



Riding Toward Opportunities:

Communities Need Better MBTA Service to Access Jobs



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UPON REQUEST
OPERATOR WILL LOWER BUS



RIDING TOWARD OPPORTUNITIES:

COMMUNITIES NEED BETTER MBTA SERVICE TO ACCESS JOBS

DECEMBER 2021

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EXECUTIVE SUMMARY

This report documents the access to jobs provided by the Massachusetts Bay Transportation Authority (MBTA) in Eastern Massachusetts and how chronic delays reduce that access. It also shows that delays disproportionately undercut economic opportunity for communities of color, low-income communities, and limited English proficient residents compared to white, wealthier, and English-speaking populations.

As the MBTA plans to adjust service on buses, trains, and ferries following winter and spring 2021 service cuts and plans to address anticipated budget shortfalls for future fiscal years, access to jobs could be undermined even more. This will have the greatest impact on those riders already hardest hit by delays.

PUBLIC TRANSIT DELAYS UNDERCUT ACCESS TO JOBS

Public transportation offers a lifeline, especially for many low-wage workers, people of color, low-income residents, and those with limited English proficiency. Indeed, public transit is often the only option these communities have to access economic opportunities. But riders of MBTA rail and buses too often experience congestion and delays, which result in a loss of efficient mobility, productivity, and growth.¹ Those losses are not felt equally. They disproportionately affect the communities most dependent on public transit. To create a more equitable transit system and not just the system that existed prior to COVID-19, this issue must be addressed.

1. A Better City, "The Transportation Dividend: Transit Investments and the Massachusetts Economy," at 2 (February 2018), <https://www.abettercity.org/assets/images/Transportation%20Dividend%20-%20FINAL%20-%2020012918.pdf>.

The MBTA is not only a driver of economic opportunity; it also provides approximately \$11.4 billion in savings annually from travel time and cost, crashes avoided, fewer greenhouse gas emissions emitted, and improved air quality.²

To close a funding gap of several hundred million dollars for fiscal year 2022, the MBTA implemented systemwide service cuts that affect transportation throughout Eastern Massachusetts. These cuts exacerbate the already diminishing access to economic opportunities that results from MBTA delays. Moreover, they are derailing our efforts to meet our state climate targets. Despite federal funds to address lost revenue during COVID-19, MBTA leaders anticipate budget shortfalls for years to come.

As the region endures the COVID-19 pandemic and considers the looming financial catastrophe on the MBTA, it is critical in the short term that the transit agency provide safe and reliable service for riders making essential trips. It also must maintain rapid transit, bus, commuter rail, and ferry service in the long term. Achieving both of these imperatives means addressing the disproportionate impacts of delays on those communities most dependent on its service for access to jobs and economic opportunities.

WHAT IS “ECONOMIC OPPORTUNITY”?

Economic opportunity is defined in this report as the total number of jobs that an individual could hypothetically access within two hours by public transportation, including bus, subway, and commuter rail. That means that having good public transit access to job centers – areas with a high concentration of jobs such as downtown Boston, Longwood, or Kendall Square – equates to greater economic opportunities.

Note that this hypothetical analysis does not take into consideration which and how many jobs are suitable for various populations based on education or skill. This analysis did separately model access to “low-income jobs” with an annual income of less than \$36,000, but it did not yield a substantially different result.

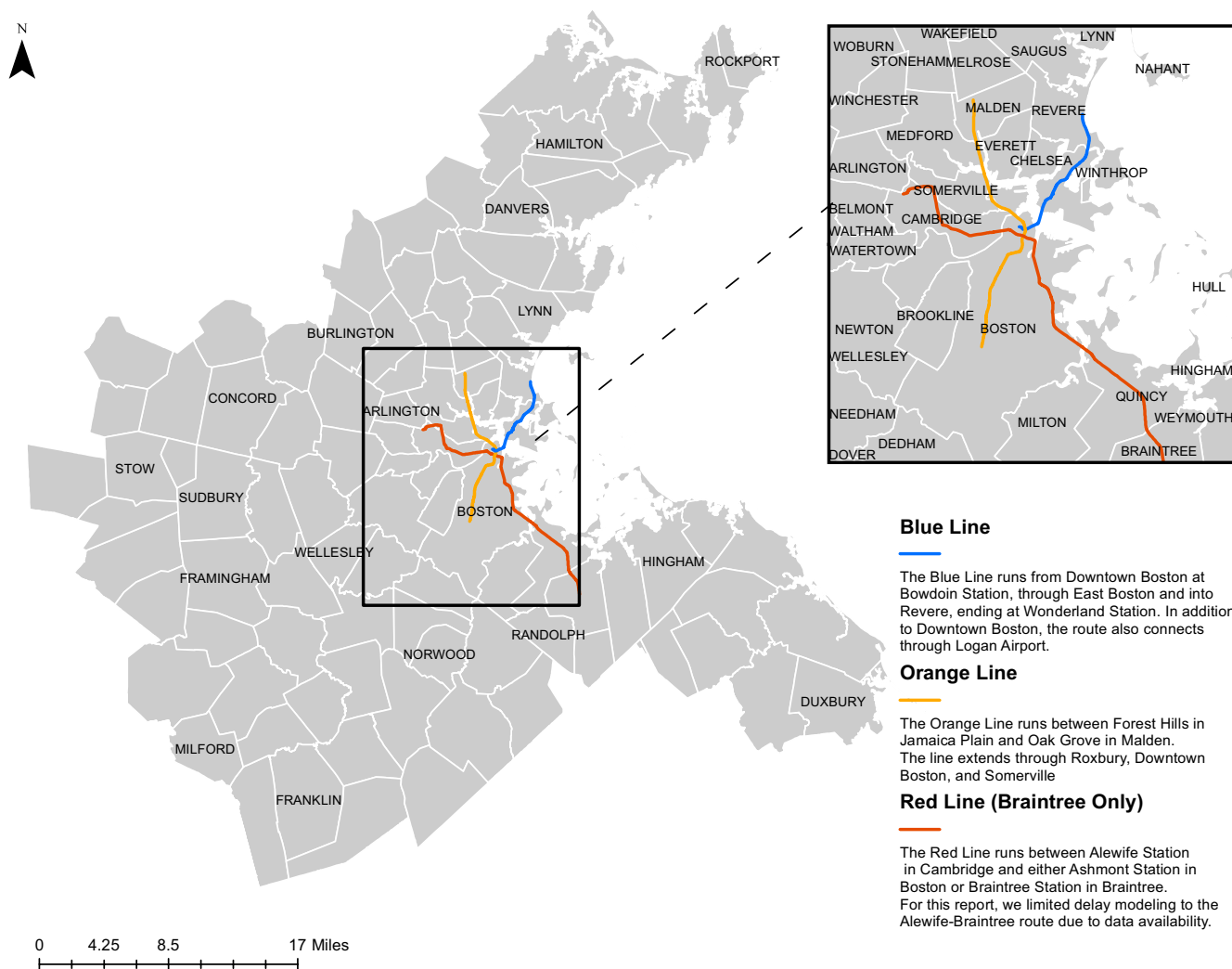
WHICH ROUTES WERE ANALYZED?

This report takes a deep dive into three rapid transit routes: the Orange Line, Red Line (to Braintree only), and Blue Line. It also examines five bus routes: Routes 28, 60, and 116, Crosstown 2, and Silver Line 5.

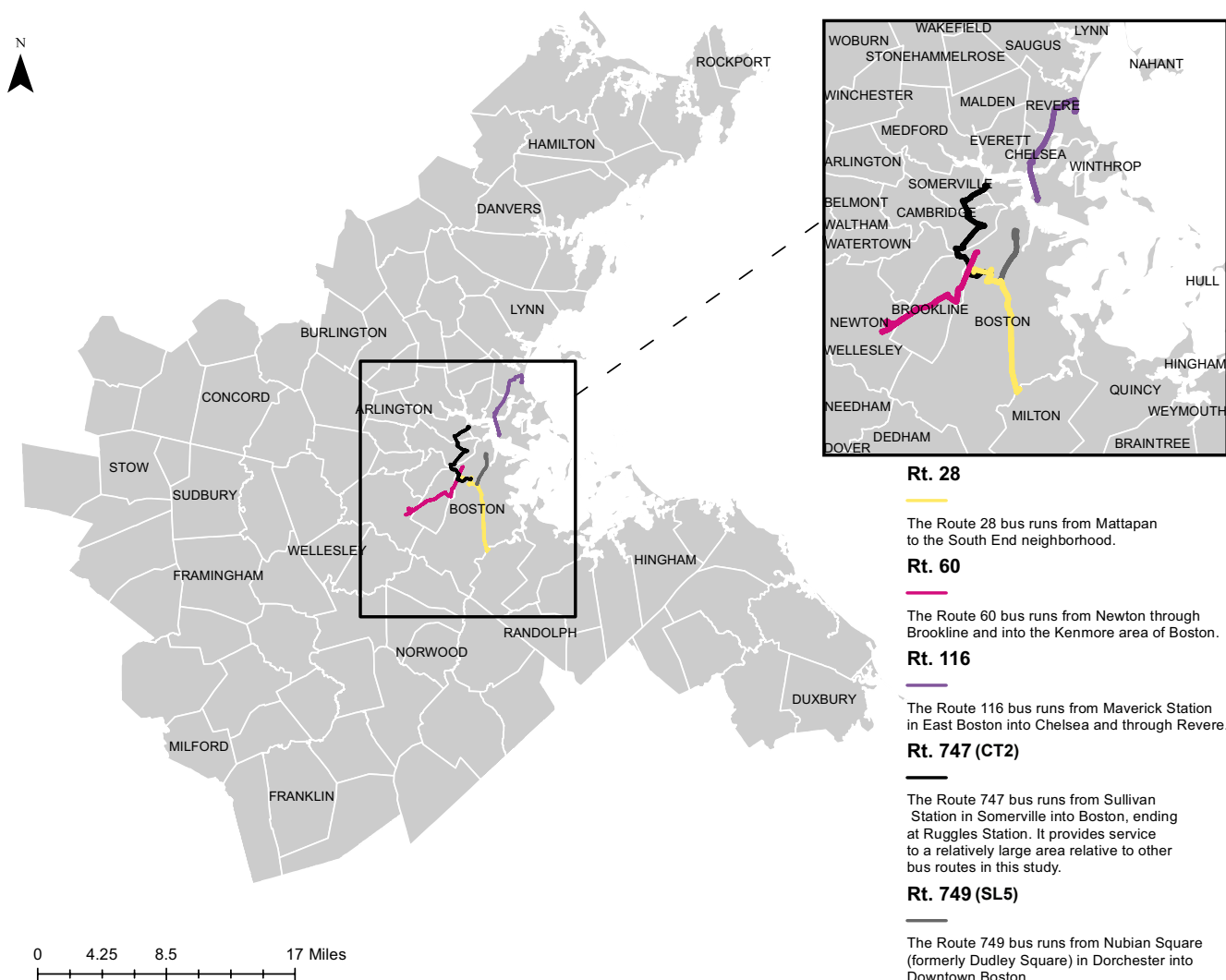
For each route, the report looks at two scenarios: transit service as scheduled (referred to as “baseline access” in the report) and riders’ reality when service deviates from the schedule. Baseline access is based on the current MBTA schedule, assuming there are no unexpected changes. The riders’ reality is based on real runtime data that tells us what riders actually experience when there are bus and train delays.

2. *Id.* at 3.

MAP: ROUTE EXTENT, SUBWAY LINES



MAP: ROUTE EXTENT, BUS ROUTES



When assessing the impact of transit delays, the report:

- Compares the loss of access to economic opportunity along the route,
- Explains how transit delays affect access to economic opportunity beyond the route within the Boston Metropolitan Planning Organization (MPO), and
- Considers loss of economic opportunity for various populations.

WHICH NEIGHBORHOODS HAVE GOOD BASELINE ACCESS TO ECONOMIC OPPORTUNITY?

The locations with the greatest baseline access to economic opportunities are closer to the urban core, which has high numbers of subway stations and bus stops. Baseline access to economic opportunities decreases as you move farther from the urban core.

- Unsurprisingly, neighborhoods with the greatest access to economic opportunities include Downtown Crossing, Chinatown, Back Bay, Bay Village, Beacon Hill, West End, Fenway, South End, North End, South Boston Waterfront, and Longwood.
- Communities with the comparatively least access to jobs include Needham, Saugus, Lynn, Waltham, Milton, and West Roxbury.
- Everett, Malden, Mattapan, Dorchester, and Chelsea have lower baseline access to economic opportunity than Cambridge, Charlestown, East Boston, Allston, Somerville, Brookline, and Roxbury.

EVEN IN NEIGHBORHOODS WITH GOOD BASELINE ACCESS, OPPORTUNITY LOSSES RESULTING FROM DELAYS DISPROPORTIONATELY AFFECT LOW-INCOME RESIDENTS.

- Low-income households in Mission Hill, Roxbury, and Chinatown are very close to transit and residents of these neighborhoods depend on good service to maintain and increase access to job opportunities. Delays undermine the quality of the transit system and threaten residents' access to these opportunities. At the same time, these populations are at risk of being displaced as the costs of housing in and near the urban core rise.
- While Lynn, Mattapan, Malden, Revere, and Chelsea have poorer baseline access compared to other neighborhoods closer to the urban core, they are home to a large number of transit-dependent users. Low-income households in these areas similarly depend on reliable transit to access critical destinations and opportunities. These areas could very much benefit from service improvements not only to reduce delays, but also to increase the baseline access.

WHICH NEIGHBORHOODS ARE MOST IMPACTED BY TRANSIT DELAYS?

- On the Orange and Red Lines, the greatest loss of economic opportunity due to delays occurs near the ends of the routes. For the Orange Line, that means people living near Oak Grove, Malden Center, Wellington, Jackson Square, Green Street, and Forest Hills stations.
- On the Red Line, impacted areas are North Quincy, Wollaston, Quincy Center, and Quincy Adams. Red Line delays also impact Randolph, which lies beyond the line's southern end in Braintree.
- For bus Routes 28 and 116, the areas with the greatest loss of economic opportunity due to transit delays are concentrated along the route.
- For bus Routes 60, CT2, and SL5, the greatest loss of economic opportunity due to transit delays affects residents both along the route and beyond the route.

Notably, because the MBTA system is so interconnected, and many public transit riders rely on bus and subway connections, delays on one line can have far-reaching impacts throughout the system. For example, 16 MBTA buses connect to Quincy Center, 16 buses connect to Forest Hills, and 13 buses connect to Malden Center. A delayed bus can already be an issue for someone trying to get to work; chronic subway delays then compound the problem.

DELAYS DON'T AFFECT POPULATIONS EQUALLY

Our analysis shows that, overall, **people of color, low-income households, and limited English proficient households currently experience high loss of economic opportunity due to transit delays.**

Demographic Distribution – High and Very High Loss of Access to Opportunity Areas

	Total Share – Within Close Proximity (one mile for subways, half mile for bus routes)	Total Share – Within Close Proximity and High-Loss Area	Total Share – Within Close Proximity Within Very High-Loss Area
People of Color	48%	52%	62%
Low-Income Households	37%	40%	44%
Limited English Households	12%	13%	17%

In addition, for every route studied, these same populations make up a larger share of the areas with high losses compared to the route in general. For example, people of color make up 82% of the population living within a half mile of bus route 28. However, those living in the areas of the route most adversely impacted by delays are 98% people of color. The Blue Line analysis tells a similar story. There, 36% of households living within a mile of the line are low-income. Yet of the households in areas with the highest loss of economic opportunity along the line, 46% are low income.

RECOMMENDATIONS FOR PRIORITIZING UPGRADES TO THE MBTA

Maintaining bus, subway, and commuter rail service throughout the MBTA is critical to ensuring access to economic opportunities. However, our analysis shows that even the status quo currently harms some populations more than others. When looking at improving service, the MBTA must prioritize areas with:

- High reliance on transit and high loss of access to economic opportunity due to delays; and
- High shares of priority populations – people of color, low-income, and limited English proficiency households that also have relatively poor access to transit.

Specifically, the MBTA should:

- Universally increase service reliability with its Bus Network Redesign. Bus routes that connect to subway stations identified by this report as experiencing high losses of economic opportunity should be prioritized for increased frequency of service.
- Improve service reliability in geographic areas that are impacted severely by delays, are more reliant on transit, and have high numbers of priority populations.
- Undertake climate resilience studies and planning to understand how extreme weather will further exacerbate delays. The MBTA should prioritize the most at-risk infrastructure for investments and upgrades. In doing so, the MBTA should consider data on flood risk, power outages, and extreme heat. Improving resiliency and minimizing delays caused by extreme weather can help increase economic opportunity for riders.
- Prioritize increased service on routes in areas where residents are less likely to be able to work remotely. This will facilitate transit access for essential workers during the COVID-19 pandemic. Some routes may be critical connections for people to access jobs even if they do not have a high concentration of priority populations along the route.

Additional Recommendations Specific to COVID-19:

Our analysis shows that all of the areas most adversely impacted by delays have a higher share of workers who are unable to work from home than the region overall. (Exceptions include the Red Line, Route 747 (CT2) in Cambridge/Somerville, and Route 60, which runs through Brookline.

To ensure these essential workers can access their jobs safely, the MBTA should:

- Shorten headways on routes serving people who are less likely to work from home to allow for social distancing on buses and trains. Delays contribute to longer commute times and more crowded buses and train cars.
- Work to implement a permanent low-income fare.

- Refrain from cutting routes or allowing long headways for routes that serve communities of color, low-income communities, and limited English proficient residents. These routes are already affected by delays, so further service cuts are problematic.

In addition, the MBTA should have all-day service that is reflective of pandemic and post-pandemic anticipated travel changes. Routes serving white collar workers will likely see fewer people traveling by T back to work full-time and may be doing so outside of rush hour.

Prioritizing Service Improvements for Communities Most Harmed by Delays is Necessary, Especially Now:

As we recover from COVID-19, it is crucial that we plan for transportation justice. Transportation justice acknowledges the right of all people – no matter their race, age, physical ability, income, or immigration status – to move freely between the places they live, learn, work, worship, and play.

Just transportation systems are affordable, reliable, and safe and do not jeopardize one community to benefit others. Transportation justice ensures that residents, riders, pedestrians, workers, and cyclists can influence decisions that impact their lives and centers people who have been historically marginalized and underserved.

The authors of this report recognize the power of transportation justice to redress racial, socioeconomic, geographic, and health inequities and create just solutions to environmental burdens and the climate crisis.



INTRODUCTION

STUDY PURPOSE

Accessible, affordable transportation is critical to the lives we live. Residents of priority populations, defined here as communities of color, low-income communities, and residents with limited English proficiency, often rely on public transportation to obtain better jobs, secure educational opportunities, and access quality health care. Too often, competing interests result in transportation policies that leave residents of these priority populations stranded. To achieve transportation justice, we need to craft and implement policies that help rural and urban communities of color get the investments needed to spur mobility and economic opportunity.

When people live in close proximity to subway and bus routes, many elected officials, employers, and others expect that such people have adequate access to public transit. Riders of certain routes will be quick to share notes about how inadequate and unreliable transit routes cause delays that impact their lives. This study sought to identify areas in Eastern Massachusetts where inadequate public transportation may hinder opportunities and lower the quality of life for residents and workers. In particular, the study focuses on the impacts of service on transit-dependent and other historically marginalized populations.

