

TECHNICAL MEMORANDUM

DATE: August 24, 2023
TO: Boston Region MPO Members
FROM: Erin Maguire
RE: Transit Transformation Literature Review

1 INTRODUCTION

The Transit Transformation investment program was established by the Boston Region Metropolitan Planning Organization's (MPO) Long-Range Transportation Plan *Destination 2050*. The program has an annual set-aside of \$6.5 million, except for federal fiscal year (FFY) 2025 in which the set-aside is \$2 million. Funding for FFYs 2025–28 totals \$21.5 million.

The Transit Transformation program is envisioned to support projects that

- enhance amenities for transit customers;
- improve accessibility on the transit system;
- increase capacity of transit stations and improve multimodal connections;
- make state-of-good repair improvements to transit assets, including tracks, signals, and power systems;
- modernize transit fleets through the purchase of vehicles and upgrades to maintenance facilities; and
- make investments in climate resiliency to support the future security of transit infrastructure, including system electrification.

MPO members also gave feedback that encouraged investments that will improve accessibility for people with disabilities, support system expansion and electrification, and expand bus infrastructure.

This memo summarizes eight recent studies examining the effectiveness of several transit investment strategies, suggestions for adaptation strategies, and evaluation of bus rapid transit (BRT) systems.

Civil Rights, nondiscrimination, and accessibility information is on the last page.

2 SUMMARIES

2.1 A Worldwide State-of-the-Art Analysis for BRT: Looking for the Success Formula

Bus rapid transit has been an attractive alternative to large-scale capital investments such as light-rail construction. Implementation can occur in accordance with political cycles and service can be adjusted as land-use and travel demand trends change. The Institute for Transportation and Development Policy has developed a BRT scorecard to evaluate BRT systems, awarding a maximum of 100 points. Criteria are grouped within the following categories:

- BRT Basics
- Service Planning
- Infrastructure
- Stations
- Communications
- Access and Integration

BRT systems lose points for low average bus travel speeds, unenforced right-of-way, poorly maintained infrastructure, and low service frequency, among other characteristics correlated with inefficient BRT services. Common criticisms of North American BRT systems state that there is a lack of real-time passenger information and insufficient last-mile connections from stations. BRT systems are vulnerable to implementation delays due to supply shortages, such as fare system infrastructure. It is important to allocate the appropriate amount of funds for operating expenses and regular maintenance, including the repair of bus lanes.

2.2 Impacts of BRT on Residential Property Values: A Comparative Analysis of 11 US BRT Systems

MPO staff consulted literature to understand potential impacts of BRT system implementation and expansion. A comparative analysis of 11 BRT systems in the United States examined the impact of BRT development on nearby property values. BRT systems have been deployed throughout the United States in a variety of capacities. The Silver Line SL4 and SL5 routes are classified as a BRT-lite system, due to the presence of partial dedicated bus lanes. Findings indicate limited impacts to property values surrounding BRT routes, except for multi-family properties where the property value is likely to increase. Researchers note the opportunity to expand transit-oriented development (TOD) along corridors where BRT or BRT-lite systems are implemented. Researchers state that the most significant impacts of BRT implementation can only be actualized when pedestrian infrastructure is expanded with the BRT development.

2.3 Planning Transport for Social Inclusion: An Accessibility-Activity Participation Approach

At the University of Toronto, researchers found that for every income level, zero-car households have a higher level of transit accessibility, but a lower rate of activities per day compared to households with at least one car. Researchers compared areas with high concentrations of low-income households to areas with participation deserts, which are areas with an average activity level below the regional average. The study concludes that low-income households and zero-car households are the most sensitive to changes in transit quality and services. Based on this finding, the researchers encourage targeted investments in low-income, inner suburban neighborhoods to experience the greatest impact on promoting mode shift and increasing economic activity.

