chapter 6

Transportation Equity Performance Report

INTRODUCTION

This chapter contains the federally required Title VI and environmental justice (EJ) analyses completed for the Recommended Plan programmed in the Long-Range Transportation Plan (LRTP), *Destination 2040*.[1] The role of these analyses is to assess how the projects may affect the minority and low-income populations in the Boston region.[2] The analyses include the mapping of projects funded by the Boston Region Metropolitan Planning Organization (MPO) in the Recommended Plan overlaid on areas where the minority and/or low-income populations exceed their regional thresholds, and disparate impact and disproportionate burden (DI/DB) analyses that determine whether minority and low-income populations may be disproportionately affected by the projects in the Recommended Plan that can be modeled in the aggregate.[3]

These analyses demonstrate the Boston Region MPO's compliance with Title VI and EJ analytical requirements as they pertain to the LRTP. They also serve to assist the MPO in future decision making concerning minimizing, avoiding, or mitigating any potential future disparate impacts and disproportionate burdens that have been identified. Finally, they help the MPO meet its transportation equity goal.

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1 The Recommended Plan consists of regionally significant projects, including those that are financed by MPO Regional Target funds. Regionally significant projects are those that change the capacity of the transportation network and/or cost more than $20 million.

2 A minority person is one who identifies as American Indian or Alaska Native; Asian; Native Hawaiian or other Pacific Islander; Black or African American; some other race other than White; and/or Hispanic or Latino/a/x. A low-income person is one who lives in a household in which the annual household income is less than or equal to 60 percent of the Boston region's average of $75,654. This threshold equals $45,392. It reflects the high cost of living in the Boston region.

3 A DI/DB analysis is conducted for both regionally significant Target-funded projects that can be modeled, as well as for all regionally significant projects that can be modeled.

The transportation needs of minority and low-income populations (as well as other transportation equity [TE] populations) considered during the development of *Destination 2040* are described in the *Destination 2040* Needs Assessment.[4] Chapter 8 of the Needs Assessment, Transportation Equity Needs, describes the unmet transportation needs of these populations gathered from public outreach, as well as from data analyses that identify transportation service and infrastructure gaps for TE populations. While Chapter 8 of the Needs Assessment contributed to the programming and planning decisions in *Destination 2040*, this chapter focuses on the potential impacts of the MPO-funded projects in the Recommended Plan that resulted from that decision-making process.

FEDERAL GUIDANCE

Two federal mandates underpin the analyses in this chapter: Title VI of the Civil Rights Act of 1964 and the EJ Executive Order (EJ EO), *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations.* As a recipient of federal funding from the Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA), the MPO complies with their Title VI and EJ requirements.

Title VI of the Civil Rights of 1964

Title VI of the Civil Rights Act prohibits discrimination on the basis of race, color, and national origin under any program or activity that receives federal financial assistance.[5] This includes unintentional discrimination, which is referred to as disparate impact discrimination. FTA and FHWA require MPOs to conduct several Title VI analyses that apply to the Recommended Plan. These requirements are described in FTA's Title VI Circular (C) 4702.1B and FHWA's *Environmental Justice Reference Guide*, which provides guidance for its nondiscrimination program that covers Title VI and the EJ EO.

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[4] The MPO considers TE populations to include those protected by federal laws and regulations and those that have specific transportation needs beyond federally protected groups. Specifically, TE populations include the following demographic groups:

- People who identify as minority, have limited English proficiency, are 75 years of age or older or 17 years of age or younger, or who have a disability; and,
- People who are members of low-income households or transit-dependent households.

[5] These protections were subsequently clarified to include people with limited English proficiency through Executive Order 13166, *Improving Access to Services for Persons with Limited English Proficiency*, which was signed on August 11, 2000.

Environmental Justice Executive Order

In 1994, President Clinton issued the EJ EO, which made achieving EJ part of the mission of the executive branch of the federal government. The EJ EO directs federal agencies to incorporate EJ principles into their activities. As part of doing so, they are required to identify and address any potential disproportionately high and adverse environmental and human health effects of their activities on minority populations and low-income populations. These requirements are described in FTA's EJ Circular (C) 4703.1 and FHWA's *Environmental Justice Reference Guide*.