The purpose of this study is twofold: (1) evaluate baseline access to economic opportunities in the Eastern Massachusetts region; and (2) evaluate the impact of transit delays on economic opportunities for several transit routes. Baseline access assumes that MBTA trains and buses routinely follow their planned schedules. In contrast, the study uses a dataset of “real runtime” (i.e., the actual schedule after delays are factored in) to analyze the impact of delays on access to economic opportunities. “Economic opportunity” is defined in this report as access to jobs.

The study area for this analysis is the **Boston Region Metropolitan Planning Organization (MPO)** area, which encompasses 97 cities and towns, covering approximately 1,360 square miles and stretching from Boston to Ipswich in the north, Marshfield in the south, and to approximately Interstate 495 in the west.

The study considers resident access to economic opportunities based on a commute time of up to two hours. The model assumes that people will walk, bike, or drive to a bus stop or train station, potentially transfer to a different route one or more times, and get to their final destination in two hours or less. The study does not measure the average delayed arrival to work as a result of MBTA delays. The study does compare the relative access to economic opportunities of people living in different communities as well as which stops or stations along a route experience the highest loss of economic opportunities as a result of a delay. A delay is considered to be a train or bus that is running behind the published schedule for that route.

This study focuses on access to job centers because of their importance to an individual's quality of life and, in some cases, their socioeconomic mobility. The impact of delays on transit-dependent and other priority populations may be even more pronounced. The priority populations used in this study include low-income households, people of color, and limited English proficiency households. We also include commentary on other variables, including car ownership (access to vehicles) and housing costs.

While not the focus of this study, the relationship between housing affordability and transit is noteworthy. An individual's ability to access high-quality transit is increasingly tied to high housing costs. Individuals who cannot afford to remain in areas served by high-quality transit may be forced to seek housing opportunities farther outside the inner core where public transportation is less frequent or reliable. Our study found a positive correlation between high-quality transit access and priority populations because these populations have historically been geographically concentrated in the inner core, but as these individuals are priced-out, there is more likely to be a negative correlation. As more individuals are priced out of high-quality transit areas, access to critical destinations will become more burdensome.³

Generally, people of color, low-income households and limited English proficiency households make up a large share of the population and household counts in areas identified as "high loss" and "very high loss" areas. High and very high loss areas are defined as areas where there is a significant loss of economic opportunities due to transit delays – basically, how much access to economic opportunities is reduced because of delays on MBTA routes.

POLICY BACKGROUND

Riding an MBTA bus "fails to live up to our own standards in too many ways."⁴ A quick scan of news articles, social media posts, and public comment periods before MBTA governance board meetings make clear that MBTA service is far from ideal.

3. Our study finds a strong positive correlation between access to economic opportunity and the presence of medium rent-burdened households (rent > 30 percent of income), and the presence of high rent-burdened households (rent > 50 percent of income), as detailed by the figure below. As demonstrated, as access to opportunity increases, the share of rent-burdened households increases.

4. Massachusetts Bay Transportation Authority, "Better Bus Project," available at: <https://www.mbta.com/projects/better-bus-project>.

In 2018, Gov. Charlie Baker issued Executive Order 579 to establish the Commission on the Future of Transportation in the Commonwealth to make recommendations to inform a common understanding of the future of transportation between 2020 and 2040.⁵ Baker acknowledged that the Commonwealth's transportation system is critical not only to meeting mobility needs but also to supporting economic development and achieving sustainability objectives.⁶

The Commission on the Future of Transportation recommended that the Commonwealth prioritize investment in public transit, recognize the impact on low-income populations and communities of color, and transform travel corridors to move people, not vehicles.⁷ Also in 2018, the MBTA committed to planning for synthesized improvements to its bus network through the Better Bus Project and the Bus Network Redesign.⁸

While the MBTA seemed to be on track for improving its service, various reports showed variations in access to the system demonstrating persistent racial inequities. In a 2019 assessment of the MBTA's performance relative to the Fiscal and Management Control Board (Control Board), the MBTA governance board, and its strategic plan, we found that the MBTA was behind schedule on meeting basic accessibility standards and identifying infrastructure deficiencies that require climate resiliency upgrades.⁹ A Control Board and Federal Transit Administration review found potential disparities in service quality for "minority bus routes" or routes predominantly serving communities of color.¹⁰ The Metropolitan Area Planning Council documented that Black bus riders spend an average of 64 more hours traveling by MBTA bus compared with white riders,¹¹ and the finding was affirmed in a subsequent report.¹²

In part to address these transit injustices, the Control Board in November 2019 voted to establish the bus and rail transformation offices. The Control Board approved five resolutions that implement electrified regional rail with short-term priority for lines that serve environmental justice populations, dedicate a new MBTA department focused on implementing the rail vision, expand opportunities for public-private partnerships, and create a visionary plan to revise the bus system.¹³

With the onslaught of COVID-19 in 2020, riders' experience with the MBTA changed dramatically. The number of riders across all MBTA modes dropped significantly, though bus

5. Massachusetts Executive Order 579, Establishing the Commission on the Future of Transportation in the Commonwealth (January 23, 2018), <https://www.mass.gov/executive-orders/no-579-establishing-the-commission-on-the-future-of-transportation-in-the>.

6. *Id.* at 1.

7. Commission on the Future of Transportation, "Choices for Stewardship: Recommendations to Meet the Transportation Future," Volume 1, pages 33-35, December 2018, <https://www.mass.gov/doc/choices-for-stewardship-recommendations-to-meet-the-transportation-future-volume-1/download>.

8. MBTA Better Bus Project: Making Transit Better Together, <https://www.mbta.com/projects/better-bus-project>.

9. Greater Boston Chamber of Commerce, Conservation Law Foundation, and Massachusetts Bay Transportation Authority Advisory Board, 2019 Accountability Report, March 2019, <https://www.clf.org/wp-content/uploads/2019/03/2019-Accountability-Report.pdf>.

10. MBTA Fiscal & Management Control Board. Federal Transportation Administration Triennial Report, Part I, Presentation to the Fiscal and Management Control Board, September 18, 2017, <https://cdn.mbta.com/sites/default/files/2017-09/2017-09-18-fta-triennial-report.pptx>. MBTA Fiscal & Management Control Board. FTA Triennial Report, Part I, Presentation to the Fiscal and Management Control Board, September 25, 2017, <https://cdn.mbta.com/sites/default/files/2017-09/2017-09-25-fmcb-fta-triennial-part2.pptx>.

11. MAPC. 2017. State of Equity. Accessed 25 November 2019 at https://www.regionalindicators.org/topic_areas/7-executive-summary.

12. LivableStreets Alliance. September 2019. 64 Hours: Closing the Bus Equity Gap.

13. Fiscal and Management Control Board Rail Vision Resolutions, November 4, 2019, <https://cdn.mbta.com/sites/default/files/2019-11/2019-11-04-fmcb-rail-vision-final-vote-accessible.pdf>.

riders and certain subway routes experienced higher pandemic ridership due to the number of essential workers continuing to rely on certain bus routes and the Blue Line to get to work.¹⁴

Communities with poor transit access and higher populations of color continue to experience higher COVID-19 mortality rates. MBTA ridership declined throughout the pandemic, though routes with the highest sustained ridership are those routes serving people of color, low-income riders, and people with limited English proficiency. Due to financial constraints, the MBTA approved and implemented service cuts beginning with suspensions and deep cuts to the ferry and commuter rail schedules beginning in January 2021 with cuts to bus and subway service beginning in March 2021. These service cuts, deemed “Forging Ahead,” were intended to preserve ridership for transit critical populations.¹⁵ As of publication, the MBTA intends to increase service frequency and restore service to “100% pre-pandemic levels”¹⁶ on many routes with suspended service, though the MBTA announced service cuts in December 2021 due to labor shortages.

Restoring service to pre-pandemic levels is insufficient to ensure transportation justice. As the MBTA looks to bring back service to pre-pandemic levels, it will need to focus resources on certain populations who rely on the public transit system, prioritize restoration on routes with priority populations, and consider how service can support the maximum access to economic opportunities.

ACCESS WITHIN THE BOSTON MPO AREA

Access to job centers is critical to a community’s vitality and quality of life.¹⁷ Infrequent and unreliable public transit can exact economic and non-economic costs on individuals who are least able to bear them.¹⁸ Access to jobs is particularly important for social mobility and prosperity. Many urban residents, particularly those who are low-income, people of color, or have limited English proficiency, rely on public transit to access employment opportunities.^{19,20} A lack of access for these individuals may result in unemployment and perpetuate cycles of poverty.²¹ For transit-dependent hourly and late-shift workers, delays or lack of public transit options could mean lost pay or even lost jobs.²² These impacts do not exist in a vacuum. The same individuals could also face lost pay or lost jobs due to acute or chronic illnesses for which they are unable to access care.²³

Transportation policy decisions that do not account for the additional hardships or barriers

14. Report from the MBTA General Manager, Presentation to the Fiscal and Management Control Board, Slide 2, March 8, 2021, available at <https://cdn.mbta.com/sites/default/files/2021-03/2021-03-08-fmcb-F-report-from-general-manager.pdf>.

15. Forging Ahead Proposal, Presentation to the Fiscal and Management Control Board, December 9, 2020, <https://cdn.mbta.com/sites/default/files/2020-12/2020-12-14-fmcb-F-forging-ahead-service-proposal.pdf>.

16. MBTA. MBTA Forging Ahead. <https://www.mbta.com/forging-ahead>.

17. Conte, E., 2013. Mobility and Equity for New York’s Transit-Starved Neighborhoods: The Case for Full-Featured Bus Rapid Transit. Pratt Center for Community Development.

18. Id.

19. Blumenberg, E. and Ong, P., 2001. Cars, buses, and jobs: welfare participants and employment access in Los Angeles. Transportation Research Record, 1756(1), pp. 22-31.

20. Pew Research Center. 2016. “Who relies on public transit in the U.S.” <https://www.pewresearch.org/fact-tank/2016/04/07/who-relies-on-public-transit-in-the-u-s/>

21. Sanchez, T.W., 1999. A Transit Access Analysis of TANF Recipients in Portland, Oregon. Journal of Public Transportation, 2(4), p.4.

22. Duncan, C., Schroeckenthaler, K. and Blair, A., 2018. The Economic Cost of Failing to Modernize Public Transportation.

23. Gould, E. and Schieder, J., 2017. Work Sick or Lose Pay?: The High Cost of Being Sick When You Don’t Get Paid Sick Days. Economic Policy Institute. June, 28.

that marginalized and under-resourced communities face can therefore exacerbate existing inequities. In contrast, policies that do account for equity can help advance economic and social prosperity, spurring economic development, promoting sustainable lifestyles, and providing a higher quality of life.²⁴

METHODOLOGY

Baseline Transit Access Modeling

Baseline access for this study was determined using MBTA commuter rail, bus, and subway schedules. CLF partnered with the State Smart Transportation Initiative (SSTI) to procure the data used in this study. The primary dataset is based on accessibility score data produced using the Sugar Access tool by Citilabs. Sugar Access is an ArcGIS add-in used to score and understand a community's accessibility to employment opportunities, daily errands, public services, and other points of interest. It is often used by transportation planning professionals for scenario planning, to quickly test and compare changes to transportation and land use.

Geographies

Transit accessibility is reported at the census block group level for the entire study area.²⁵ However, a more detailed analysis is conducted for block groups within 0.1 mile of transit stops in the Boston MPO area. This more detailed analysis lets us account for variations in walking accessibility within block groups due to geographic constraints.

For example, assume a block group is split by some barrier (shown below), such as a river, so that its centroid (the center point of the block group) is a 20-minute walk from the nearest transit station (left). Two blocks within that block group, however, are not cut off by the barrier, so they are only a 5-minute walk from the station (right). Measuring access at this fine-grained level and aggregating to block groups lets us calculate the average accessibility (12.5 minutes), which is more representative of actual conditions. The individual block level scores are then averaged together to provide a score for the entire block group.

Figure 1:

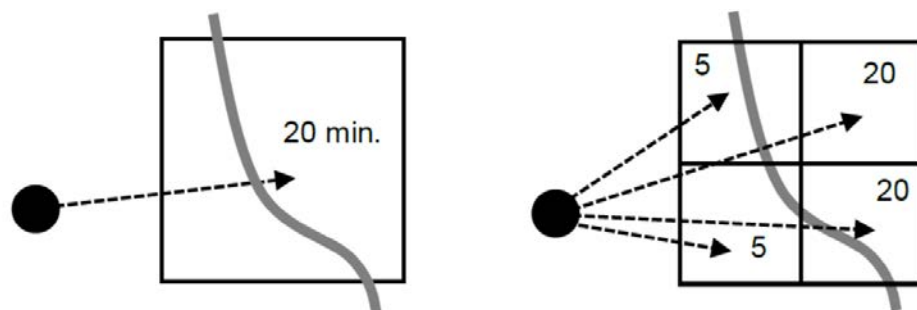


Image provided by State Smart Transportation Initiative (SSTI)

24. LINK Houston. 2018. Equity in Transit – 2018 Report. Accessed 9 June 2021 at https://36su8y45dw4h-332koa18cw3v-wpengine.netdna-ssl.com/wp-content/uploads/LINKHouston_EquityinTransit2018_Report.pdf

25. Access is determined based on the distance riders will travel to get to a bus or train. Riders will generally walk up to a quarter mile to a bus stop or a half mile to a light or heavy rail station, or drive up to three miles to a commuter rail station. The demographics of the neighborhoods within those distances should be the focus but transit providers may use the data from an entire census block or block group when a portion of the area is within the walking or driving distance described above. FTA C. 4702.1B, Chap. IV-14(e), Chap. IV-17(f). We considered FTA guidance and we relied on census block groups to incorporate our findings.

Access to Economic Opportunity

Sugar Access generated accessibility scores for each census block group in the study area using the MBTA's General Transit Feed Specification (GTFS) data. GTFS "feeds" let public transit agencies publish their transit data and developers write applications that consume that data in an interoperable way.²⁶ The scores report the number of accessible jobs during the morning period of 7-10 a.m. using a decay function derived from all commute trips in the National Household Travel Survey (NHTS). The decay function assigns weights to a job or other key destination depending on its total travel time, which includes walking to and from transit stations. For example, the NHTS estimates that 90% of commuters travel at least 15 minutes, so a job requiring a 15-minute transit commute is assigned a weight of 0.9. A job 40 minutes away, on the other hand, is valued at 0.6. The final accessibility metric, therefore, is the weighted sum of opportunities within the project area.²⁷

The effect of this is that locations with good public transit access to job centers (where there are high concentrations of jobs in close proximity, such as downtown Boston, Longwood, or Kendall Square) have greater access to economic opportunities. It is important to keep in mind that this is a hypothetical analysis that focuses on overall economic opportunity. It does not take into consideration which and how many jobs are suitable for various populations based on education or skill. This analysis did, however, separately model "low-income jobs" (defined as jobs with an annual income of less than \$36,000), but it did not yield a substantially different result so it is omitted.

While this report is useful for understanding the overall context of access to economic opportunity by public transit, it cannot say how many minutes late to work someone might be or how many people have lost their jobs because of a transit delay. This report focuses on the hypothetical ability of any rider in the Boston MPO area to access as many jobs as possible within a two-hour time frame through a combination of walking, buses, and subway routes.

MODELING IMPACTS OF DELAYS ON JOB ACCESS

Reduced Job Access Data and Selection of Routes

To better understand the impact of delays on access to economic opportunities, this analysis uses a dataset of delays on the MBTA system.²⁸ Delays were modeled using Sugar Access on eight routes: MBTA Red,²⁹ Orange, and Blue Lines; MBTA bus routes 28, 60, 116, 747, and 749.³⁰

We selected three bus routes that predominantly serve communities of color and low-income communities: routes 28, 116, and 749 (Silver Line 5 or SL5). Route 28 serves residents and workers of Mattapan, Dorchester, and Roxbury. Route 116 serves residents and workers of Chelsea and East Boston. Route SL5 serves residents and workers of Roxbury and the South End.

26. Google. GTFS Static Overview. Accessed 9 June 2021 at <https://developers.google.com/transit/gtfs>

27. The model only includes jobs that can be accessed within two hours (through a combination of walking and public transit) from each census block group.

28. Data were collected from July 31, 2017, to September 2018 by Brian Sanders.

29. Note that the Sugar Access model produced incomplete data on the Ashmont section of the Red Line, which is why we chose to omit it.

30. To model the impact of delays on transit access to jobs, SSTI had to manually enter delay data into Sugar Access, which was a time-consuming process that ultimately limited the number of routes that we could investigate,

We selected one route that serves a wide variety of demographics: route 747 (Cross Town 2 or CT2). Route CT2 serves residents and workers of Charlestown, Somerville, Cambridge, Fenway, and Roxbury. We selected one bus route that predominantly serves a wealthier and white community: Route 60. We also chose route 60 because it approximates the route of light rail (i.e., the Green Line), to see whether we could draw conclusions between light rail and bus routes. In this case, route 60 serves neighborhoods between Chestnut Hill and Kenmore Station traveling through Brookline, approximating the Green Line D train, which travels from Riverside Station in Newton to Government Center in downtown Boston. Two of these lines, Route CT2 and the Red Line, are some of the routes with the highest delays compared to other routes.

Trip simulations were run for each subway or bus line to determine the impact of delays on access to economic opportunity (i.e., jobs). Therefore, the results are line-specific and cannot be combined into one dataset or map. The results for each line were individually analyzed and are discussed in Section II. It is, however, noteworthy that the results of the modeling for individual routes demonstrate the far-reaching impacts that delays on one route have on the rest of the MBTA system. Transit riders often depend on connections between routes to get to their ultimate destination. Delays can cause a missed connection, which reverberates systemwide.

The accessibility scores produced by Sugar Access were weighted and normalized to facilitate this analysis. The accessibility score for each block group was converted into a ratio of delay impact to overall access to characterize the degree by which delays affect baseline access. These ratios were then weighted by the percentage of transit commuters within each block group based on American Community Survey (2018) data.³¹ The weighted scores were then normalized by taking the natural log and standardized by creating Z-scores.³² The spread of Z-scores is variant by route, where routes covering larger areas have comparatively lower-skewed scores, since reduced job access due to delays affect comparatively more block groups. Routes covering smaller areas have comparatively higher-skewed scores, since reduced job access due to delays affect comparatively fewer block groups.³³

31. American Community Survey (5-Year Estimate) for 2018 – Table B08301. Transit commuters self-identified as such as part of the survey.

32. Z-scores represent the relative distance of a data point from the mean value in the overall dataset. This allows for comparison of relative impacts for these weighted scores.

33. The Orange and Red lines cover the most block groups; therefore, the Z-score values are skewed downward. We consider Z-scores between 1 and 2 standard deviations from the mean to be “high loss” areas in so far as delays reduce job access, and Z-scores greater than 2 standard deviations from the mean as “very high loss” areas. The Blue Line and MBTA bus routes 60, 747, and 749 cover a midlevel range of block groups. We consider Z-scores between 2 and 3 standard deviations from the mean to be “high loss” areas and Z-scores greater than 3 standard deviations from the mean as “very high loss” areas. Finally, MBTA bus routes 28 and 116 cover the lowest number of block groups and have the most localized impacts. We consider Z-scores between 3 and 4 standard deviations from the mean to be “high loss” areas and Z-scores greater than 4 standard deviations from the mean to be “very high loss” areas.