2.4 Can Transit Investments in Low-Income Neighborhoods Increase Transit Use? Exploring the Nexus of Income, Car-Ownership, and Transit Accessibility in Toronto

Researchers investigated the opportunities for mode shifts for “transit captive” populations by comparing how household income and vehicle ownership are correlated with one another. From this analysis, it was found that low-income households that own between 0.5 and 1 car per person per household have the greatest demand elasticity for transit accessibility. The paper states that there are conflicting forces impacting this trend: the high cost of car ownership and the perceived reduced marginal cost of car travel. In practice, many low-income households will opt for private vehicle travel over transit, as these households are often further from accessible public transit than peer, high-income households. To see the greatest impact in mode shift, the researchers conclude by recommending transit investments in areas with higher concentrations of low-income, car-owning households.

2.5 Equitable Access to Public Transport: Corridor Plans for Transit-Oriented Development in Soweto, South Africa and Boston, Massachusetts Compared

Griffith examines the development of Boston and Soweta, South Africa’s BRT systems and the associated TOD along the service corridors. Study locations were selected due to existing equity issues: the corridor in Soweta was initially developed during apartheid, while the corridor in Boston, the Fairmount Indigo corridor, serves low-income and minority neighborhoods of Dorchester, Roxbury, Mattapan, and Hyde Park. Griffith notes that key aspects of the planning process, especially for TOD, are local government coordination between agencies and municipalities, along with strong community support. Griffith argues that in

Boston and Soweta, the corridors have the potential to increase mobility and improve the economic well-being of residents in impacted communities.

2.6 Sustainable Mobility in Auto-Dominated Metro-Boston: Challenges and Opportunities Post-COVID-19

Researchers argue that a suitable strategy for post-COVID-19 recovery in the Boston region is to prioritize policies for sustainable mobility. Since 2005, the number of two-car households has increased by 60 percent, compared to a total household growth of 25 percent. The disruptions caused by COVID-19 provide opportunities to implement policies that promote the use of mass transit throughout the region. Public health concerns related to overcrowded buses, especially in the beginning stages of the pandemic, shifted public perception to be more skeptical of public transit services. Factors such as unreliable service frequency, insufficient safety measures, and a lack of enforcement were strong contributors to this phenomenon. Policies suggested to leverage this opportunity to promote mode shift include an increased fleet size, reduced headways, and supplemental policies to disincentivize car use, such as congestion pricing or parking fees.

2.7 The COVID-19 Pandemic's Impact on Public Transportation Ridership and Revenues Across New England

Using data from the Federal Transit Administration's National Transit Database, Sullivan found that among all modes of public transit, local bus and demand-response service utilization remained closest to their pre-COVID levels. This indicates the strong reliance that the passengers of these systems have on reliable operations. Sullivan discusses the Massachusetts Bay Transportation Authority's (MBTA) reliance on generated revenue and states that in 2019, fares and parking fees accounted for 47 percent of the MBTA's operating expenses. Federal stimulus packages such as the Coronavirus Aid, Relief, and Economic Security (CARES) Act supplemented the agency's directly generated revenue by approximately \$2.1 billion in 2020. Many federal stimulus appropriations are set to conclude before ridership trends return to pre-pandemic levels.

2.8 Resilience of Rapid Transit Networks in the Context of Climate Change

In this thesis, Martello develops a methodology to assess the resilience of Boston's rapid transit network as it relates to sea level rise. Factors influencing the resilience metric include climate models such as the Boston Harbor Floor Risk Model, transit network connections, points of minimum elevation, and historic passenger flows. Martello assesses the importance of a transit location by the impact on connectivity throughout the system if the service was not

functioning there. From these inputs, Martello developed a list of the highest-priority stations to be modified for resilient infrastructure. Seven of the ten highest ranked stations are found on the Blue Line, which is likely to flood according to flood risk models. Cabot Yard, ranked number nine, is projected to result in a 21 to 45 percent connectivity loss, due to its use for Red Line car storage. Other stations with a large risk of lost connectivity include Courthouse Station, JKF/UMass to Andrew Station, and North Station. Suggested adaptation strategies include the elevation of critical systems and the installation of flood barriers or gates.