TRANSPORTATION EQUITY ANALYSES

The remainder of this chapter discusses the results of analyses required by FTA and FHWA guidance:

- The Geographic Distribution of Transportation Investments analysis maps the locations of MPO-funded projects programmed in the Recommended Plan overlaid on areas that have a high share of minority and/or low-income populations. They include all MPO-funded projects in the Recommended Plan; this is different from those that are analyzed in the DI/DB analysis.

- Two DI/DB analyses are conducted to determine if projects in the Recommended Plan that can be modeled, when analyzed in the aggregate, may disproportionately affect minority and low-income populations compared to nonminority and non-low-income populations, respectively. (Because this Recommended Plan does not include any transit projects, FTA's Title VI analysis to analyze the distribution of state and federal funds in the aggregate for public transit is not necessary.)

The MPO's approach to conducting these analyses began with identifying the share of the minority population and low-income population that lives within defined geographical areas, called transportation analysis zones (TAZ).[6] First, for each TAZ, MPO staff identified the share of the population that meets the definition of minority and the share that meets the MPO's definition of low-income. Then the share of each TAZ that belongs to the minority or low-income population is compared to that population's regional threshold. The threshold

[6] The TAZ is the unit of geography most commonly used in regional travel demand models. The spatial extent of TAZs typically ranges from very large (less densely developed) areas in suburban communities to as small as city blocks or buildings in (more densely developed) central business districts. The MPO region is divided into 1,901 TAZs.

for defining a minority population is the average percentage of the minority population for the Boston region, 28.2 percent. The threshold for defining a low-income population is 60 percent of the regional annual household income ($45,392).[7] If the TAZ meets or exceeds the threshold for the minority population, and/or has an average household income that is equal to or less than the low-income threshold, it is considered a transportation equity zone (TEZ).[8]

Geographic Distribution of Transportation Investments Analysis

Using the approach described above, MPO staff then mapped the minority and low-income TEZs in the Boston region. Figure 6-1 shows the projects in the Recommended Plan that are MPO funded overlaid on TAZs that meet the definition of minority and/or low-income TEZs. (Although the analysis is required only for the minority population, it is also completed for the low-income population to incorporate EJ principles more fully.) About 34 percent of TAZs in the MPO region are minority TEZs, about 10 percent are low-income TEZs, and about 9 percent are both minority and low-income TEZs.[9] The analysis shows that 6 of the 11 MPO-funded projects in the Recommended Plan intersect with minority and/or low-income TEZs.

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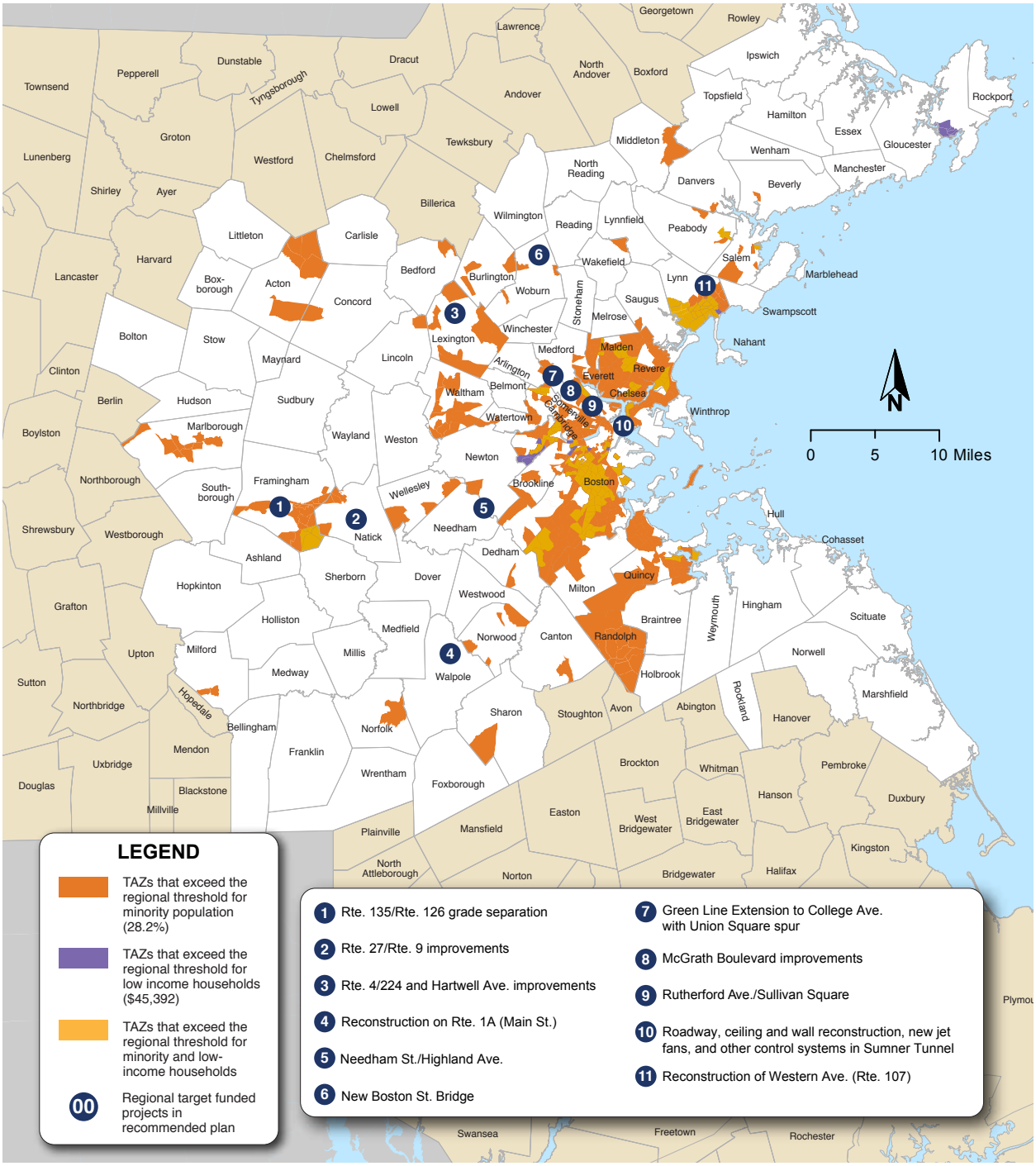
[7] Minority and low-income status are derived from the 2010 US Census and the 2010–14 American Community Survey, respectively.