PHOTO: TRAVELER / SHUTTERSTOCK.COM

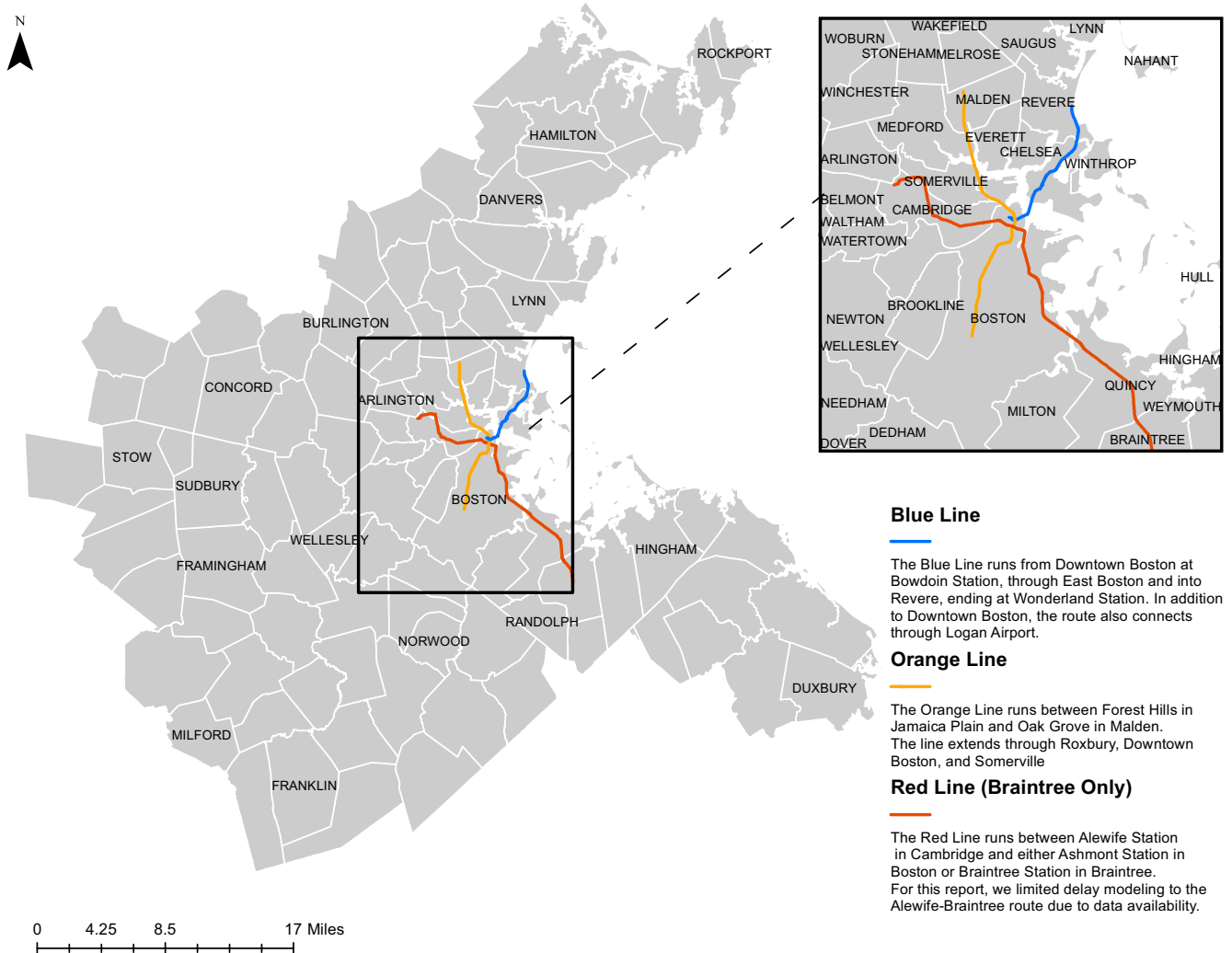
SECTION I: REDUCED JOB ACCESS & PRIORITY POPULATIONS

This section reviews key findings by route. For each route, we document the following:

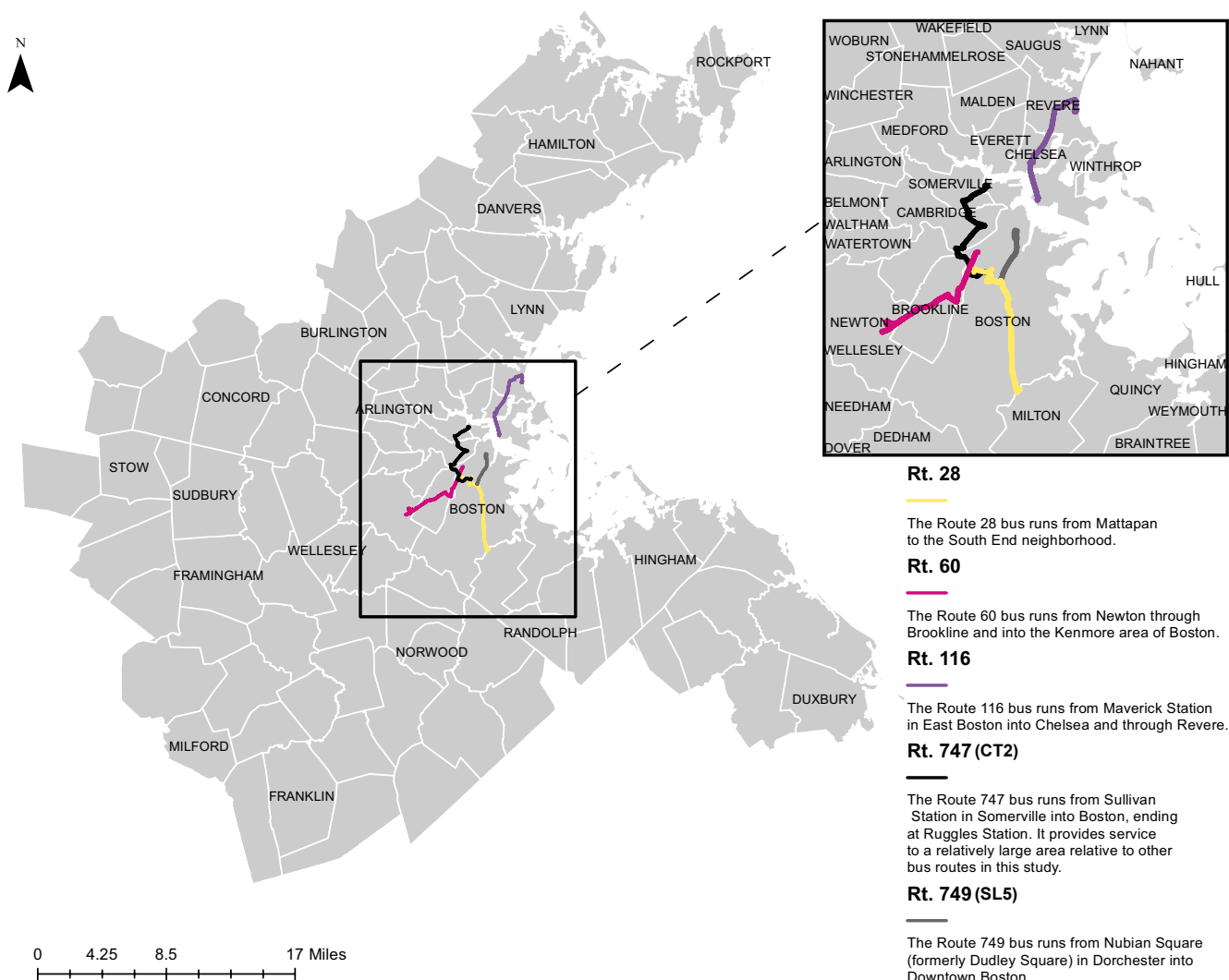
- An overview of each route and the areas it covers within the MPO
- An overview of the demographics of areas immediately surrounding each route
- A depiction of loss of economic opportunity due to transit delays for areas immediately surrounding each route
- A depiction of loss of economic opportunity due to transit delays for areas that are observed in areas beyond the route

The maps on the next two pages depict the extent of both subway routes and bus routes included in the study.

MAP 1: ROUTE EXTENT, SUBWAY LINES



MAP 2: ROUTE EXTENT, BUS ROUTES



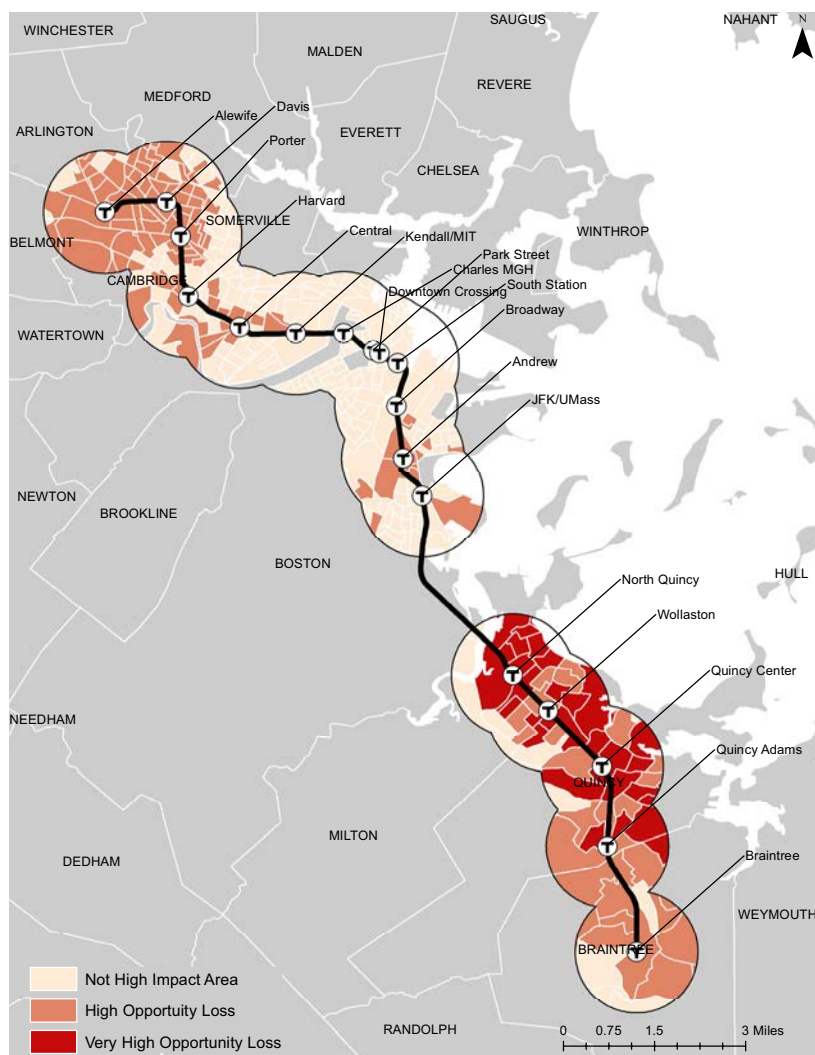
RED LINE (BRAINTREE ONLY)

Most block groups in proximity to the Red Line have high numbers of people of color, low-income households, and limited English households relative to the MPO. Within a mile of the Red Line, 37% of the population are people of color, 31% of households are low-income, and 8% are limited English households. People of color, low-income households, and limited English households are especially present around Andrew, JFK/UMass, and Broadway stations. These populations are also present near Quincy Center and Wollaston stations.

Red Line, Alewife-Braintree, Economic Opportunity Losses – Within a Mile of the Route

The areas experiencing **very high loss** of access to economic opportunity are within a half mile of Quincy Center Station. **High losses** and **very high losses** are also present near North Quincy, Wollaston, Quincy Center, and Quincy Adams stations. Losses are generally higher farther outbound on the line, where Alewife, Davis, and Porter stations experience higher losses than stations farther inbound, though losses are highest on the Braintree side.

MAP 3: RED LINE, CLOSE PROXIMITY



- Within this geographic bounding, people of color, limited English households and low-income households are disproportionately represented in **high loss** and **very high loss** areas.
- While people of color make up 37% of the share of the population living within a mile of the Red Line, they make up 46% of individuals living in areas experiencing **very high loss** of access to economic opportunity as a result of delays.
- Similarly, while low-income households make up 31% of all households within a mile of the line, they make up 35% of the households living in **very high loss** areas.

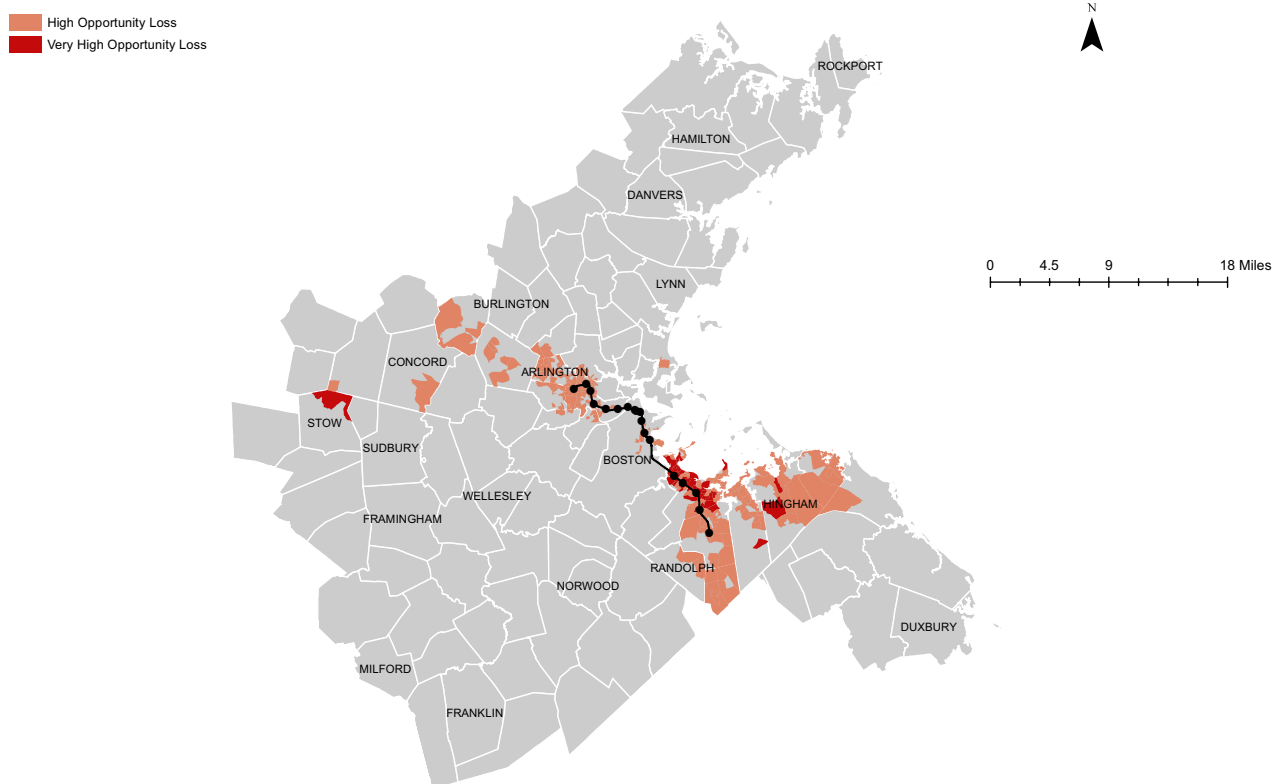
Chart 1: Economic Opportunity Loss Summary of Demographics – 1 Mile from Red Line to Braintree

	High Loss Area	Very High Loss Area	Total
% of Population that is People of Color	36%	46%	37%
% of Households that are Low-Income	30%	35%	31%
% of Households that are Limited English	7%	13%	8%

The Red Line running between Alewife and Braintree is often used by individuals who do not live along it. It connects to several other routes; therefore, the outward effects of delays are far-reaching relative to the line itself.

The map below depicts these far-reaching effects.

MAP 4: RED LINE, MPO IMPACTS



As shown on the map above, there are sections of **very high loss** areas in Stowe, Weymouth, and Hingham. **High loss** areas stretch up into Bedford, Lexington, Concord, and Arlington. On the southern side, **high loss** areas stretch into Braintree, Weymouth, Randolph, Holbrook, Cohasset, Hingham, and Scituate. Generally, **very high loss** areas and **high loss** areas are concentrated on the Braintree side of the route.

ORANGE LINE

Most block groups proximate to the Orange Line have high numbers of people of color, low-income households, and limited English households relative to the MPO and the Red Line.

Within a mile of the Orange Line, 46% of the population are people of color, 39% of households are low-income, and 12% are limited English households. People of color, low-income households, and limited English households are especially present around Jackson Square, Roxbury Crossing, and Stony Brook, in addition to Forest Hills, Malden Center, and Wellington.

Orange Line, Economic Opportunity Losses – Within a Mile of the Route

The **very high loss** areas are near Oak Grove, Malden Center, and Wellington stations, and from Roxbury Crossing through Forest Hills stations, with both occurring near the train and also out into the one-mile area. For stations on the southern part of the route, these **very high loss** areas are concentrated within a half mile of the route. **High loss** and **very high loss** areas persist at the ends of the line, including Malden Center, Green Street, Wellington, Stony Brook, and Jackson Square stations.

Generally, people of color, low-income households, and limited English households make up a large share of the population and household counts in high and very high loss areas.

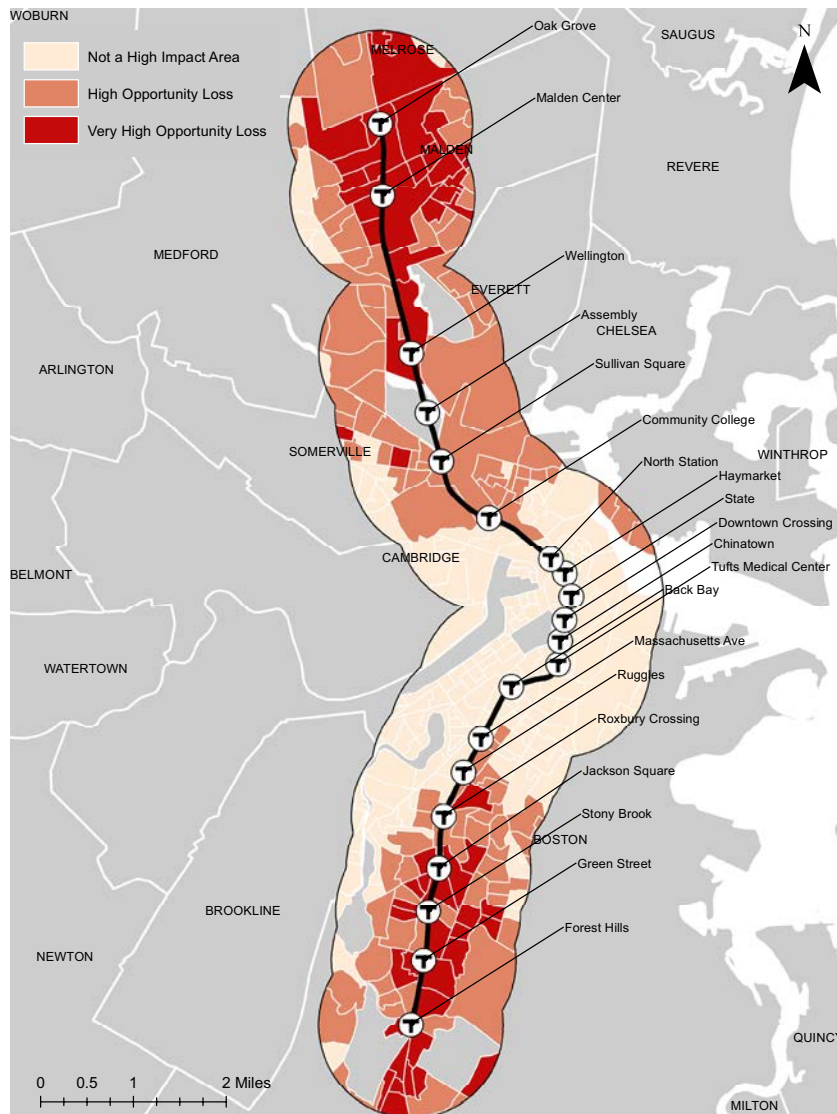
- While people of color make up 46% of the share of the population living within a mile of the Orange Line, they make up 61% of individuals living in **very high loss** areas.
- Similarly, while low-income households make up 39% of all households within a mile of the line, they make up 44% of households living in **very high loss** areas.
- The same is true for limited English households, where they make up 17% of **very high loss** areas, but only 12% of all households.

