

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<sup>1</sup> <https://nacto.org/bike-share-statistics-2017/>

<sup>2</sup> <https://trrjournalonline.trb.org/doi/abs/10.3141/2534-01>

<sup>3</sup> <https://www.climatebonds.net/market/explaining-green-bonds>

<sup>4</sup> [https://www.progressiverailroading.com/passenger\\_rail/article/Seattles-Sound-Transit-sells-1-billion-in-green-bonds-to-fund-transportation-projects--45681](https://www.progressiverailroading.com/passenger_rail/article/Seattles-Sound-Transit-sells-1-billion-in-green-bonds-to-fund-transportation-projects--45681)

report on the use of proceeds), issuers typically find that the marketing of their sustainability commitment along with the attraction of environmentally conscious investors outweigh these costs. Like normal bonds, there are a variety of different types of green bonds.

The objective of this research is to document how public transit agencies have been capitalizing on the emerging trend of green bond financing and the implications of doing so. Analysis should focus on the following areas:

- A brief overview of traditional transit bond issuances;
- A discussion of the rise of green bonds, their criteria, their role in sustainability, and the respective supply and demand of green bonds;
- A benchmarking of transit agency green bond issuances with summary findings;
- Examining trends of issuances and providing an outlook for future developments in the green bond sector. This may include an analysis of the pricing differences compared to traditional bonds;
- Examining the benefits that green bonds have provided for transit agencies, and the external market; and
- A guidebook lessons learned/recommendations for transit agencies looking to utilize green bonds.