[8] These thresholds were developed based on federal guidance. The FTA Title VI Circular states that a predominantly minority area is one where the share of the minority population exceeds the average in the region. It also states that a predominantly low-income area is one where the share of the low-income population exceeds the average in the region.

[9] Individual maps of TEZs for each population can be found in Chapter 8 of the Needs Assessment.

Figure 6-1
Recommended Plan Projects in Minority and Low-income Transportation Equity Zones



Notes: TEZs are determined as follows:

- Criteria for low-income TEZs—A TAZ in which the median household income is less than or equal to 60 percent of the MPO's region's median household income ($45,392).
- Criteria for minority TEZs—A TAZ in which the minority population is greater than or equal to the MPO region's average minority population, 28.2%.
- Criteria for minority and low-income TEZs—A TAZ that meets the definition for both minority TEZs and low-income TEZs.

TAZ = transportation analysis zone. TEZ = transportation equity zone.
Sources: 2010 US Census, 2010–14 American Community Survey, and the Boston Region MPO.

Disparate Impact and Disproportionate Burden Analysis

The DI/DB analyses identify potential future disparate impacts that may result from the modeled projects on minority populations, as well as potential future disproportionate burdens on low-income populations.[10] Disparate impacts refer to potential future adverse effects that would disproportionately affect minority populations. Disproportionate burdens refer to potential future adverse effects that would disproportionately affect low-income populations. Adverse effects may be either a delay or denial of benefits or an imposition of burdens. The DI/DB analyses assessed a suite of 10 metrics for potential future disparate impacts or disproportionate burdens. The MPO's draft DI/DB Policy describes how the MPO determines whether impacts are disparate or disproportionate (see Appendix C).

Methodology

Federal regulations provide MPOs direction on how to conduct DI/DB analyses. Projects must be analyzed as a group and not individually. In addition, potential impacts must be analyzed for the entire minority or low-income population in the region. The analysis does not assess potential impacts to individual communities or municipalities. It also only assesses the impacts of the regionally significant projects in the Recommended Plan that are not already programmed in the Transportation Improvement Program (TIP) and that can be modeled—specifically, those that change the capacity of the transportation network. Those that do not change capacity are analyzed in the TIP, along with projects that are programmed in the other investment programs through the TIP.