Chart 2: Summary of Demographics – 1 Mile from Orange Line

	High Loss Areas	Very High Loss Areas	Total
% of Population that is People of Color	49%	61%	46%
% of Households that are Low-Income	41%	44%	39%
% of Households that are Limited English	12%	17%	12%

The Orange Line is also used by many individuals who do not live along it. Like the Red Line, it connects to a number of other routes; therefore, via the delay modeling process, the effects of delays are far-reaching relative to the line itself.

MAP 5: ORANGE LINE, CLOSE PROXIMITY

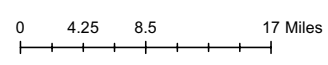
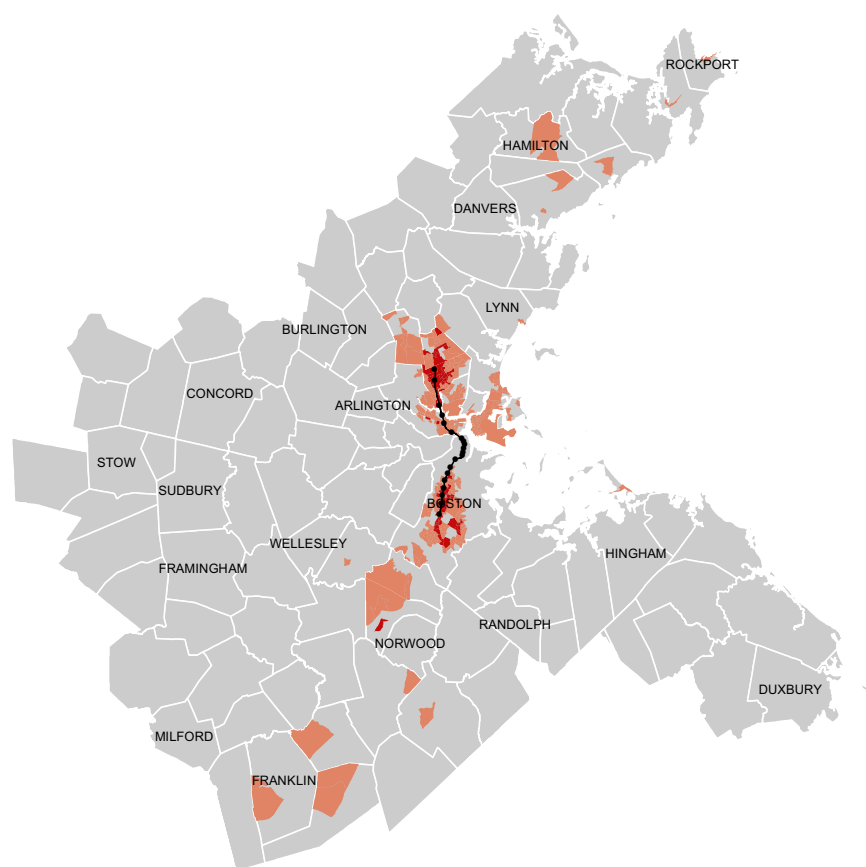


Very high loss areas stretch up into Melrose and Malden on the northern side and through Roslindale and Mattapan on the southern side. **High loss** areas are in Stoneham, North Melrose, East Boston, and Revere on the northern side, and down through Roslindale, West Roxbury, Dedham, and Westwood on the southern side. They are also observed reaching as far as through parts of Walpole, Norfolk, Wrentham, Franklin, Hamilton, and Beverly.

The results demonstrate the far-reaching, cascading effects of delays on this line. Not only do delays affect the areas surrounding the line, but also the access and transportation options of individuals living farther away from the inner core of Greater Boston.

MAP 6: ORANGE LINE, MPO IMPACTS

- High Opportunity Loss
- Very High Opportunity Loss



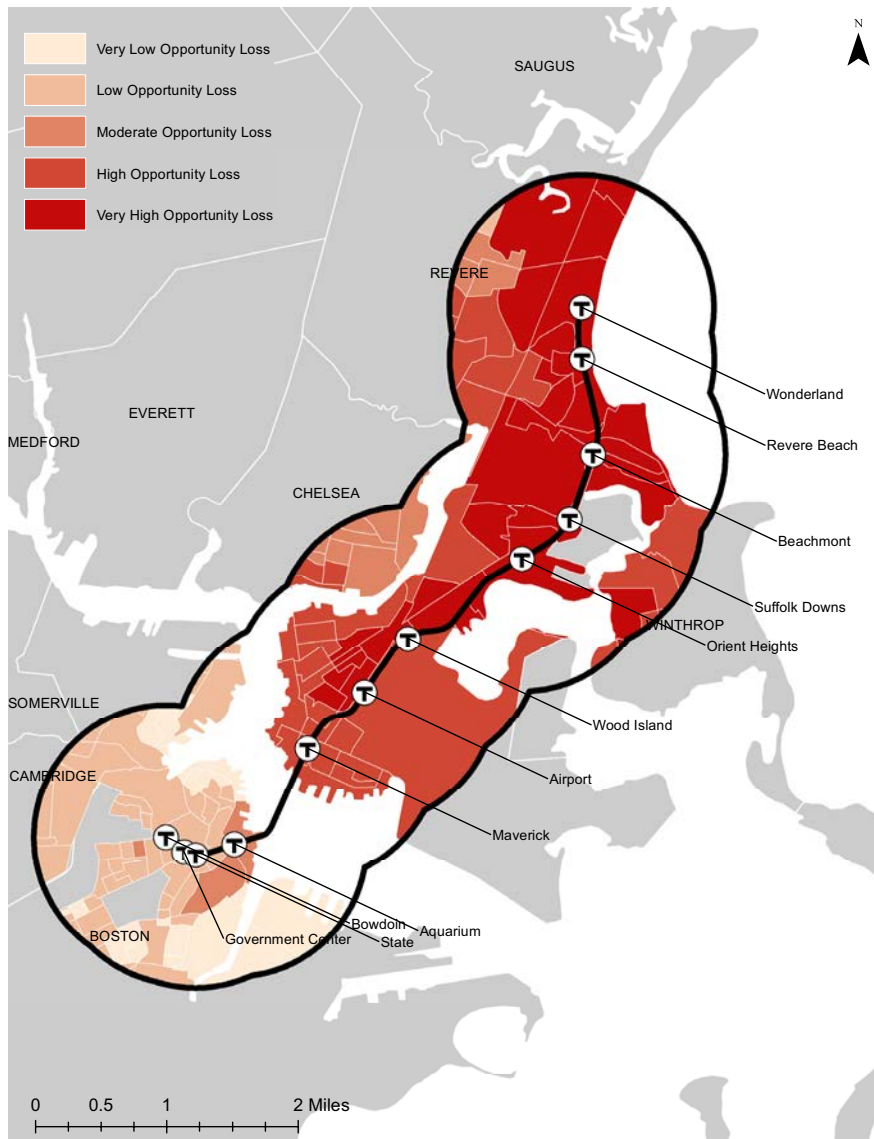
BLUE LINE

Most block groups in proximity to the Blue Line have high numbers of people of color, low-income households, and limited English households relative to the MPO. Within a mile of the Blue Line, 48% of the population are people of color, 36% of households are low-income, and 14% are limited English households. People of color, low-income households, and limited English households are especially present around Maverick, Airport, and Wood Island stations.

Blue Line, Economic Opportunity Losses – Within a Mile of the Route

The **high loss** areas are near Revere Beach Station but **very high loss** areas exist from Maverick Station through Wonderland Station. Delays tend to worsen further north out of downtown and more adversely affect access in East Boston and Revere than the central core area.

MAP 7: BLUE LINE, CLOSE PROXIMITY



Generally, people of color, low-income households, and limited English households make up a large share of the population and household counts in **high loss** and **very high loss** areas.

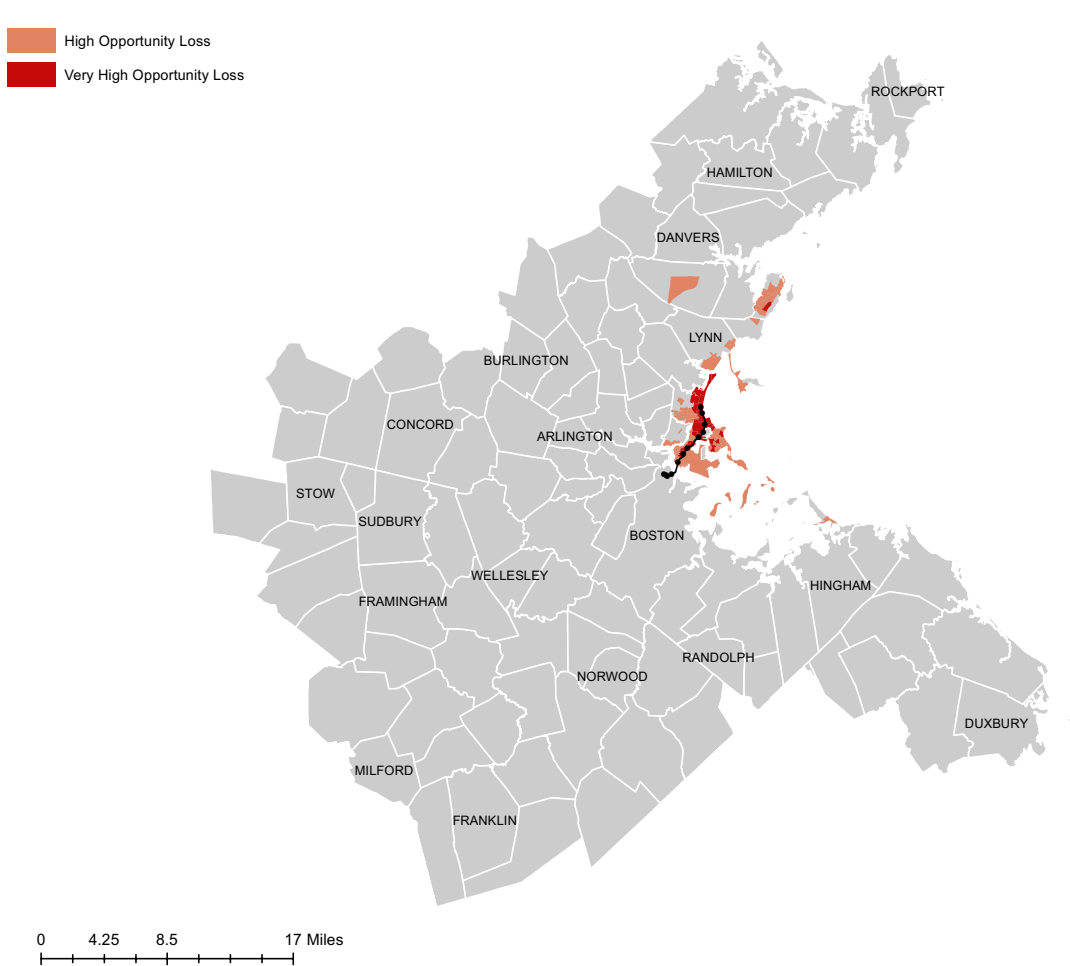
- While people of color make up 48% of the share of the population living within a mile of the Blue Line, they make up 57% of individuals living in **high loss** areas.
- Similarly, while low-income households make up 36% of all households within a mile of the line, they make up 46% of the households living in **very high loss** areas.
- The same is true for limited English households, where they make up 20% of **very high loss** areas, but only 14% of all households.

Chart 3: Summary of Demographics – 1 Mile from Blue Line

	High Loss Areas	Very High Loss Areas	Total
% of Population that is People of Color	57%	57%	48%
% of Households that are Low-Income	46%	46%	36%
% of Households that are Limited English	22%	20%	14%

Though individuals who do not live along it also use the Blue Line, it is not as far-connecting as the Red Line or the Orange Line. It also has comparatively lower ridership. However, it still connects to several key routes; therefore, via the delay modeling process, the cascading effects of delays are far-reaching relative to the line itself.

MAP 8: BLUE LINE, MPO IMPACTS



Very high losses stretch into Revere past Wonderland Station. Peabody also sees **very high losses**, though not in the immediate vicinity of the route. **High losses** stretch into Nahant and parts of Marblehead and Swampscott, even further north of where the route ends in Revere.

ROUTE 28

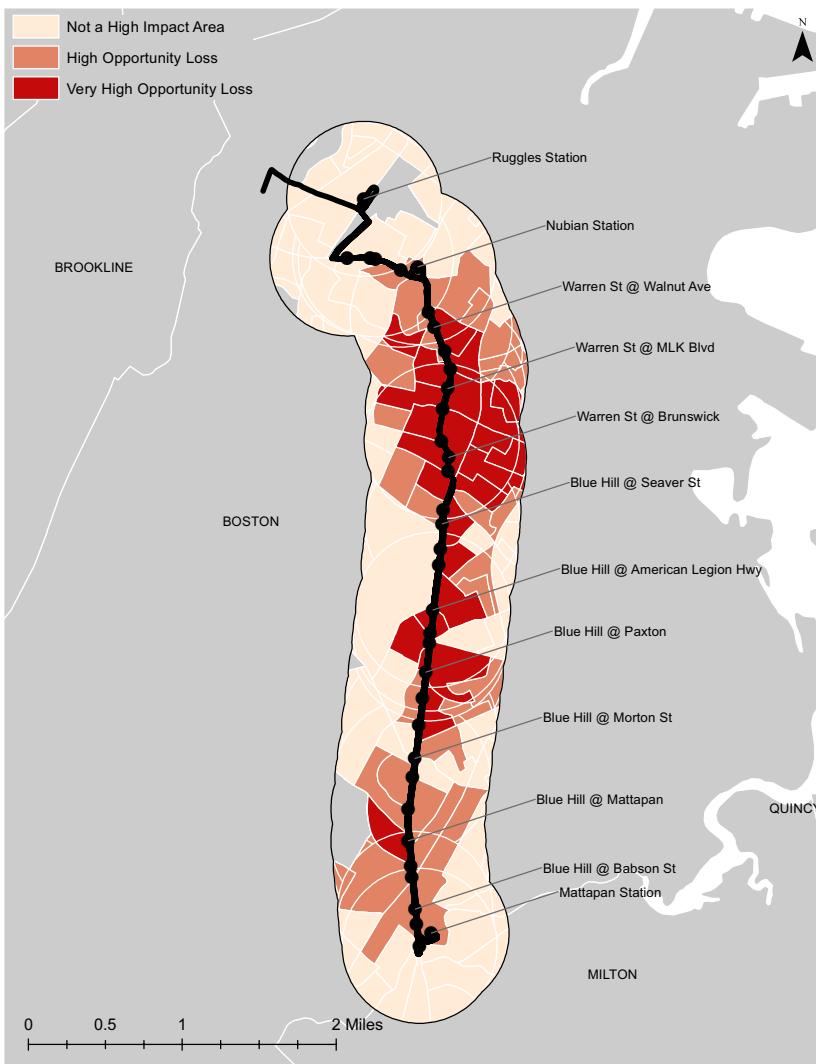
Most block groups in proximity to bus Route 28 have high numbers of people of color, low-income households, and limited English households relative to the MPO. This route especially has a high number of people of color and runs through Mattapan and Dorchester, two of Boston's Black neighborhoods.

Within a half mile of bus Route 28, 82% of the population are people of color, 58% of households are low-income, and 14% are limited English households. People of color, low-income households, and limited English households are present throughout the route.

Route 28, Economic Opportunity Losses – Within a Half Mile of the Route

The highest losses are near Blue Hill at Wayne Street and Warren Street at Crawford Street, toward the northern part of the route. The impact of delays are present throughout the majority of the route, especially mid-route. Losses are generally lower at the ends of the lines, both near the South End and further south of Blue Hills Parkway and River Street.

MAP 9: ROUTE 28, CLOSE PROXIMITY



- People of color, low-income households, and limited English households have a disproportionately high presence in **high loss** and **very high loss** areas.
- While people of color make up 82% of the share of the population living within a half of the route, they make up 98% of individuals living in **high loss** areas.
- Similarly, while low-income households make up 58% of all households within a mile of the line, they make up 67% of households living in **very high loss** areas.
- The same is true for limited English households, which make up 17% of **very high loss** areas, but only 14% of all households.

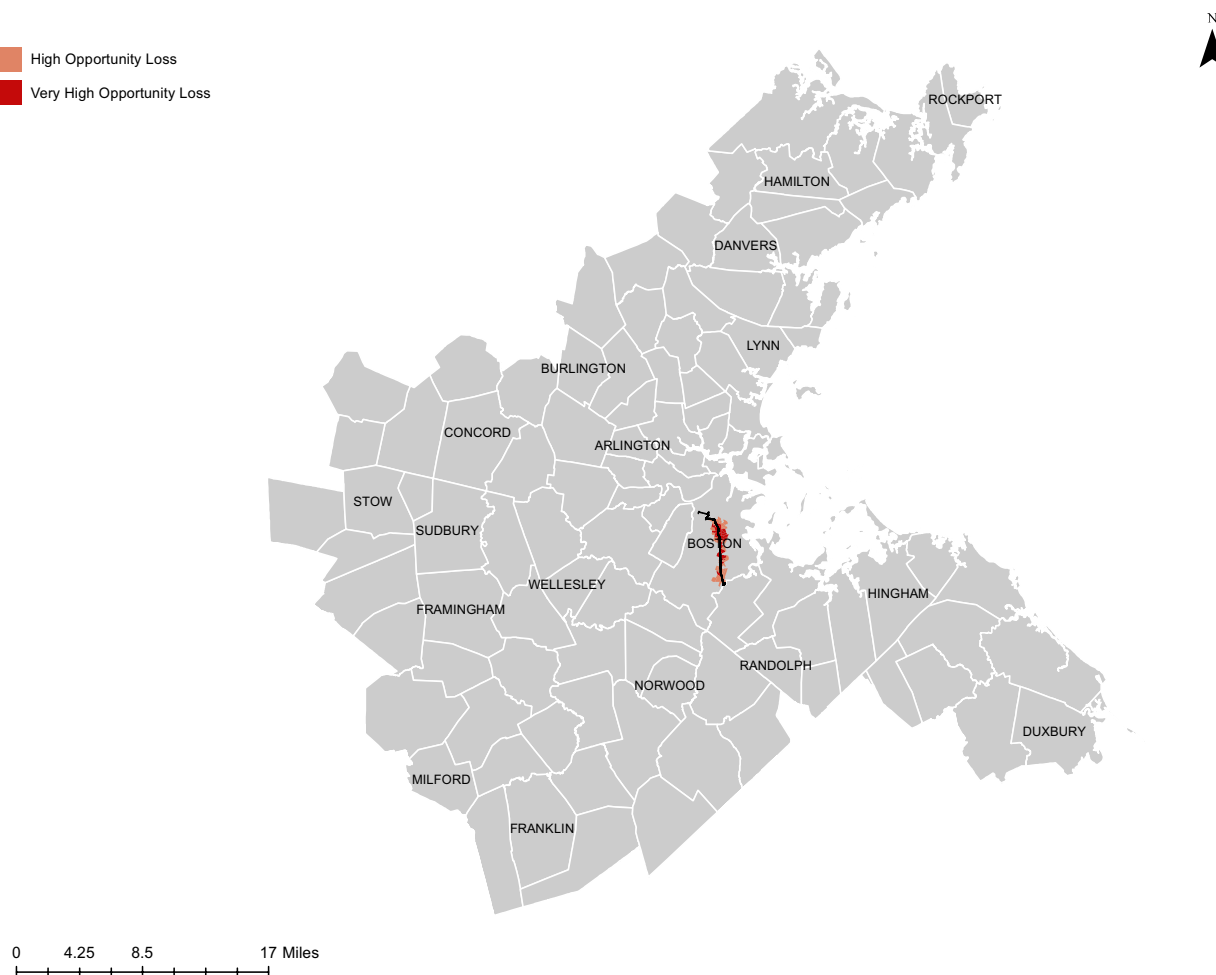
Chart 4: Summary of Demographics – Half Mile from Route 28

	High Loss Area	Very High Loss Area	Total
% of Population that is People of Color	96%	98%	82%
% of Households that are Low-Income	58%	67%	58%
% of Households that are Limited English	12%	17%	14%

Bus Route 28 connects individuals from Mattapan to the South End area. It has fewer transit connections than subway lines; therefore, the effects of delays tend to be more localized. The map below depicts the effects of delays. **Very high losses** do not extend beyond the route, while **high losses** extend down into Milton and Canton, with other observable stray areas.