3 SOURCES

- Acton, B., Le, H.T.K., & Miller, Harvey J. (2022). Impacts of bus rapid transit (BRT) on residential property values: A comparative analysis of 11 US BRT systems. *Journal of Transport Geography*, 100. <https://doi.org/10.1016/j.jtrangeo.2022.103324>.
- Allen, J. and Farber, S. (2020). Planning transport for social inclusion: An accessibility-activity participation approach. *Transportation Research Part D: Transport and Environment*, 78. <https://doi.org/10.1016/j.trd.2019.102212>.
- Barri, E.Y., Farber, S., Kramer, A., Jahanshahi, H., Allen, J., & Beyazit, E. (2021). Can transit investments in low-income neighborhoods increase transit use? Exploring the nexus of income, car-ownership, and transit accessibility in Toronto. *Transportation Research Part D: Transport and Environment*, 95. <https://doi.org/10.1016/j.trd.2021.102849>.
- Basu, R., and Ferreira, J., (2021). Sustainable mobility in auto-dominated Metro Boston: Challenges and opportunities post-COVID-19. *Transport Policy*, 103, 197-210. <https://doi.org/10.1016/j.tranpol.2021.01.006>.
- Griffith, J. (2017). Equitable Access to Public Transport: Corridor Plans for Transit-Oriented Development in Soweto, South Africa and Boston, Massachusetts Compared. *Journal of Comparative Urban Law and Policy*, 1(1). <https://readingroom.law.gsu.edu/jculp/vol1/iss1/5>
- Martello, M.V. (2020). Resilience of Rapid Transit Networks in the Context of Climate Change [Master's thesis, Massachusetts Institute of Technology].
- Nikitas, A. and Karlsson, M. (2015). A Worldwide State-of-the-Art Analysis for Bus Rapid Transit: Looking for the Success Formula. *Journal of Public Transportation*, 18(1), 1-33. <http://dx.doi.org/10.5038/2375-0901.18.1.3>
- Sullivan, R. (2021). The COVID-19 Pandemic's Impact on Public Transportation Ridership and Revenues across New England [Regional Policy Brief]. Federal Reserve Bank of Boston. <https://ssrn.com/abstract=3932001>.

The Boston Region Metropolitan Planning Organization (MPO) operates its programs, services, and activities in compliance with federal nondiscrimination laws including Title VI of the Civil Rights Act of 1964 (Title VI), the Civil Rights Restoration Act of 1987, and related statutes and regulations. Title VI prohibits discrimination in federally assisted programs and requires that no person in the United States of America shall, on the grounds of race, color, or national origin (including limited English proficiency), be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination under any program or activity that receives federal assistance. Related federal nondiscrimination laws administered by the Federal Highway Administration, Federal Transit Administration, or both, prohibit discrimination on the basis of age, sex, and disability. The Boston Region MPO considers these protected populations in its Title VI Programs, consistent with federal interpretation and administration. In addition, the Boston Region MPO provides meaningful access to its programs, services, and activities to individuals with limited English proficiency, in compliance with U.S. Department of Transportation policy and guidance on federal Executive Order 13166.

The Boston Region MPO also complies with the Massachusetts Public Accommodation Law, M.G.L. c 272 sections 92a, 98, 98a, which prohibits making any distinction, discrimination, or restriction in admission to, or treatment in a place of public accommodation based on race, color, religious creed, national origin, sex, sexual orientation, disability, or ancestry. Likewise, the Boston Region MPO complies with the Governor's Executive Order 526, section 4, which requires that all programs, activities, and services provided, performed, licensed, chartered, funded, regulated, or contracted for by the state shall be conducted without unlawful discrimination based on race, color, age, gender, ethnicity, sexual orientation, gender identity or expression, religion, creed, ancestry, national origin, disability, veteran's status (including Vietnam-era veterans), or background.

A complaint form and additional information can be obtained by contacting the MPO or at http://www.bostonmpo.org/mpo_non_discrimination.

To request this information in a different language or in an accessible format, please contact

Title VI Specialist
Boston Region MPO
10 Park Plaza, Suite 2150
Boston, MA 02116
civilrights@ctps.org

By Telephone:

857.702.3700 (voice)

For people with hearing or speaking difficulties, connect through the state MassRelay service:

- **Relay Using TTY or Hearing Carry-over:** 800.439.2370
- **Relay Using Voice Carry-over:** 866.887.6619
- **Relay Using Text to Speech:** 866.645.9870

For more information, including numbers for Spanish speakers, visit <https://www.mass.gov/massrelay>.