MPO staff conducted two DI/DB analyses. The first analyzes only the MPO's Regional Target-funded projects and the second analyzes MPO- and MassDOT-funded regionally significant projects that are within the Boston region. The projects that were included in the first DI/DB analysis include the following:

- Reconstruction of Rutherford Avenue, from City Square to Sullivan Square (Boston)
- McGrath Boulevard (Somerville)
- Bridge replacement, New Boston Street over MBTA (Woburn)
- Route 4/225 (Bedford Street) and Hartwell Avenue (Lexington)
- Intersection improvements at Route 126/Route 135/MBTA and CSX railroad (Framingham)

[10] A disparate impact is a facially neutral policy or practice that results in impacts that disproportionately affect members of a group based on their race, color, or national origin, where the recipient's policy or practice lacks a substantial legitimate justification and where there exists one or more alternatives that would serve the same legitimate objectives but with a less disproportionate effect on the basis of race, color, or national origin.
A disproportionate burden refers to a neutral policy or practice that disproportionately affects low-income populations more than non-low-income populations. A finding of a disproportionate burden requires the recipient to evaluate alternatives and mitigate burdens where practicable.

The projects that were included in the second DI/DB analysis are as follows:

- Reconstruction of Rutherford Avenue, from City Square to Sullivan Square (Boston)
- McGrath Boulevard (Somerville)
- Bridge replacement, New Boston Street over MBTA (Woburn)
- Route 4/225 (Bedford Street) and Hartwell Avenue (Lexington)
- Intersection improvements at Route 126/Route 135/MBTA and CSX railroad (Framingham)
- Cypher Street Extension (Boston)
- Allston Multimodal Improvement Project (Boston)
- Reconstruction of I-90 and I-495 (Hopkinton and Westborough)

For the purpose of the analyses, MPO staff assumed that the distribution of the minority population would remain unchanged in 2040 and that the growth rate would be the same as that forecast for the overall population in the region. For the low-income population, the analyses used a forecast of the distribution of various income categories in 2040.

The process for identifying potential future disparate impacts and disproportionate burdens involves comparing the projected impacts on minority populations to those on nonminority populations, and those on low-income populations to those on non-low-income populations. First, two scenarios are run using a regional travel demand model that analyzes these metrics to identify the projected impacts of the transportation network on each of the four populations. One scenario is run in which the transportation network in 2040 includes the modeled projects (build scenario), and one scenario is run where the transportation network in 2040 does not include them (no-build scenario).[11]

[11] The modeling region includes all of Massachusetts, Rhode Island, and southeastern New Hampshire, in addition to the MPO region. This allows travel demand modeling analyses to account for trips that originate in or end outside of the MPO region. Model results are only reported for the MPO region's 1,901 TAZs.

For each TAZ, the model produces results for each scenario for the following 10 metrics:

- Accessibility metrics[12]
  - Access to jobs within a 60-minute transit trip
  - Access to retail opportunities within a 60-minute transit trip
  - Access to healthcare services within a 40-minute transit trip
  - Access to two- and four-year institutes of higher education within a 40-minute transit trip
- Mobility metrics
  - Average travel time for transit trips produced in MPO TAZs
  - Average travel time for transit trips attracted to MPO TAZs
  - Average travel time for highway trips produced in MPO TAZs[13]
  - Average travel time for highway trips attracted to MPO TAZs
- Environmental metrics
  - Carbon monoxide (CO) emissions per square mile
  - Congested vehicle-miles traveled (VMT) per square mile

Then, the weighted regionwide average for each metric is calculated for the minority, nonminority, low-income, and non-low-income populations by TAZ. This is calculated for both the no-build and build scenarios. For example, for the minority population, the projected CO emissions per square mile, weighted by the entire minority population in the region, is calculated for both the no-build and build scenarios. The CO emissions per square mile for the no-build scenario are then subtracted from the CO emissions per square mile for the build scenario. This determines the change in CO emissions per square mile that is projected to occur in 2040 as a result of implementing the projects.

[12] Accessibility metrics only analyze public transit trips; there is a high degree of uncertainty in modeling highway trips, so accessibility by highway metrics were not used in this analysis. The access to jobs and retail metrics were updated in this LRTP to reflect the unweighted average travel times to jobs reported in the American Community Survey. Given a lack of data about average travel times to healthcare facilities and higher education, travel time thresholds remained at 40 minutes.

[13] Highway trips consist of automobile and truck trips taken on any road in the MPO region. It does not include bus trips.