MAP 10: ROUTE 28, MPO IMPACTS

High Opportunity Loss
Very High Opportunity Loss



ROUTE 60

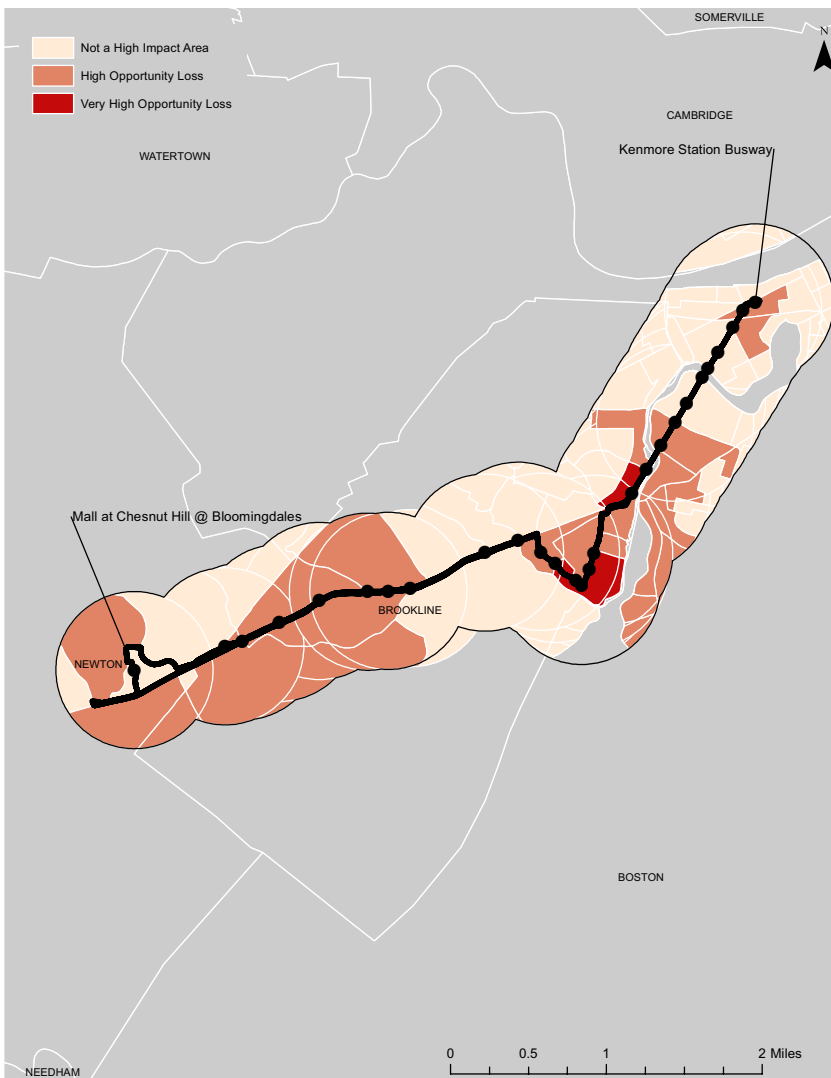
Most block groups in proximity to bus Route 60 have high numbers of people of color, low-income households, and limited English households relative to the MPO; however, this bus line generally runs through wealthier and whiter areas compared to other routes studied.

Within a half mile of Route 60, 38% of the population are people of color, 37% of households are low-income, and 14% are limited English households. People of color, low-income households, and limited English households are more present around the ends of the route, in Newton and in Boston. The middle of the route in Brookline is generally wealthier and whiter.

Route 60, Economic Opportunity Losses – Within a Half Mile of Route

Very high loss areas are present between Boylston Street at Summer Road and Cyprus Street at Rice Street. **Very high loss** areas are also present between Pearl Street and Aspinwall Avenue on Brookline Avenue. These losses occur further into the route, closer toward Boston.

MAP 11: ROUTE 60, CLOSE PROXIMITY



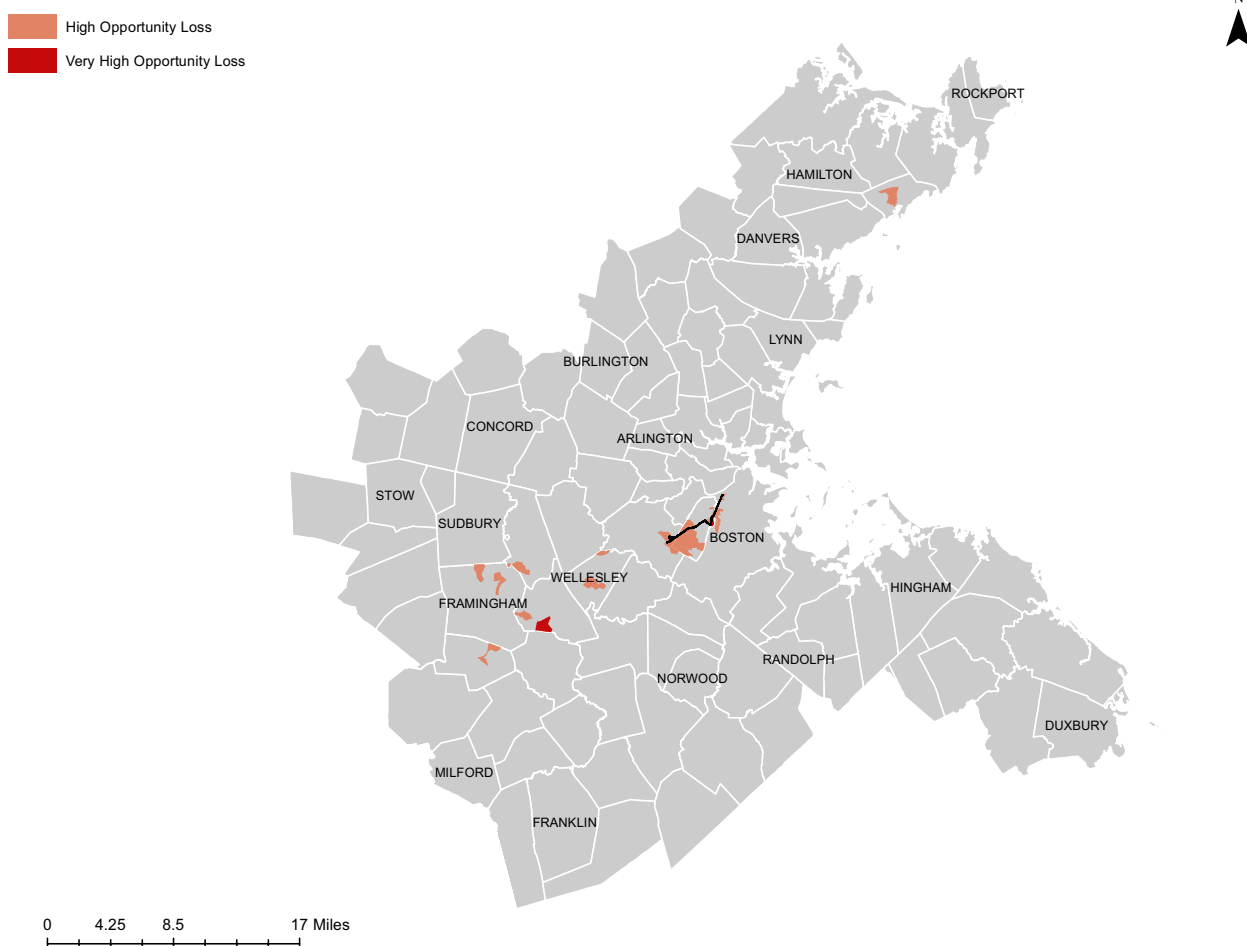
- People of color and low-income households have a disproportionately high presence in **high loss** and **very high loss** areas even though the route is generally wealthier and whiter than others featured in this report.
- While people of color make up 38% of the share of the population living within half a mile of the route, they make up 52% of individuals living in high loss areas. These areas of **high losses** include parts of Mission Hill and Roxbury.
- Similarly, while low-income households make up 37% of all households within a mile of the line, they make up 53% of households living in **very high loss** areas.
- The same is not true for limited English households.

Chart 5: Summary of Demographics – Half Mile from Route 60

	High Loss Areas	Very High Loss Areas	Total
% of Population that is People of Color	44%	52%	38%
% of Households that are Low-Income	37%	53%	37%
% of Households that are Limited English	14%	12%	14%

Route 60 connects parts of the western suburbs into the inner core. While it does not have as many transit connections as the subway lines, the effects of delays are far-reaching, all the way into Framingham, parts of Natick, and Wellesley. Other areas in these western municipalities are also affected at the high delay level, as well as parts of Boston south of the route.

MAP 12: ROUTE 60, MPO IMPACTS



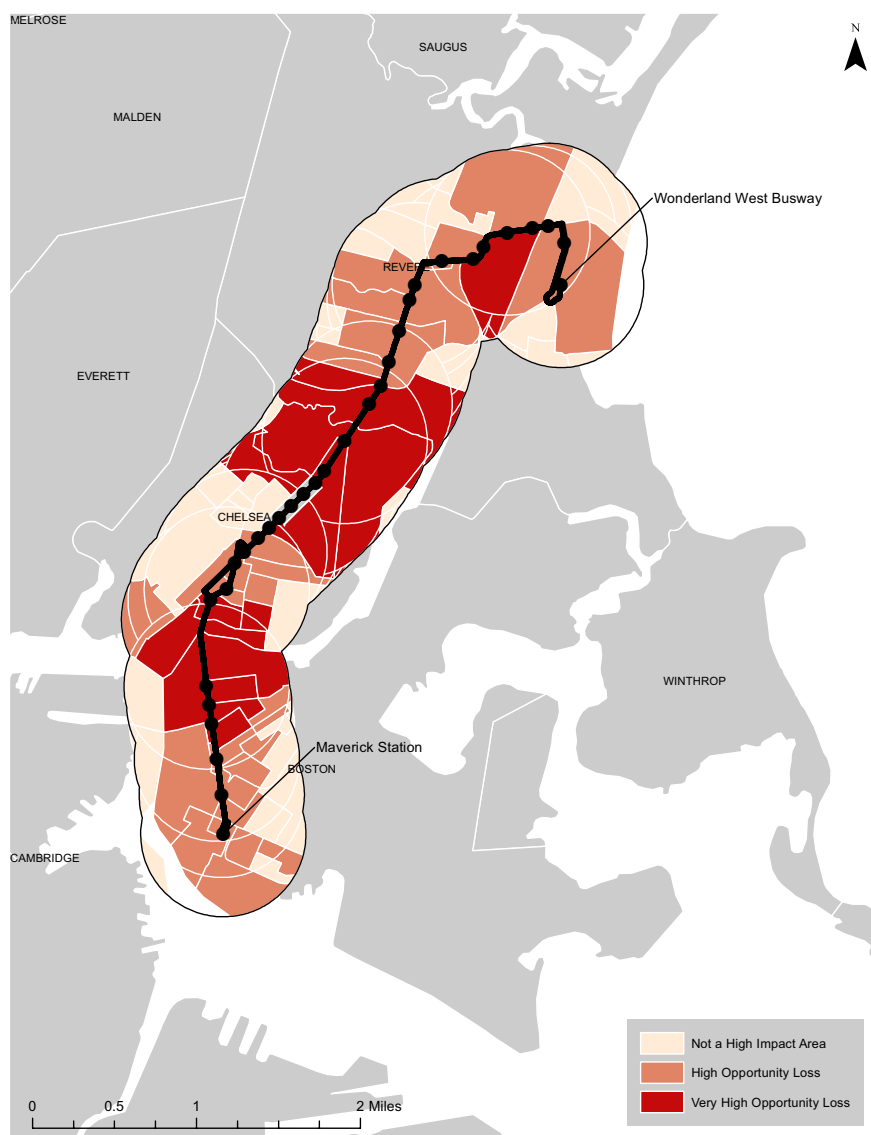
ROUTE 116

Most block groups in proximity to bus Route 116 have high numbers of people of color, low-income households, and limited English households relative to the MPO, where the demographics reflect the populations of East Boston and Revere. The route has a comparatively high share of limited English households. Within a half mile of Route 116, 65% of the population are people of color, 46% of households are low-income, and 23% are limited English households.

Route 116, Economic Opportunity Losses – Within a Half Mile of Route

Very high loss areas are present at Broadway between Gerrish Avenue and Eleanor Street throughout parts of Chelsea. However, **high loss** areas are observed northward up to Broadway at Taft.

MAP 13: ROUTE 116, CLOSE PROXIMITY



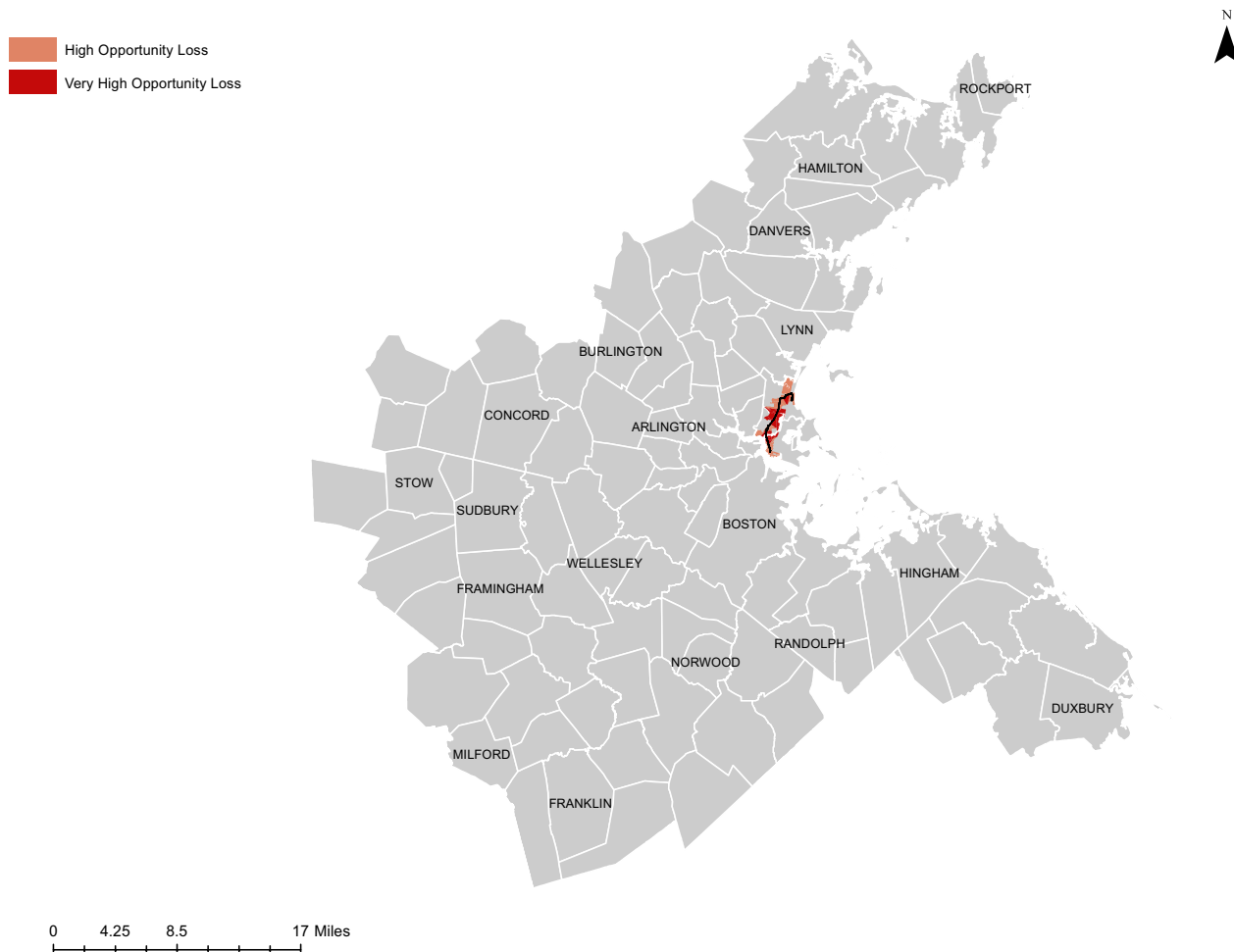
- People of color, low-income households, and limited English households are close to proportionally represented in **very high loss** and **high loss** areas.
- People of color make up 65% of the share of the population living within half a mile of the route and they make up 70% of individuals living in **high loss** areas.
- Similarly, low-income households make up 46% of all households within half a mile of the route, and the same percentage of **very high loss** area households.
- Finally, limited English households make up 23% of all households within half a mile of the route and the same percentage of **very high loss** area households.

Chart 6: Summary of Demographics – Half Mile from Route 116

	High Loss Areas	Very High Loss Areas	Total
% of Population that is People of Color	65%	70%	65%
% of Households that are Low-Income	48%	46%	46%
% of Households that are Limited English	26%	23%	23%

Route 116 connects North Shore communities to the Blue Line. Therefore, losses stretch northward in most cases. Very high losses are present in Hamilton, Rockport, and Manchester. Patches of high losses exist in Lynn, Salem, Manchester, and Gloucester. Other parts of the MPO also appear to be affected away from this area, including Concord, Norwood, etc.

MAP 14: ROUTE 116, MPO IMPACTS



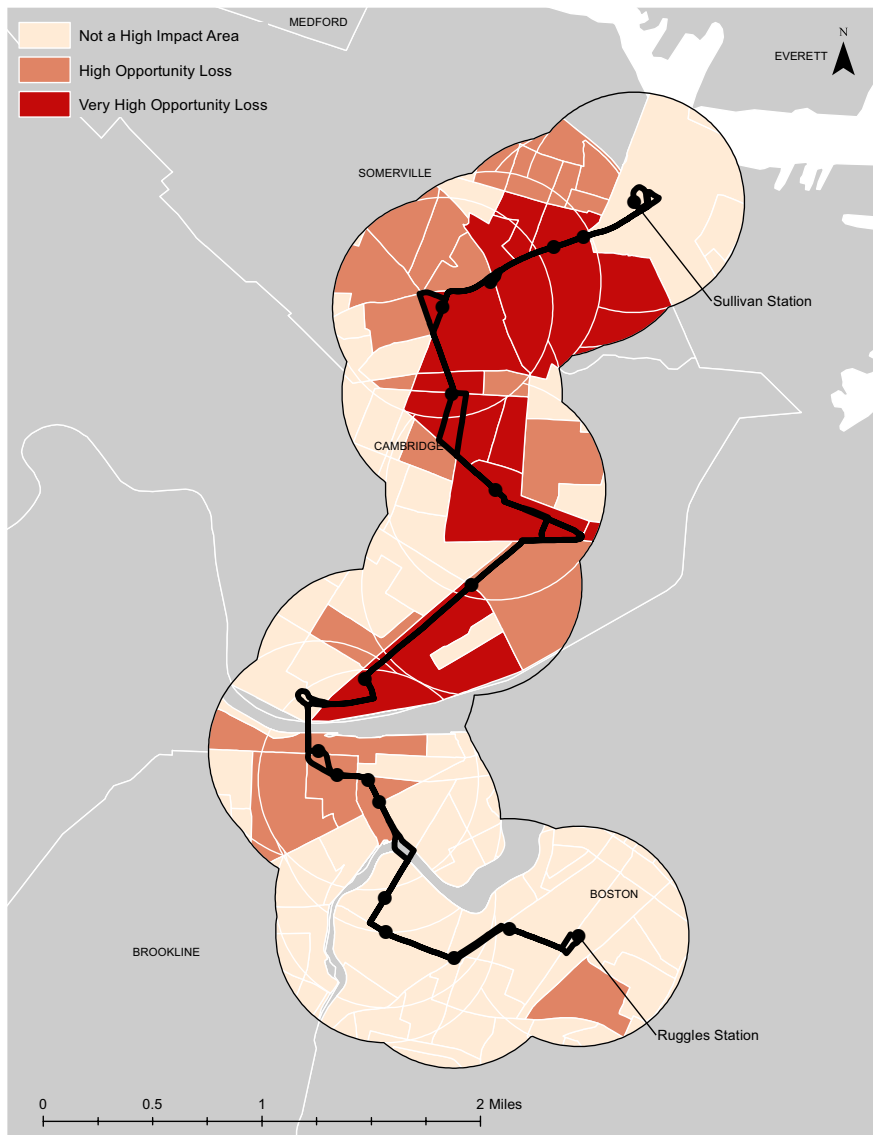
ROUTE 747

Most block groups in proximity to bus Route 747 have high numbers of people of color, low-income households, and limited English households relative to the MPO, though demographics are variant because the route covers a large geographic area. Within a half mile of Route 747, 44% of the population are people of color, 41% of households are low-income, and 12% are limited English households.

Route 747, Economic Opportunity Losses – Within a Half Mile of Route

Very high loss areas are on Hampshire Street and Cardinal Medeiros Avenue in Cambridge. Losses are also high northward in Somerville.

MAP 15: ROUTE 747, CLOSE PROXIMITY



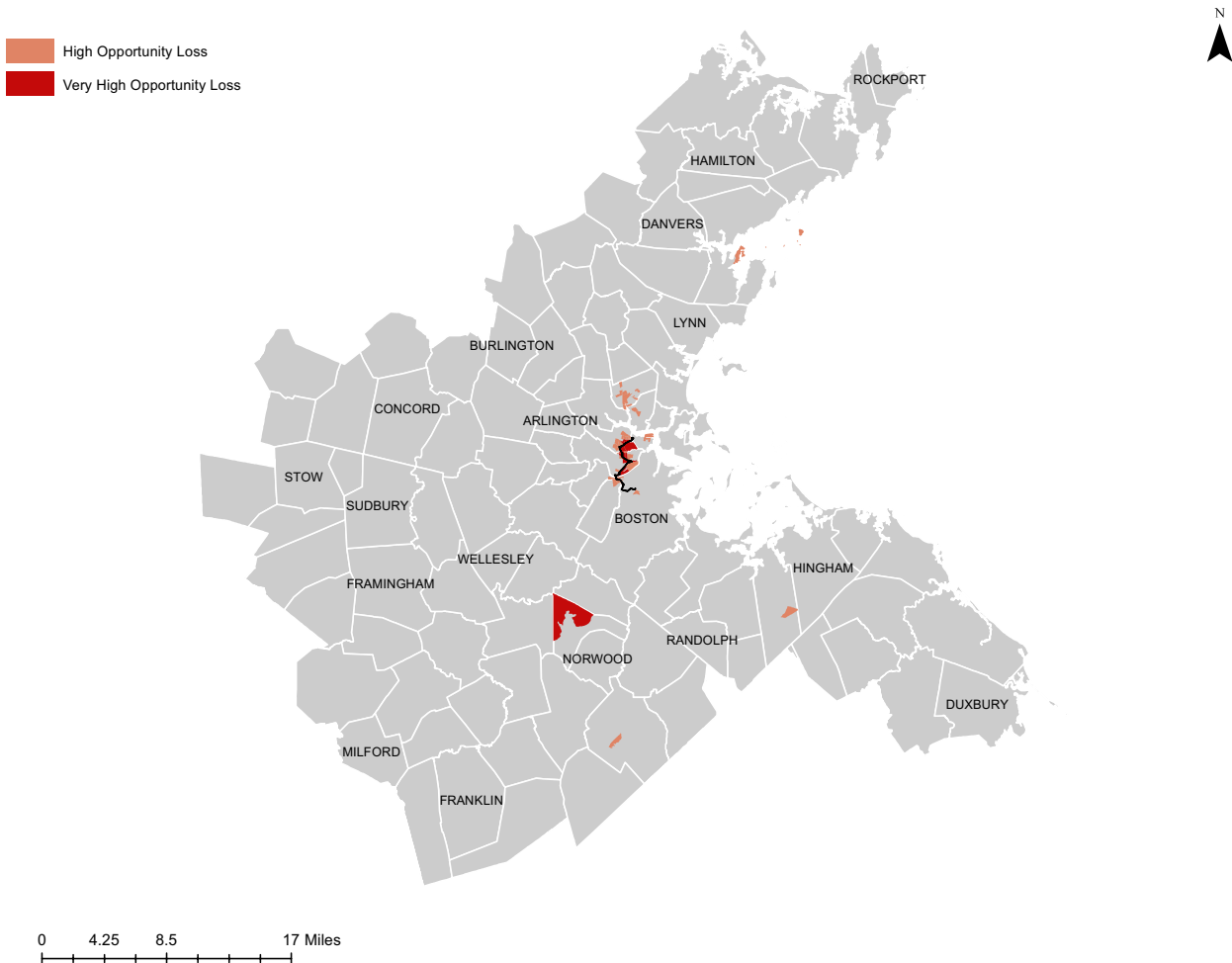
- People of color, low-income households, and limited English households are close to proportionally represented in **high loss** and **very high loss** areas.
- People of color make up 44% of the share of the population living within half a mile of the route and they make up 43% of individuals living in **high loss** areas.
- Similarly, low-income households make up 41% of all households within half a mile of the route, and 35% of **very high loss** area households.
- Finally, limited English households make up 12% of all households within half a mile of the route and 13% of **very high loss** area households.

Chart 7: Summary of Demographics – Half Mile from Route 747

	High Loss Area	Very High Loss Area	Total
% of Population that is People of Color	43%	43%	44%
% of Households that are Low-Income	37%	35%	41%
% of Households that are Limited English	12%	13%	12%

Route 747 connects Somerville and areas more central to Boston. Traversing a large area within inner-core communities, the effects are far-reaching. **Very high losses** occur as far south as Westwood and as far north as Salem. However, **high losses** and **very high losses** extend northward from Sullivan Station to Saugus.

MAP 16: ROUTE 747, MPO IMPACTS



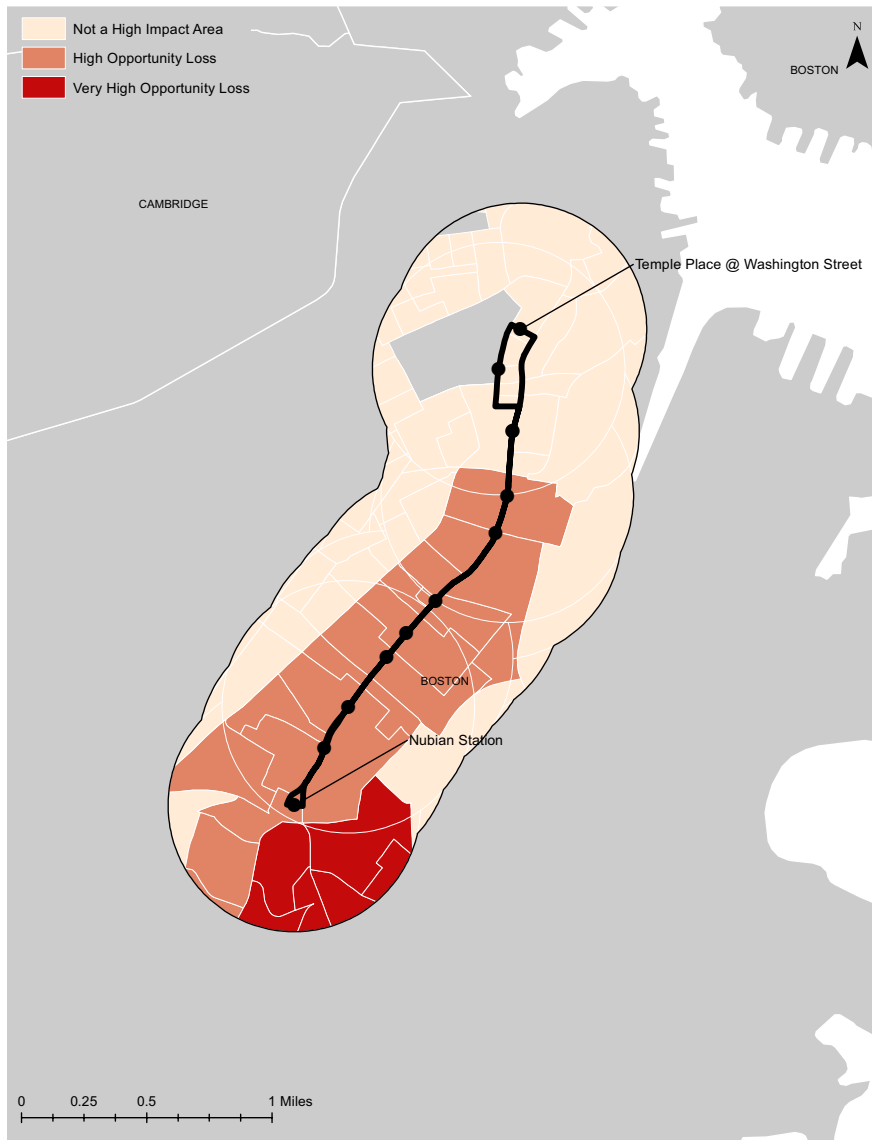
ROUTE 749

Most block groups in proximity to bus Route 749 have high numbers of people of color, low-income households, and limited English households relative to the MPO, especially further south toward Nubian Square. Within a half mile of Route 749, 49% of the population are people of color, 43% of households are low-income, and 13% are limited English households.

Route 749, Economic Opportunity Losses – Within a Half Mile of Route

Very high loss areas are concentrated near Nubian Square at the very beginning of the route.

MAP 17: ROUTE 749, CLOSE PROXIMITY



- People of color and low-income households are very disproportionately represented in **high loss** and **very high loss areas**. Limited English households are proportionately represented.
- People of color make up 49% of the share of the population living within half a mile of the route and they make up 94% of individuals living in **very high loss** areas.
- Similarly, low-income households make up 43% of all households within half a mile of the route, and 77% of **very high loss** area households.
- Limited English households are more proportionately represented, making up 13% of all households and the same percentage of **very high loss** area households.

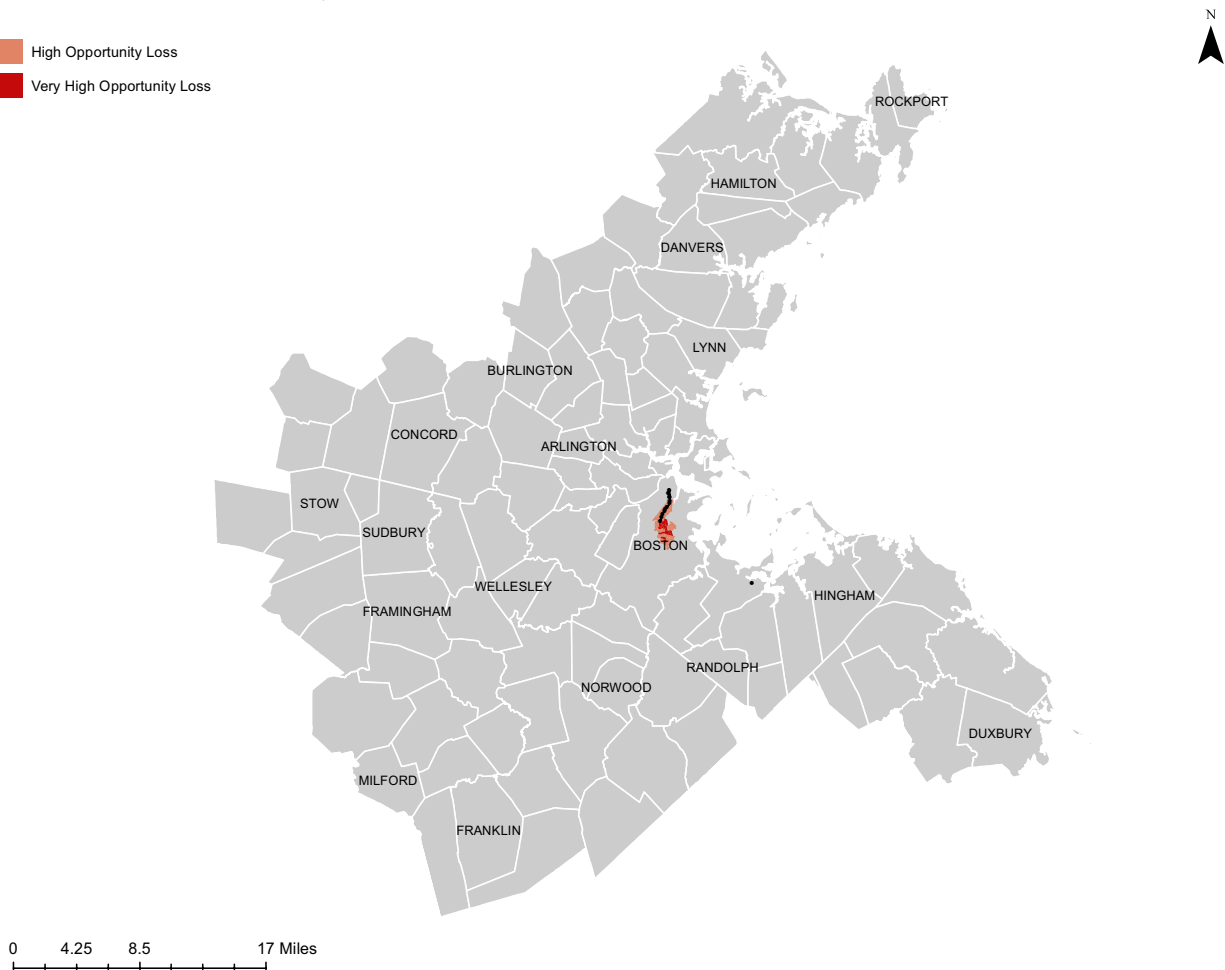
Chart 8: Summary of Demographics – Half Mile from Route 749

	High Loss Area	Very High Loss Area	Total
% of Population that is People of Color	67%	94%	49%
% of Households that are Low-Income	27%	77%	43%
% of Households that are Limited English	17%	13%	13%

Route 749 connects Nubian Square and downtown. Some of the effects reach further south of the route. Very high losses stretch further south into Roxbury. High losses also stretch into Roxbury and further into Dorchester. Sporadic high loss areas are also found far north of the route and in East Boston.

MAP 18: ROUTE 749, MPO IMPACTS

High Opportunity Loss
Very High Opportunity Loss



ECONOMIC OPPORTUNITY LOSS & OCCUPATION CATEGORIES – COVID-19

In light of the pandemic, we also reviewed key areas where workers are more likely not to be able to work from home. To do this, we reviewed occupation-related data at the census tract level, specifically for tracts that overlap with high loss and very high loss areas.³⁴ The goal of this comparison is to demonstrate how the areas that are most affected by delays on our chosen routes compare to the overall study area in terms of the share of workers that are unlikely to be able to work from home. To analyze this, we utilized American Community Survey (2018) data and assumed that all individuals in the following occupation categories are less likely to work from home:

- Protective Service Occupations
- Food Preparation and Serving-Related Occupations
- Building and Grounds Cleaning and Maintenance Occupations
- Personal Care and Service Occupations
- Farming, Fishing, and Forestry Occupations
- Construction, Extraction, and Maintenance Occupations
- Production Occupations
- Transportation and Material Moving Occupations

The total number of workers aged 16+ within each of these categories were calculated for each tract. For the entire MPO, around 26% of individuals are employed in these “non-work from home” occupations. The map on the next page shows the total number of workers that are employed within these occupations.

In most cases, very high and high loss areas include a higher share of individuals employed in these non-work from home occupations. Chart 9 below describes the shares of these workers employed in these occupations.



34. Although census tracts are larger than block groups, we included all reported data at the tract level with significant overlap. We did not attempt to proportionally allocate worker counts as represented at the tract levels to economic loss areas represented at the block group level.