After completing this process for all populations, MPO staff applies the LRTP draft DI/DB Policy to determine whether there may be a potential disparate impact for the minority population or a disproportionate burden for the low-income population. In this example, the DI/DB Policy would compare the projected impact on the minority population to that on the nonminority population to determine whether there may be a potential future disparate impact for the minority population.

Applying the Draft DI/DB Policy

The MPO's LRTP draft DI/DB Policy states how the MPO identifies and addresses potential future disparate impacts and disproportionate burdens that may result from the modeled projects. The policy enables the MPO to meet federal requirements in a clear and consistent manner, and it makes the MPO's approach to identifying and addressing potential future disparate impacts and disproportionate burdens transparent to the public. Because of the similarities between FTA's and FHWA's EJ requirements to identify and address disproportionately high and adverse effects of MPO activities and their Title VI disparate impact requirements, the draft policy was developed to meet both.

The policy was used for the first time in *Destination 2040*. In federal fiscal year (FFY) 2018, MPO staff began the first of a two-phase effort to develop a DI/DB policy for the modeled projects. Over the course of a year, MPO staff conducted public outreach to get input on the policy and the metrics that staff could analyze for potential future disparate impacts and disproportionate burdens. Staff responded to this input by updating those metrics, as well as the DI/DB analysis methodology that is described in this chapter. This included identifying the forecasting error for each metric, which was critical for determining whether the impacts were outside the bounds of the uncertainty inherent to travel demand modeling. Subsequently, MPO staff developed this draft DI/DB Policy that allows the MPO to identify only those impacts that would likely be due to implementation of the modeled projects and avoid labeling impacts as disparate impacts or disproportionate burdens when they would likely be due to forecasting error.

The full draft DI/DB Policy can be found in Appendix C. In sum, it states that there would be a potential future disparate impact or disproportionate burden if

- the minority or low-income population would likely be more adversely affected than the nonminority or non-low-income population, respectively; and
- this result is not due to the metric's forecasting error.

Analysis Results

This section describes the results of the two DI/DB analyses. Tables 6-1 through 6-10 report the results for each evaluation metric. Table numbers followed by an "a" indicate that the

results are for the MPO's Regional Target-funded projects only, while table numbers followed by a "b" indicate that the results are for MPO- and MassDOT-funded regionally significant projects. (Both sets of projects refer only to those that can be modeled.) Each table includes the forecasting error (expressed as a percentage) that was calculated for each metric as part of the development of the draft DI/DB Policy and the no-build scenario results.[14] They also show the range of values for the build scenario that is expected based on the forecasting error. (For example, if the no-build scenario result is 1,000 and the forecasting error is 10 percent, then the expected range of values would be 900 to 1,100.) Finally, the tables show whether the analysis indicates a potential disparate impact or disproportionate burden. If the no-build scenario result for both the protected and non-protected populations falls within the expected range of values for the build scenario, then there is no disparate impact or disproportionate burden. This is because an overlap indicates that any difference between the build and no-build scenarios is likely due to model uncertainty, not the MPO projects that are being analyzed. It is statistically unlikely that the projects being analyzed disproportionately affect the protected population.

Accessibility Metrics

The MPO's accessibility metrics are based on the number of destinations of various types (jobs, retail, education, and health care) by TAZ that are reachable within a given travel time by transit. The average number of destinations is then calculated for minority, nonminority, low-income, and non-low-income populations, based on their respective shares within each TAZ. These metrics use the number of total jobs, healthcare facilities, institutes of higher education, and retail opportunities as proxies for activity opportunities at destination TAZs. Travel times to jobs were updated to reflect average commute times for the MPO region as documented in the American Community Survey. Access to retail opportunities uses retail jobs as a proxy. Access to higher education uses enrollment data for two- and four-year institutes of higher education as a proxy. Access to health care uses the number of hospital beds as a proxy.

Tables 6-1a and 6-1b show the DI/DB analysis results for access to jobs, Tables 6-2a and 6-2b show the results for access to retail opportunities, Tables 6-3a and 6-3b show the results for access to higher education, and Tables 6-4a and 6-4b shows the results for access to healthcare facilities. The results of the DI/DB analysis of the MPO's Regional Target-funded projects show that the differences for all four metrics between the build and no-build scenarios are within the forecasting error. Therefore, the analysis indicates that there are no potential disparate impacts or disproportionate burdens for these metrics.

[14] Note that in the tables, the no-build results are the same for both the MPO Regional Target-funded projects analysis and the analysis of the MassDOT- and MPO-funded regionally significant projects. This is because the same no-build scenario was used in both analyses.

The analysis for the MPO- and MassDOT-funded regionally significant projects also shows that likely there will not be any disparate impacts or disproportionate burdens. The results for two other metrics show there likely will be a positive impact in terms of access to healthcare facilities for minority and nonminority populations and for low-income and non-low-income populations, and access to jobs for minority and nonminority populations. In both cases, the minority or low-income population is projected to benefit more than their respective nonminority or non-low-income populations.

Table 6-1a
DI/DB Analysis Results for Access to Jobs by Transit—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	3.3%	481,608	462,864 to 494,455	No
Nonminority	6.2%	265,441	248,984 to 281,899	
Low-income	3.7%	404,775	387,326 to 417,090	No
Non-low-income	5.0%	305,360	288,423 to 318,783	

Notes: The no-build and build scenarios are for the year 2040. Access to jobs is calculated for those within a 60-minute transit trip and is reported in number of jobs.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-1b
DI/DB Analysis Results for Access to Jobs by Transit—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	3.3%	481,608	481,771 to 514,653	No
Nonminority	6.2%	265,441	258,741 to 292,946	
Low-income	3.7%	404,775	403,167 to 434,148	No
Non-low-income	5.0%	305,360	301,338 to 333,058	

Notes: The no-build and build scenarios are for the year 2040. Access to jobs is calculated for those within a 60-minute transit trip and is reported in number of jobs.
DI/DB = Disparate impact and disproportionate burden.

Source: Boston Region MPO.

Table 6-2a
DI/DB Analysis Results for Access to Retail Opportunities by Transit—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	9.1%	52,609	47,538 to 57,056	No
Nonminority	16.6%	29,522	24,485 to 34,232	
Low-income	10.2%	44,513	39,731 to 48,757	No
Non-low-income	13.7%	33,810	29,013 to 38,224	

Notes: The no-build and build scenarios are for the year 2040. Access to retail opportunities is calculated for those within a 60-minute transit trip and are reported in number of retail jobs.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-2b
DI/DB Analysis Results for Access to Retail Opportunities by Transit—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	9.1%	52,609	49,695 to 59,645	No
Nonminority	16.6%	29,522	25,778 to 36,040	
Low-income	10.2%	44,513	41,583 to 51,030	No
Non-low-income	13.7%	33,810	30,512 to 40,200	

Notes: The no-build and build scenarios are for the year 2040. Access to retail opportunities is calculated for those within a 60-minute transit trip and are reported in number of retail jobs.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-3a
DI/DB Analysis Results for Access to Higher Education by Transit—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	3.5%	50,776	48,897 to 52,444	No
Nonminority	6.0%	29,372	27,563 to 31,082	
Low-income	3.4%	44,968	43,358 to 46,410	No
Non-low-income	5.6%	33,692	32,065 to 35,157	

Notes: The no-build and build scenarios are for the year 2040. Access to higher education is calculated for those within a 40-minute transit trip and is reported in number of students enrolled.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-3b
DI/DB Analysis Results for Access to Higher Education by Transit—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	3.5%	50,776	49,947 to 53,571	No
Nonminority	6.0%	29,372	28,336 to 31,954	
Low-income	3.4%	44,968	44,493 to 47,625	No
Non-low-income	5.6%	33,692	32,573 to 35,912	

Notes: The no-build and build scenarios are for the year 2040. Access to higher education is calculated for those within a 40-minute transit trip and is reported in number of students enrolled.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-4a
DI/DB Analysis Results for Access to Healthcare Facilities by Transit—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	3.2%	987	950 to 1,013	No
Nonminority	5.8%	563	529 to 594	
Low-income	3.3%	892	859 to 918	No
Non-low-income	4.5%	641	610 to 667	

Notes: The no-build and build scenarios are for the year 2040. Access to healthcare facilities is calculated for those within a 60-minute transit trip and is reported in number of hospital beds.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-4b
DI/DB Analysis Results for Access to Healthcare Facilities by Transit—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	3.2%	987	1,003 to 1,069	No
Nonminority	5.8%	563	554 to 622	
Low-income	3.3%	892	898 to 959	No
Non-low-income	4.5%	641	640 to 701	