MAP 19: NON-WORK FROM HOME POPULATION, MPO AREA

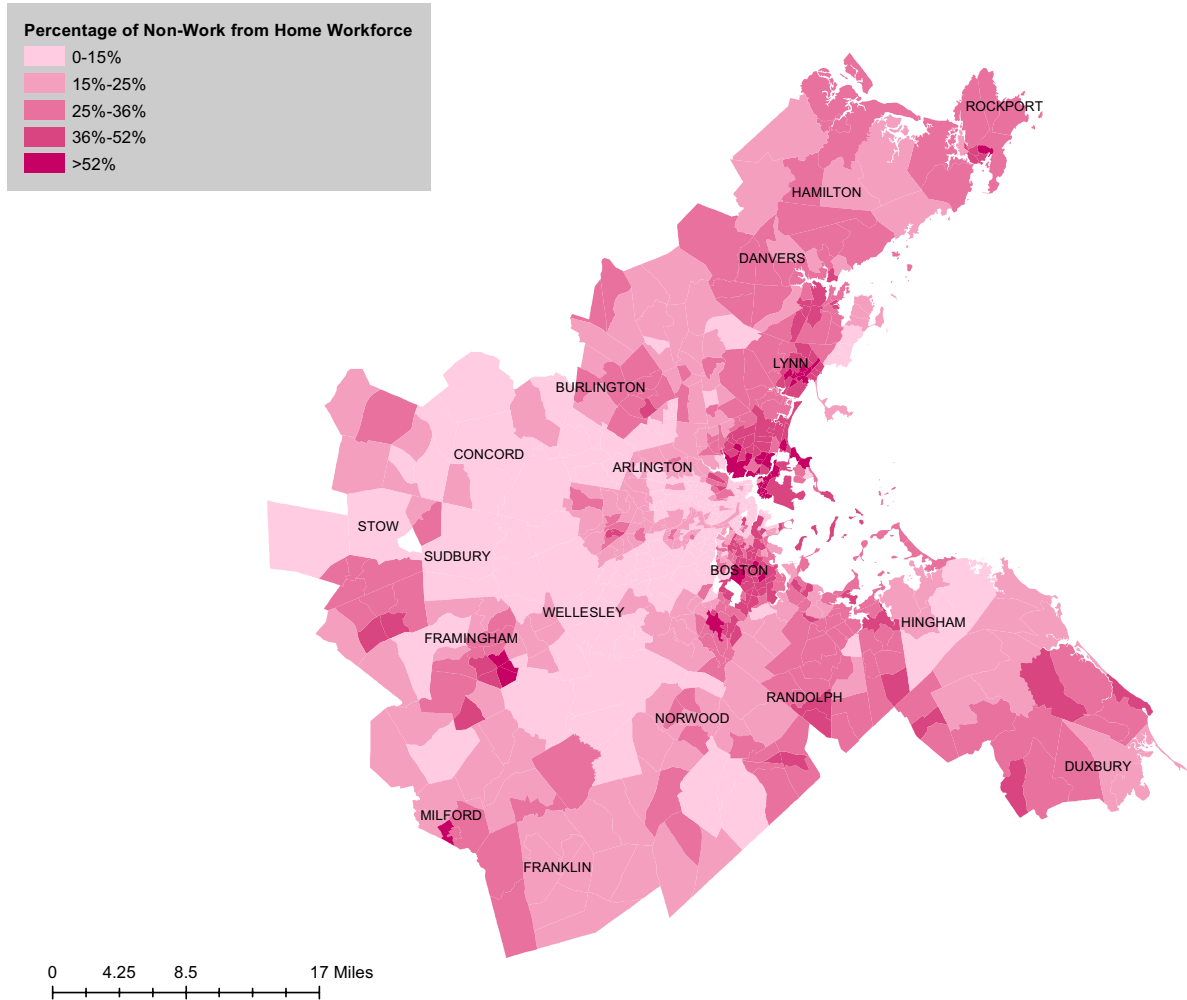


Chart 9: Share of “Non-Work from Home” Workers in High Loss and Very High Loss Areas

	Share of Non-WFH Workers in High Loss Area	Share of Non-WFH Workers in Very High Loss Area
Rt. 28	39%	42%
Rt. 60	14%	15%
Rt. 116	58%	59%
Rt. 747	25%	22%
Rt. 749	33%	39%
Blue	42%	50%
Orange	33%	31%
Red	20%	28%

In particular, there is a much higher share of workers employed in these occupations for Route 116, the Blue Line, and Route 28 compared to the rest of the MPO area.

SECTION II: GENERAL FINDINGS

ACCESS & ECONOMIC OPPORTUNITY LOSSES

ACCESS IN INNER CORE COMMUNITIES

In addition to route-specific characterizations, we also reviewed general trends related to baseline access. As stated earlier, baseline access is the MBTA schedule as planned – essentially, the access that riders would have if the MBTA functioned without delay. Of course, the MBTA does not function without delay, so evaluating baseline access has its limitations. However, looking at the disparities in baseline access can help uncover where the system needs reform beyond service reliability and delays.

To evaluate general trends for baseline access, we focused on the Metropolitan Area Planning Council's (MAPC) Inner Core Committee (ICC) designation.³⁵ The Inner Core Committee area extends from Needham to the harbor; it includes communities as northward as Saugus and as far south as Quincy. We focus on the ICC in addition to the whole study area for this section because it is more likely that these individual communities rely on transit than communities farther away from Boston; transportation infrastructure is also more concentrated in this area. The goal of this closer review is to evaluate baseline access where transit options are concentrated and to make demographic comparisons.

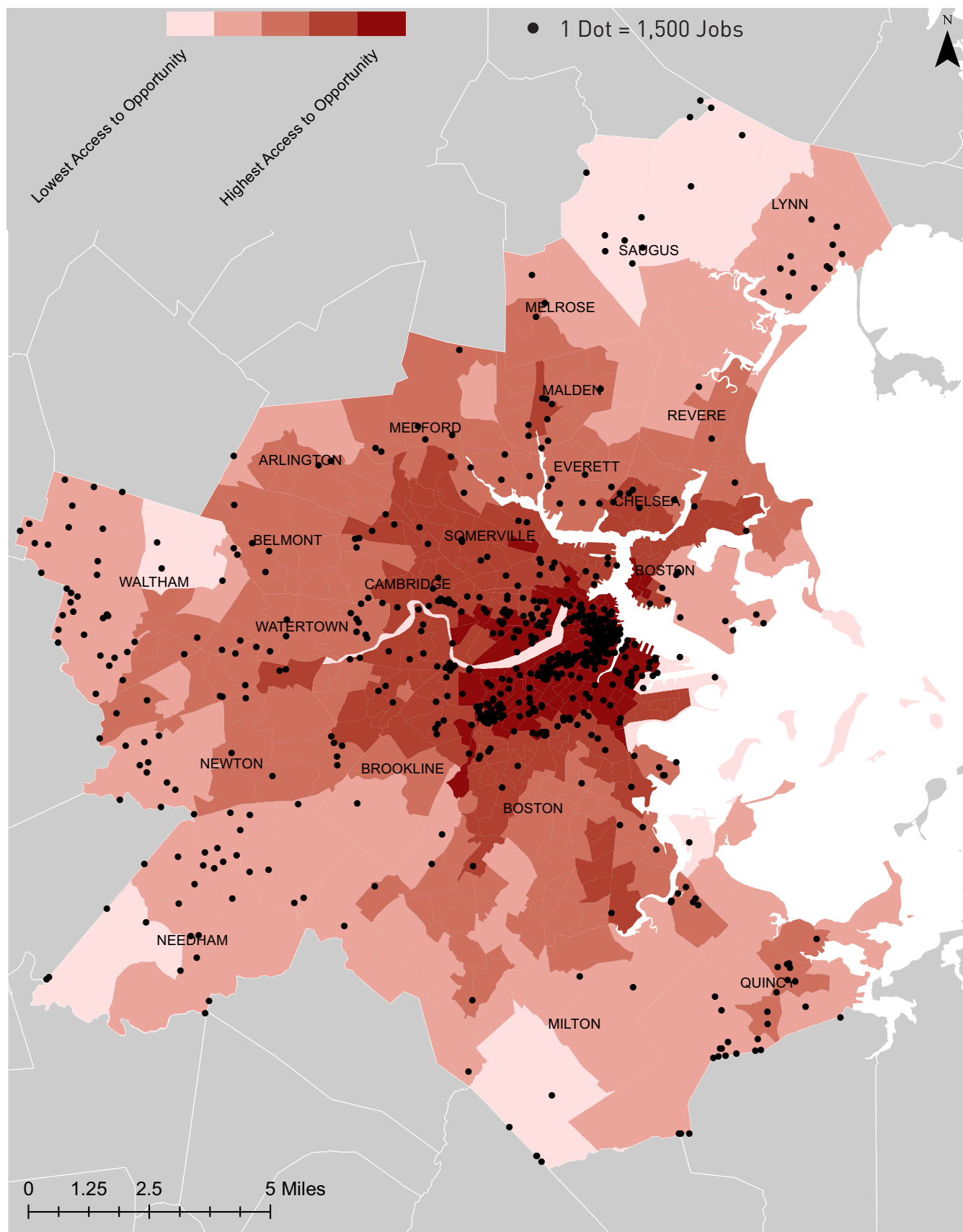
We analyzed baseline access to opportunity by community within the ICC. The darkest areas in the map on the next page represent areas with the highest access.

Generally, jobs are most concentrated downtown; therefore, access follows the same pattern. Better baseline access also correlates with the location of transportation infrastructure. For example, in areas with train or commuter rail stops, baseline access is generally higher. Overall, baseline access generally decreases as it expands radially outward from downtown.

We ranked communities by average baseline access to economic opportunity. Generally, neighborhoods close to downtown Boston have the highest relative baseline access to economic opportunity, including downtown, Chinatown, Back Bay, and Beacon Hill. Neighborhoods in Boston that are further away from downtown, including Allston, East Boston, Brighton, and Dorchester, are within the middle range of access. Communities that are the farthest away, including Mattapan, Roslindale, Hyde Park, and West Roxbury, have the poorest access.

Outside of Boston proper, Cambridge, Somerville, and Brookline also have relatively good access. Chelsea, Watertown, and Malden have access in the middle range, while Milton,

35. See <https://www.mapc.org/get-involved/subregions/> for review of individual subregions.

MAP 20: AVERAGE JOB ACCESS, INNER CORE COMMUNITY ACCESS

Quincy, Needham, Saugus, and Lynn have some of the poorest access. It is important to note the demographic composition of communities relative to their level of access. While having the third poorest access, 21% of Lynn's households do not have access to a vehicle, while 45% of households are low-income. Reliable transportation is essential for this community. In contrast, around 6% of Saugus' and Needham's households do not have access to vehicles, a much lower share than Lynn's population. Shares of low-income populations are also lower in these communities, meaning that individuals in these communities are less likely to depend on transit. Other communities that are both low-income and low in access (and therefore more likely to depend on transit) include Quincy, Hyde Park, Revere, and Everett.

The figure below this bar graph plots communities by the average access to economic opportunity relative to the share of low-income households in the community. We categorize communities in the following way:

- **High access, low share of low-income households** (toward top left) – Back Bay, Downtown Crossing, etc. These are the inner core areas that are expensive and very close to transit.
- **Low access, low share of low-income households** (toward bottom left) – Needham, Milton, Newton, Arlington, etc. These are the areas that are farther away from transit and are likely more suburban in nature, with lower concentrations of priority populations.
- **High access, high share of low-income households** (toward top right) – Mission Hill, Roxbury, Chinatown. These are the areas that are very close to transit and historically segregated. Populations in these neighborhoods depend on transit, where service interruptions are consequential as a result.
- **Low access, high share of low-income households** (toward bottom right) – There are fewer of these communities, but we can point to Lynn, Mattapan, Malden, Revere, Chelsea. These are communities that are within the inner core, but have poorer access and a lot of transit users (or people that drive who would benefit from the reduced transportation costs that transit would provide). These are areas where service improvements could be high-impact.

See average access bar chart for ICC communities on pages 48 and 49 (landscape orientation).

TRENDS IN LOSS OF ACCESS TO ECONOMIC OPPORTUNITY

The previous section of this report described how priority populations are represented in economic loss areas for individual routes. To characterize our findings more generally, we determined how these priority populations are represented in loss areas for all of the eight routes we studied.

Specifically, we concentrated on areas half a mile from bus routes and a mile from subway routes, and compared the share of people of color and low-income and limited English households in high and very high loss areas with the share of these populations in the general area.

We found that each of the three priority populations are disproportionately represented in high loss and very high loss areas. The differences between the shares represented in very high loss areas and the areas close to the route are statistically significant.

Chart 10: Share of Priority Populations in High Loss and Very High Loss Areas

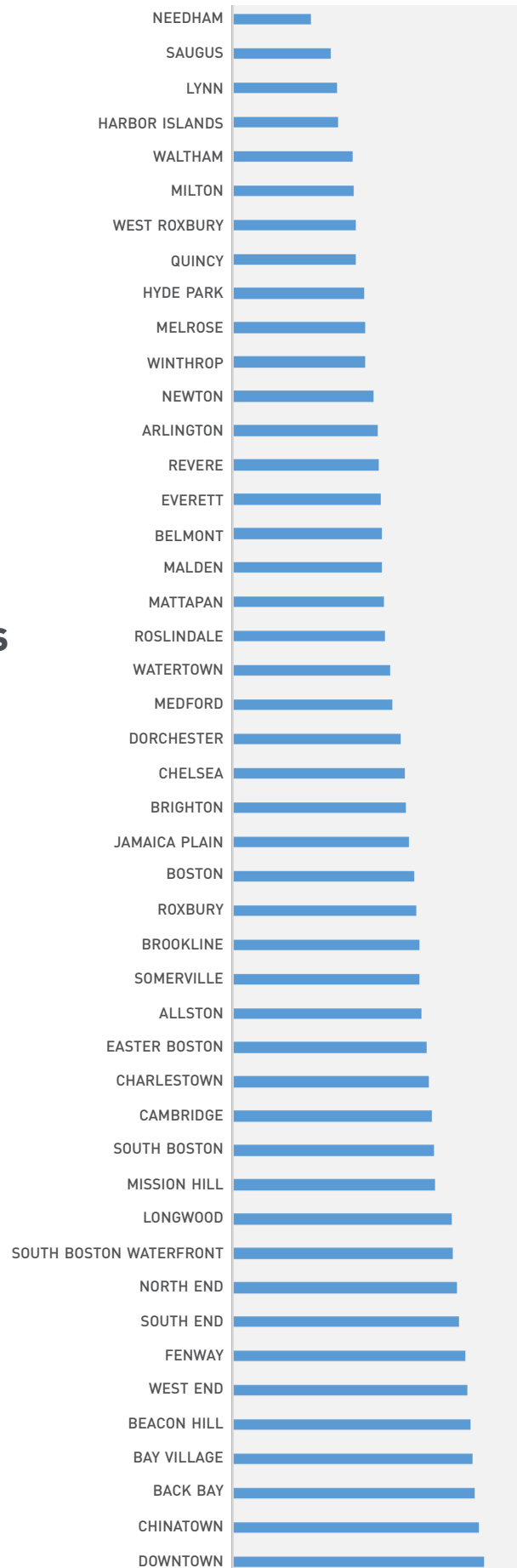
	Total Share – Within Close Proximity (one mile for subways, half mile for bus routes)	Total Share – Within Close Proximity and High Loss Area	Total Share – Within Close Proximity Within Very High Loss Area
People of Color	48%	52%	62%
Low-Income Households	37%	40%	44%
Limited English Households	12%	13%	17%

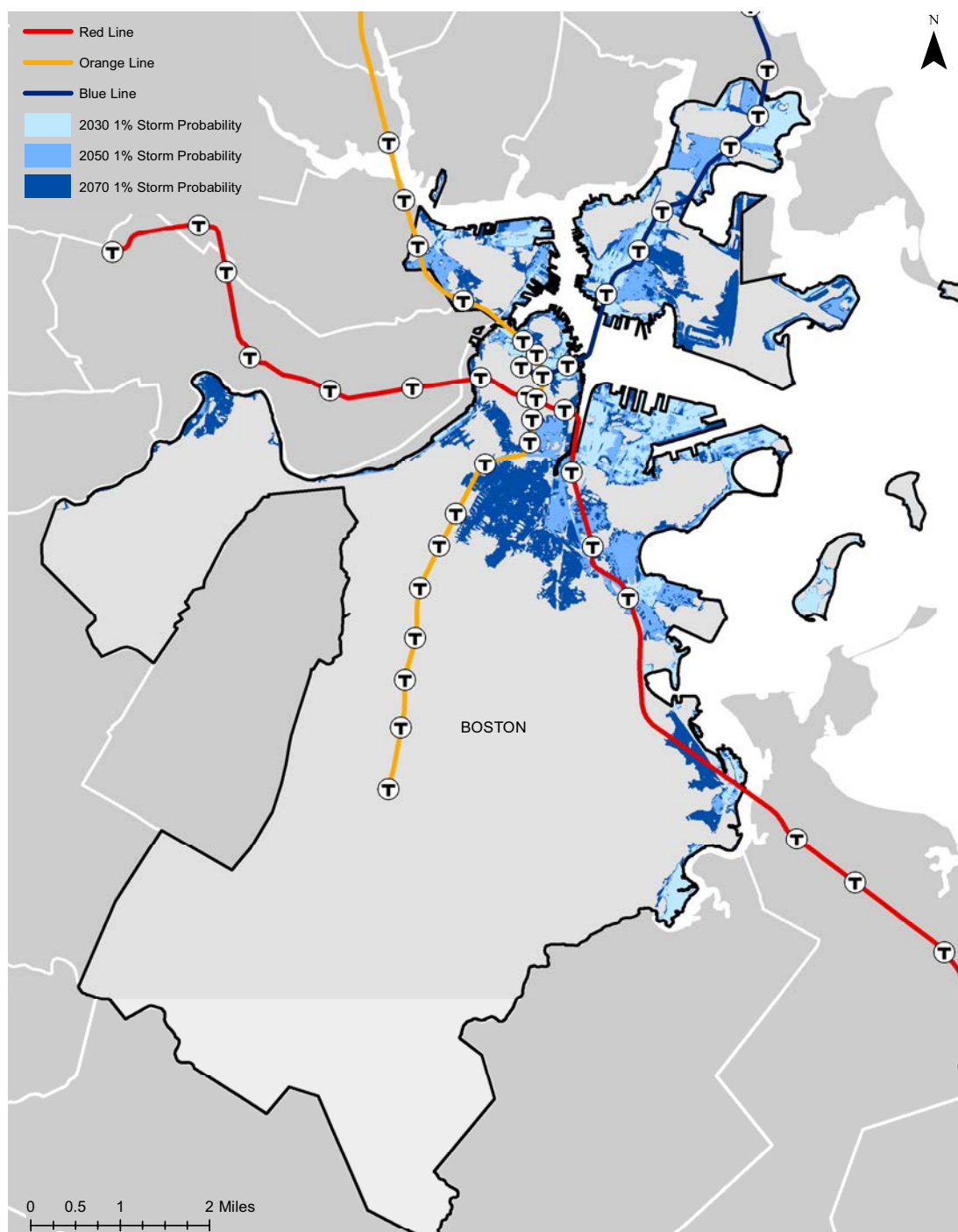
The chart below summarizes route-specific findings. An up (↑) arrow indicates that the population is higher in very high loss areas versus the area immediately surrounding the route. For most routes, the priority populations are disproportionately represented.

Chart 11: Share of Priority Populations in Very High Loss Areas – By Route

Route	People of Color	Low-Income Households	Limited English Households
Orange Line	↑	↑	↑
Red Line	↑	↑	↑
Blue Line	↑	↑	↑
Rt. 28	↑	↑	↑
Rt. 60	↑	↑	↑
Rt. 116	↑		
Rt. 747			↑
Rt. 749	↑	↑	

**FIGURE 2: AVERAGE ACCESS
COMMUNITIES**

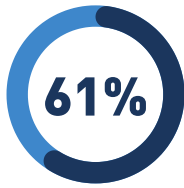




HAZARD OVERLAY - A WORD ON CLIMATE RISKS

Climate hazards will affect transit riders and exacerbate many of the service quality issues that already exist. Delays and associated loss of economic opportunity will likely increase unless resilience is integrated into the system. The image above is a map of the transit system under the predictions of Climate Ready Boston, which models 100-year storm flooding for three different dates – 2030, 2050, and 2070. Flooding and the interruptions that it will cause will affect many of the MBTA's routes. While the effects of increasingly severe and more frequent storms will affect many components of the system, the Blue Line will be particularly affected by this increased flooding as demonstrated in the map.