Notes: The no-build and build scenarios are for the year 2040. Access to healthcare facilities is calculated for those within a 60-minute transit trip and is reported in number of hospital beds.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Mobility Metrics

The mobility metrics are used to evaluate the door-to-door travel time for trips produced in and attracted to MPO TAZs. Average travel times are then calculated for minority, nonminority, low-income, and non-low-income populations, based on their respective shares within each TAZ. Trips attracted to TAZs are those that are generated by non-household land uses (such as retail, employment, health care, and education) within the MPO region. They can originate from either households within the MPO region or from outside of the region.[15] Trips produced in TAZs are those trips generated by households (trip generation varies based on

[15] Trips ending or originating outside of the MPO region are only those within the modeled area, which includes all of Massachusetts and Rhode Island, as well as southern New Hampshire. Only surface transportation trips are included—air travel is not.

household income, number of cars, and the number of people in the household, among other characteristics). The trips can end either within another TAZ in the region or outside of the region.

Tables 6-5a, 6-5b, 6-6a, and 6-6b show the DI/DB analysis results for the transit trip attraction and production metrics. Tables 6-7a, 6-7b, 6-8a, and 6-8b show the results for the highway trip attraction and production metrics. The results for the DI/DB analysis for both the MPO-funded Regional Target projects and MPO- and MassDOT-funded regionally significant projects for all four of the mobility metrics show that the changes between the build and no-build scenarios fall within the forecasting error. Therefore, both analyses indicate that neither disparate impacts nor disproportionate burdens are likely to occur.

Table 6-5a
DI/DB Analysis Results for Average Transit Travel Times: Trip Attractions—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	14.5%	47.8	40.9 to 54.7	No
Nonminority	12.0%	51.8	45.3 to 58.3	
Low-income	13.0%	49.5	43.0 to 55.9	No
Non-low-income	12.2%	51.5	45.2 to 57.7	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-5b
DI/DB Analysis Results for Average Transit Travel Times: Trip Attractions—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	14.5%	47.8	39.4 to 52.8	No
Nonminority	12.0%	51.8	43.4 to 55.8	
Low-income	13.0%	49.5	41.4 to 53.8	No
Non-low-income	12.2%	51.5	43.3 to 55.3	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-6a
DI/DB Analysis Results for Average Transit Travel Times: Trip Productions—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	17.3%	46.9	38.7 to 55.0	No
Nonminority	15.5%	51.4	43.4 to 59.3	
Low-income	16.1%	49.0	41.1 to 56.8	No
Non-low-income	15.7%	50.9	42.9 to 58.9	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-6b
DI/DB Analysis Results for Average Transit Travel Times: Trip Production—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	17.3%	46.9	37.3 to 52.9	No
Nonminority	15.5%	51.4	41.5 to 56.8	
Low-income	16.1%	49.0	39.5 to 54.6	No
Non-low-income	15.7%	50.9	41.1 to 56.4	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-7a
DI/DB Analysis Results for Average Highway Travel Times: Trip Attractions—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	13.9%	19.1	16.4 to 21.8	No
Nonminority	13.1%	19.0	16.5 to 21.6	
Low-income	13.2%	18.8	16.3 to 21.3	No
Non-low-income	13.2%	19.0	16.5 to 26.1	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-7b
DI/DB Analysis Results for Average Highway Travel Times: Trip Attractions—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	13.9%	19.1	16.4 to 21.7	No
Nonminority	13.1%	19.0	16.5 to 21.5	
Low-income	13.2%	18.8	16.3 to 21.2	No
Non-low-income	13.2%	19.0	16.5 to 21.5	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-8a
DI/DB Analysis Results for Average Highway Travel Times: Trip Productions—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	13.2%	19.1	16.6 to 21.6	No
Nonminority	13.2%	19.0	16.5 to 21.6	
Low-income	13.1%	18.8	16.4 to 21.3	No
Non-low-income	13.3%	19.0	16.5 to 21.6	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-8b
DI/DB Analysis Results for Average Highway Travel Times: Trip Productions—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	13.2%	19.1	16.5 to 21.5	No
Nonminority	13.2%	19.0	16.5 to 21.5	
Low-income	13.1%	18.8	16.3 to 21.2	No
Non-low-income	13.3%	19.0	16.5 to 21.5	

Notes: The no-build and build scenarios are for the year 2040. Travel times are in minutes.
DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Environmental Metrics

The two environmental metrics are congested VMT and CO emissions per square mile. While the other metrics evaluate the impacts affecting users of the roadway or transit system, these metrics assess the VMT and CO impacts on residents. Both are calculated based on highway trips, not transit trips. The CO metric assesses the CO emissions per square mile within each TAZ. The congested VMT metric assesses the volume-to-capacity ratio on the roads within or adjacent to each TAZ; those with a ratio of 0.75 or greater are considered congested.