How Do Chronic MBTA Delays Affect Riders?



61% of MBTA riders who responded to an informal 2020 survey said they are stressed because they lack reliable public transit to get to work, school, a doctor, or other appointments.



"As a person reliant on public transportation, any service change has the potential to be a huge disruption if not an insurmountable obstacle."



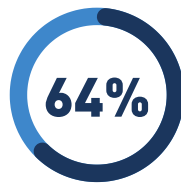
"I live on the Red Line. If I want to get to my doctor in Longwood, I have to leave at least an hour early. Even if I do, I sometimes end up being so late I have to cancel my appointment."



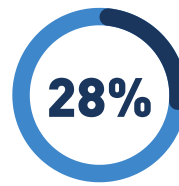
"I used to rely on the 66 [bus] to get to work, and I was late nearly every day, no matter how much time I gave myself beforehand."



Riders who have turned down, quit or lost a job because of a difficult commute



Riders who build in 10 to 30 minutes of extra commuting time due to worry about unexpected MBTA delays



Riders who have been late or missed a job interview because of MBTA delays



"I've turned down several jobs because there was no easy way to commute due to multiple bus routes being unreliable."



"The Orange line was so packed, we had to ride it in the opposite direction (from Assembly Row to Oak Grove) just to get to Downtown Crossing."

SECTION III: KEY FINDINGS & RECOMMENDATIONS

KEY FINDINGS

Neighborhoods closer to the urban core have good baseline access to economic opportunity.

The high number of subway stations and bus stops in the urban core means better baseline access to economic opportunity. This access decreases as you move farther from the urban core. Baseline access, or the ability to access economic opportunities based on scheduled transit service generally indicates that the greater the proximity to transit stations and stops, the greater the ability to reach economic opportunities.

- Unsurprisingly, neighborhoods with the greatest access to economic opportunities include Downtown Crossing, Chinatown, Back Bay, Bay Village, Beacon Hill, West End, Fenway, South End, North End, South Boston Waterfront, and Longwood.
- Communities with the comparatively least access to jobs include Needham, Saugus, Lynn, Waltham, Milton, and West Roxbury.
- Everett, Malden, Mattapan, Dorchester, and Chelsea have lower baseline access to economic opportunity than Cambridge, Charlestown, East Boston, Allston, Somerville, Brookline, and Roxbury.

Even in neighborhoods with good baseline access, economic opportunity losses resulting from delays disproportionately affect people of color, low-income households, and limited English proficient residents.

For communities with good baseline access, it is crucial to not degrade that access through longer headways or scheduled times between vehicles.

- Low-income households in Mission Hill, Roxbury, and Chinatown are very close to transit and residents of these neighborhoods depend on good service to maintain and increase access to job opportunities. Delays undermine the quality of the transit system and threaten residents' access to these opportunities. At the same time, these populations are at risk of being displaced as the costs of housing in and near the urban core rise.
- While Lynn, Mattapan, Malden, Revere, and Chelsea have poorer baseline access compared to other neighborhoods closer to the urban core, they are home to a large number of transit-dependent users. Low-income households in these areas similarly depend on reliable transit to access critical destinations and opportunities. These areas should benefit from service improvements not only to reduce delays, but also to increase baseline access.

When factoring in the impact of delays on transit service, or the increased time waiting for or riding on a slower train or bus, delays do not impact all populations in a geographic area the same.

- People of color, low-income households, and limited English households are disproportionately represented in high loss and very high loss areas. This is true for all routes in aggregate, and for most routes studied.
- For many routes studied, high loss and very high loss areas have higher shares of workers that are unable to work from home relative to the MPO in general.
- In addition, for every route studied, these same populations make up a larger share of the areas with high losses compared to the route in general. For example, people of color make up 82% of the population living within a half mile of bus Route 28. However, those living in the areas of the route most adversely impacted by delays are 98% people of color. The Blue Line analysis tells a similar story. There, 36% of households living within a mile of the line are low-income. Yet, of the households in areas with the highest loss of economic opportunity along the line, 46% are low-income.

On the routes we modeled, neighborhoods most impacted by transit delays throughout the MBTA system tend to have residents of color, low-income households, and limited English proficient speakers.

Since our analysis required manual data input of route delays compared to the baseline schedule, we were unable to model the impacts of delays on all routes. For the eight routes that we modeled, we confirmed that populations that were more likely to experience loss of access to economic opportunities are people of color, low-income residents, and limited English proficient speakers.

- On the Orange and Red lines, the greatest loss of economic opportunity due to delays occurs near the ends of the routes. Impacts stretch far north and south. For the Orange Line, that means people living near Oak Grove, Malden Center, Wellington, Jackson Square, Green Street, and Forest Hills stations. On the Red Line, impacted areas are North Quincy, Wollaston, Quincy Center, and Quincy Adams. Red Line delays also impact Randolph, which lies beyond the line's southern end in Braintree.
- Blue Line delays are concentrated toward the center of the line. The highest loss areas are near Revere Beach Station but are very high from Maverick Station through Wonderland Station. Delays tend to worsen further north out of downtown, and more adversely affect access in East Boston and Revere than the central core area.
- Our findings on the Green Line, which are omitted from this report, did not demonstrate substantial delays from the baseline schedule.

- For bus Routes 28 and 116, the areas with the greatest loss of economic opportunity due to transit delays are concentrated along the route. For Route 28, the highest losses concentrate in the center of the route and do not extend further. For Route 116, high and very high losses are concentrated throughout the route and stretch north past the route.
- For bus Routes 60, CT2, and SL5, the greatest loss of economic opportunity due to transit delays affects residents along the route and beyond the route. For Route 60, the highest losses concentrate in the center of the route, between Brookline and Boston. Losses stretch far west. For Route 747 (CT2) the highest losses are concentrated in the Cambridge and Somerville part of the route. They stretch north of the route. For Route 749 (SL5), the highest losses are concentrated where the route begins in Nubian Square. High loss and very high loss areas stretch south of the route into Roxbury and Dorchester.
- Notably, because the MBTA system is so interconnected, and many public transit riders rely on bus and subway connections, delays on one line can have far-reaching impacts throughout the system. For example, 16 MBTA buses connect to Quincy Center, 16 buses connect to Forest Hills, and 13 buses connect to Malden Center. A delayed bus can already be an issue for someone trying to get to work; chronic subway delays then compound the problem.



PHOTO: LNP IMAGES / SHUTTERSTOCK

RECOMMENDATIONS

It is crucial that we incorporate transportation justice into MBTA capital and operations planning. Transportation justice acknowledges the rights of all people – no matter their race, age, physical ability, income, or immigration status – to move freely between the places they live, learn, work, worship, and play. Just transportation systems are affordable, reliable, and safe and do not jeopardize one community to benefit others. Transportation justice ensures that residents, riders, pedestrians, workers, and cyclists can influence decisions that impact their lives and centers people who have been historically marginalized and underserved. Below we discuss recommendations, many of which focus on improving economic opportunities for priority populations – people of color, limited English proficient speakers, and low-income households.

1. Building Back Better means improving access to economic opportunities, not returning to the status quo.

Maintaining bus, subway, and commuter rail service throughout the MBTA is critical to ensuring access to economic opportunities. However, our analysis shows that even the status quo currently harms some populations more than others. While this study focuses on the impact of transit delays on job access for only eight MBTA bus and subway routes, the results indicate that there is a systemwide need to improve transit access by providing more frequent and reliable service.

When looking at improving service, the MBTA must prioritize areas with high reliance on transit, high loss of access to economic opportunities due to delays, poor access to transit, and higher shares of priority populations – people of color, low-income households, and limited English proficient speakers. For example, the MBTA must maintain improve access for residents of Mission Hill, Roxbury, and Chinatown, which are communities located very close to transit, to maintain and increase access to job opportunities. At the same time, these populations are at risk of being displaced as the costs of housing in and near the urban core rise. The MBTA must also improve access for Lynn, Mattapan, Malden, Revere, and Chelsea, which have poorer baseline access compared to other neighborhoods closer to the urban core, because these neighborhoods are home to a large number of transit-dependent users. Low-income households in these areas similarly depend on reliable transit to access critical destinations and opportunities. These areas should benefit from service improvements not only to reduce delays, but also to increase baseline access.

The MBTA should recruit and retain bus and rail operators and the level of employees necessary to increase bus service over fall 2020 schedules (the date when transit critical populations received more frequent bus service) and increase subway and commuter rail schedules over fall 2021 schedules (the time when subway service frequency was restored close to pre-pandemic levels and commuter rail service began operating on a clock-face schedule with consistent time intervals).

2. Prioritize the elimination of delays on routes serving priority populations first to limit loss of economic opportunities.

Eliminating delays is necessary to maintain access to economic opportunities. Delays on certain routes affect economic opportunities for all residents. Because transit routes are interconnected, what happens on one subway line has ramifications throughout the region. Delays compound and negatively impact mobility and access to economic opportunities. The MBTA system is the greatest tool for maintaining and expanding economic opportunities. As the MBTA faces a budget gap in fiscal years 2022 and beyond, it must maintain service on all subway, bus, commuter rail, and ferry routes. Eliminating routes or significantly cutting service hours will reduce economic opportunities at a time when economic recovery is necessary.

Decreasing or halting commuter rail service will encourage people from the suburbs to drive into Boston and exacerbate vehicle emissions on roads that travel through communities with priority populations. Decreasing or halting commuter rail service would also impact plans for affordable housing. There are affordable housing developments recently constructed and planned in places located in proximity to commuter rail trains. If those commuter lines are stranded assets, it will undercut economic investments in affordable housing.

The COVID-19 pandemic has laid bare the reality that many workers living in priority populations are unable to work from home and continue to rely on the MBTA to access economic opportunities. As COVID-19 persists and ridership is shifting, it is critical to eliminate delays on the following routes serving people less able to work from home, which overlaps with the priority populations of this study.

- Eliminate Orange Line delays at Oak Grove, Malden Center, Wellington, Jackson Square, Green Street, and Forest Hills stations.
- Eliminate Red Line delays at North Quincy, Wollaston, Quincy Center, and Quincy Adams.
- Eliminate Blue Line delays at Revere Beach Station, Maverick Station, Airport Station, Wood Island, Orient Heights, Suffolk Downs, and Wonderland Station.
- Eliminate delays on bus Route 28, with a focus on the highest losses concentrated in the center of the route.
- Eliminate delays on bus Route 116, with a focus on the high and very high losses throughout the route and northernmost route stops.
- Eliminate delays on bus Route 60, with a focus on the highest losses in the center of the route, between Brookline and Boston.
- Eliminate delays on bus Route 747 (CT2), with a focus on the highest losses in the Cambridge and Somerville part of the route.
- Eliminate delays on bus Route 749 (SL5), with a focus on the highest losses concentrated where the route begins in Nubian Square.

- Shorten headways on routes serving people who are less likely to work from home to allow for social distancing on buses and trains. Delays contribute to longer commute times and more crowded buses and train cars.
- Routes serving white-collar workers will likely see fewer people traveling by T back to work full time and may be doing so outside of rush hour. The MBTA should have all-day service that is reflective of pandemic and post-pandemic anticipated travel changes.
- The MBTA should offer temporary low-fare or fare-free options to entice people who have been working remotely to get back on transit.

More consistent, frequent service will allow riders to be physically distant. The MBTA should identify corridors such as the Fairmount Line and stations such as Roslindale Village where commuter rail can relieve pressure on the bus network. The MBTA should work with community partners to conduct affirmative marketing and provide a way for riders to use their CharlieCard for payments. The MBTA should work with Keolis and labor unions to implement more off-peak trips to better serve essential workers and support a mode shift from cars to trains. Additionally, schedule changes to most regions should be coordinated with Regional Transit Authorities, which will then need to alter their respective schedules.

Transit delays are a result of one or more issues, such as deferred maintenance, traffic congestion, weather stressors, insufficient maintenance facilities, MBTA employees calling out of work, and unstaffed positions. Working through deferred maintenance and maintaining a state of good repair are critical solutions. Working with the Massachusetts Department of Transportation and municipalities to establish bus lanes and implement transit-priority traffic signals will reduce bus delays and are necessary to improve bus reliability.

3. The MBTA should make progress on Bus Transformation by the end of 2022.

A dedicated and operational bus transformation office is necessary to ensure dedicated MBTA staff can focus on achieving a new bus system that works for all riders. The Bus Transformation Office staff will need to work with municipalities to establish bus priority lanes, implement transit-priority signals, coordinate with Regional Transit Authorities to ensure coordinated fare payment options, particularly with the forthcoming Fare Transformation system, and work with utilities to establish electric vehicle charging infrastructure. Staff are needed to ensure climate resiliency is integrated into existing and future bus operations.

Areas most impacted by delays should be the first to benefit from dedicated bus lanes. The MBTA should work with municipalities where these high delay loss areas are located to recommend bus lane implementation. The Bus Network Redesign should incorporate increased service that is reliable and frequent, particularly on routes that serve priority populations – people of color, low-income residents, and limited English proficient speakers. The majority of bus riders

transfer to a subway line, which compounds delays on buses by additional delays on subways. As the data from this study shows, service quality can have effects far beyond the route and what policymakers may consider to be the service area of the route.

4. The MBTA's Service Delivery Policy should be amended to require the MBTA to evaluate service quality and allocate transit service to meet the needs of the service area.

The MBTA's Service Delivery Policy establishes “key bus routes” on the basis of ridership demand. These key bus routes operate with longer hours and at higher frequencies than local bus routes to meet passenger demand in high-density travel corridors. The current approach under the Service Delivery Policy overlooks critical routes that should be prioritized. MBTA should reconsider its key routes criteria to consider the impacts of delay. Our study shows that delays on a single route can have far-reaching ramifications for job access across the Eastern Massachusetts region. Our data also shows that these impacts are disproportionately borne by marginalized populations. Specifically, MBTA should consider:

- Service quality is disproportionately low in certain geographic areas. Investments in improved transit service should be targeted where riders are most severely impacted by delays, are more reliant on transit, and have higher concentrations of priority populations, including people of color, low-income households, and limited English households. Delays translate into economic impacts – lost hours or loss of employment, people more reliant on jobs, family implications due to late pickup of children from child care. Our data indicates that these populations currently have poorer access to economic opportunities due to delays.
- The MBTA has historically defined key bus routes as those with the highest ridership and frequency (Routes 1, 15, 22, 23, 28, 32, 57, 66, 71, 73, 77, 111, 116, and 117). Additional routes should be added to the key bus route list to ensure that high-quality, reliable bus service is prioritized for our region's most vulnerable communities. This should be a long-term priority for the MBTA and should not end when the immediate public health crisis has abated. In most cases, very high and high loss areas include a higher share of individuals employed in these occupations.

5. Implement Equitable Fare Policies.

The MBTA should implement a means-tested fare. Before COVID-19, many people were struggling to pay their MBTA fares. Now, with significant unemployment and a likely slow recovery, ensuring all people have access to affordable fares is essential. We recommend that the MBTA work with public sector partners to implement a means-tested fare program to allow people to make essential trips

or get to their jobs. We know that the MBTA is wrestling with the many questions regarding how to deploy this program systemwide in the context of a challenging budget picture. It will be important for the MBTA to work with the administration and the Massachusetts Legislature to ensure this program is sustainably funded and does not diminish the MBTA's ability to provide core service.

It is also critical for the MBTA to complete a fare evasion regulatory update to create alternatives to fare evasion.

6. Prepare for Climate Change.

The MBTA should target climate resilience improvements and signal upgrades in stations and bus stops at or below grade that are currently subject to stormwater or coastal flooding or expected to be at risk in the future. The MBTA should undertake climate resilience studies and planning to prioritize the most at-risk infrastructure for investments and upgrades. In doing so, the MBTA should consider data on flood risk, power outages, and extreme heat. Improving resiliency will help reduce delays, but failure to address these risks could exacerbate delays, thereby amplifying the effects of delays on access to jobs and other critical destinations. Within the Boston area, where routes overlap with projected floodplain, we cannot say with certainty how it will affect routes – above-ground versus underground tunneled routes, signal upgrade needs. MBTA has identified key stops they want to prioritize, such as Aquarium and others. The Blue Line is in the flood plain. Heat, wind, and flooding will exacerbate delays.

7. Electrify buses starting with key bus routes serving environmental justice populations that have the worst access.

Electrifying our transportation systems will improve reliability, air quality, and contribute to climate targets. Electrifying transportation systems will facilitate compliance with the Global Warming Solutions Act and Roadmap Law. Making progress with electrification will improve air quality in air pollution hot spots near transportation hubs, highways, and major intersections.

8. Transit Governance.

The new MBTA Board of Directors has an opportunity to oversee an improved, reliable, on-time system. The board has a responsibility to focus attention on ways to improve service for priority populations.

9. Capital Planning.

The capital investment plan needs to prioritize improvements that will support a transition to transit electrification and prioritizing capital improvements in targeted locations. This study demonstrates a need for route-specific improvements to increase access to economic opportunities.

- **Red Line (Braintree Only):** MBTA employees should be stationed during peak travel times at stations with areas of highest delays and high loss of job access: Quincy Center, North Quincy, Wollaston, and Quincy Adams. The role of these employees would be to maximize boarding and alighting efficiency. MBTA bus operations staff should alter bus route schedules that intersect at these four stations since economic opportunity losses on those routes will exacerbate the high economic opportunity loss at these stations. Those routes include: 210, 211, 212, 215, 216, 217, 220, 221, 225, 230, 236, 238, and 245. Further, the MBTA must manage to stay on track with implementation of the new Red Line cars so that the full set of new cars is operating by 2023. Reducing economic opportunity loss on the Red Line will benefit residents of Bedford, Lexington, Concord, Arlington, Braintree, Weymouth, Randolph, Holbrook, Cohasset, Hingham, and Scituate.
- **Orange Line:** MBTA employees should be stationed during peak travel times at stations with areas of highest delays and high loss of job access: Oak Grove, Malden Center, Wellington, Roxbury Crossing, Jackson Square, Stony Brook, Green Street, and Forest Hills. The role of these employees would be to maximize boarding and alighting efficiency. MBTA bus operations staff should alter bus route schedules that intersect at these eight stations since economic opportunity losses on those routes will exacerbate the high economic opportunity loss at these stations. Those routes include: 131, 136, 137, 97, 99, 101, 104, 105, 106, 108, 131, 132, 136, 137, 411, 430, 100, 110, 112, 134, 710, 14, 22, 29, 41, 44, 16, 21, 30, 3, 32, 33, 34, 34E, 35, 36, 37, 38, 39, 40, 42, and 50. Further, the MBTA must manage to stay on track with implementation of the new Orange Line cars so that the full set of new cars is operating by 2022. Reducing economic opportunity loss on the Orange Line will benefit people living in Peabody, Nahant, Swampscott, and parts of Marblehead.

10. Additional Studies.

Future studies should further examine the quality of access in the Boston MPO area. Specifically, we recommend that future studies look at the quality of access to higher education and health care destinations using a different modeling software or technique, not Sugar Access.

More studies are also needed to determine ideal locations for first- and last-mile transportation solutions such as electric bikes, bike share, electric scooters, expanded pedestrian paths, and other forms of non-motor vehicle transportation.

Finally, we recommend that additional studies focus on the cost of access to transportation; specifically, the correlation between rent-burdened households and access, as well as correlation between median rent and access.



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RIDING TOWARD OPPORTUNITIES:
COMMUNITIES NEED BETTER MBTA SERVICE TO ACCESS JOBS

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