Tables 6-9a and 6-9b show the DI/DB analysis results for congested VMT per square mile and Tables 6-10a and 6-10b show the results for CO emissions per square mile. The results for the DI/DB analysis for both the MPO-funded Regional Target projects and MPO- and MassDOT-funded regionally significant projects show that the projected differences for both metrics are within the forecasting error. Therefore, both analyses indicate that neither disparate impacts nor disproportionate burdens are likely to occur for these metrics.

Table 6-9a
DI/DB Analysis Results for Congested VMT—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	16.3%	110,490	89,797 to 124,772	No
Nonminority	22.6%	81,396	61,390 to 97,241	
Low-income	16.5%	102,537	83,379 to 116,331	No
Non-low-income	20.3%	92,044	71,169 to 107,423	

Notes: The no-build and build scenarios are for the year 2040. Congested VMT is determined by analyzing the volume-to-capacity ratio on the roads within each TAZ. Those with a ratio of 0.75 or greater are considered congested.
DI/DB = Disparate impact and disproportionate burden. VMT = vehicle-miles traveled.
Source: Boston Region MPO.

Table 6-9b
DI/DB Analysis Results for Congested VMT—MPO- and MassDOT-Funded Regionally Significant Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	16.3%	110,490	90,759 to 126,108	No
Nonminority	22.6%	81,396	62,184 to 98,498	
Low-income	16.5%	102,537	84,761 to 118,259	No
Non-low-income	20.3%	92,044	71,992 to 108,665	

Notes: The no-build and build scenarios are for the year 2040. Congested VMT is determined by analyzing the volume-to-capacity ratio on the roads within each TAZ. Those with a ratio of 0.75 or greater are considered congested.
DI/DB = Disparate impact and disproportionate burden. VMT = vehicle-miles traveled.
Source: Boston Region MPO.

Table 6-10a
DI/DB Analysis Results for CO Emissions—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	11.9%	184	158 to 201	No
Nonminority	17.2%	134	109 to 154	
Low-income	12.6%	172	147 to 189	No
Non-low-income	15.4%	150	123 to 168	

Notes: The no-build and build scenarios are for the year 2040. CO emissions are per square mile and are reported in kilograms.
CO = Carbon monoxide. DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

Table 6-10b
DI/DB Analysis Results for CO Emissions—MPO-Funded Regional Target Projects

Population	Forecasting Error	No-build Scenario Result	Range of Expected Values for the Build Scenario	Disparate Impact or Disproportionate Burden?
Minority	11.9%	184	160 to 203	No
Nonminority	17.2%	134	110 to 156	
Low-income	12.6%	172	149 to 192	No
Non-low-income	15.4%	150	125 to 171	

Notes: The no-build and build scenarios are for the year 2040. CO emissions are per square mile and are reported in kilograms.
CO = Carbon monoxide. DI/DB = Disparate impact and disproportionate burden.
Source: Boston Region MPO.

CONCLUSION AND NEXT STEPS

The MPO's DI/DB analyses found that both the MPO's Regional Target-funded projects and the MPO- and MassDOT-funded regionally significant projects that can be modeled in the Recommended Plan, in the aggregate, would likely not result in any potential future disparate impacts or disproportionate burdens. This means that no further action is required by the MPO.

In FFY 2020, MPO staff will conduct a study to develop thresholds for each metric that will allow the MPO to determine when a potential impact to the minority or low-income

populations would be significantly greater than the potential impact to the nonminority or non-low-income population, respectively. Federal guidance states that disparate impacts and disproportionate burdens are those impacts where the minority or low-income population may be affected significantly more than the nonminority or non-low-income population. The study will define the meaning of *significantly more* for each metric. When the study is completed, MPO staff will update the draft DI/DB Policy to reflect the findings, and subsequently seek MPO endorsement.