TECHNICAL MEMORANDUM

DATE: **November 15, 2019**
TO: **Boston Region Metropolitan Planning Organization**
FROM: **Betsy Harvey**
RE: **Development of the DI/DB Policy for the LRTP: Phase One**

This memo describes phase one of the Boston Region Metropolitan Planning Organization (MPO) two-phase effort to develop a Disparate Impact and Disproportionate Burden (DI/DB) Policy for the MPO's Long-Range Transportation Plan (LRTP). The policy will be used to evaluate, in the aggregate, the MPO-funded projects in the LRTP Recommended Plan that can be modeled for potential future disparate impacts and disproportionate burdens on minority and low-income populations, respectively.[1] The memo also describes the steps MPO staff undertook to develop a draft LRTP DI/DB Policy based on the findings from phase one. The draft policy will be updated when phase two is completed in federal fiscal year (FFY) 2020. In phase two, staff will develop thresholds to determine whether impacts on minority and low-income populations are practically significant. The full version of the draft LRTP DI/DB policy resulting from phase one can be found on the MPO's website.

1   BACKGROUND OF DISPARATE IMPACT DISCRIMINATION AND ENVIRONMENTAL JUSTICE

The MPO's draft LRTP DI/DB Policy responds to two federal mandates: Title VI of the Civil Rights Act of 1964 and Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-income Populations*, known as the Environmental Justice Executive Order (EJ EO).

1.1   Civil Rights Act of 1964

Title VI of the Civil Rights Act of 1964 states that

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[1] The Recommended Plan consists of regionally significant projects within the MPO region that will be financed with federal funds. Regionally significant projects are those that change the capacity of the transportation network and/or cost more than $20 million. The DI/DB analysis is completed only for those projects that are financed with MPO regional target funds and that change the capacity of the transportation network. Projects that do not change the capacity of the transportation network, including those programmed in the MPO's investment programs, are analyzed when they are programmed in the Transportation Improvement Program.

> No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.[2]

Title VI prohibits intentional discrimination (disparate treatment) and unintentional discrimination (disparate impact) based on race, color, or national origin.[3] Disparate treatment refers to actions that result in circumstances where similarly situated persons are intentionally treated differently because of their race, color, or national origin. Disparate impacts refer to a facially neutral policy or practice that disproportionately affects members of a group identified by 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.

Federal agencies enforce disparate impact compliance through Title VI implementing regulations, with which recipients of an agency's funding must comply. As recipients of funding from Federal Transit Administration (FTA) and Federal Highway Administration (FHWA), MPOs comply with both of these agencies' Title VI disparate impact regulations. Although there is no private right of action for disparate impact claims, federal agencies have the authority to challenge a recipient's action in the face of a disparate impact claim.[4]

1.2   Environmental Justice Executive Order

In 1994, President Clinton issued the EJ EO, which made achieving EJ a mission of the executive branch. The EJ EO directs federal agencies to identify and address disproportionately high and adverse environmental and human health effects of their activities, policies, and practices on minority populations and low-income populations. This obligation is passed to recipients of federal funding through executive branch agencies, including FTA and FHWA. For low-income

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[2] Civil Rights Act of 1964, Pub. Law No. 88-352, 78 Stat.

[3] In 2000, the EO "Improving Access to Services for Persons with Limited English Proficiency" affirmed that national origin is identified by one's English proficiency. Those with limited English proficiency (LEP) are therefore covered by national origin protections under Title VI. (See Exec. Order No. 13166, 65 C.F.R. 159 [August 11, 2000].)

[4] Until 2001, individuals could file civil lawsuits to enforce disparate impact regulations promulgated under Title VI. In *Alexander v. Sandoval*, the Supreme Court ruled that individuals no longer have that right. (See Alexander v. Sandoval, 532 U.S. [2001].) Federal agencies may still enforce their disparate impact regulations for any of their recipients and may take corrective actions should they find a recipient to be in violation of those regulations. (See *Title VI Legal Manual: Section VII: Proving Discrimination—Disparate Impact,* prepared by the Civil Rights Division, Department of Justice, 2016, www.justice.gov/crt/case-document/file/934826/download.)

populations, disproportionately high and adverse effects are referred to as disproportionate burdens.

1.3   Federal Disparate Impact and EJ Regulations and Guidance

Disparate Impact Regulations and Guidance

FTA and FHWA Guidance for MPO Recipients

FTA's most recent Title VI circular was issued in 2012. It requires MPOs to identify and address disparate impacts on minority populations that may result from state and federal funds in the aggregate. In 2015, FHWA issued combined Title VI and EJ guidance that similarly states that MPOs must assess the impacts on minority populations that may result from its activities. These documents set several overarching guidelines:

- MPO investments must be analyzed as a group, not individually.

- Impacts to the minority and nonminority populations must be assessed for the entire MPO region, not by neighborhood or municipality.

- Disparate impacts refer to impacts that may result from proposed MPO activities, not impacts from the current transportation network.

- Potential impacts on minority and low-income populations must be analyzed and reported on separately; they cannot be combined.

Department of Justice Guidance

The United States Department of Justice (DOJ) *Title VI Legal Manual: Section VII* is a guide for federal agencies evaluating their recipients' compliance with Title VI disparate impact regulations. According to the manual, the analysis for identifying potential disparate impacts consists of three parts: establishing causation, establishing adversity, and establishing practical significance. If all three criteria are met, there would be a potential disparate impact. Subsequently, the practice in question may only be implemented if there is a substantial, legitimate justification for its implementation and there are no less discriminatory alternatives; otherwise, there would be a disparate impact violation and the practice may not be implemented.[5]

There is substantial disparate impact case law pertaining to many sectors of public life, including transportation, employment, environment, education, and housing. Because of this history, this section draws on these sectors to provide an overview of the measures that courts and/or federal regulators have accepted as evidence of a disparate impact. While some of the cases discussed are not

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[5] Department of Justice, *Title VI Legal Manual: Section VII,* 18–24.

directly related to transportation, the discussion will still prove helpful as they informed the MPO's approach.

Establishing Causation

Causation must be established between the practice in question and the observed or projected impacts to the protected population.[6] To establish causation, recipients must provide statistical evidence that an impact would likely be caused by a seemingly neutral practice—in the case of the MPO's LRTP, the projects in the Recommended Plan that are funded by the MPO and that can be modeled.[7] Causation can be established using any method that is appropriate. Regardless of the measure that is used, the US Supreme Court has asserted that recipients hew strictly to the requirement to show robust causality, and are not responsible for any adverse effects that were not or would not be created by the practice in question.[8]

Establishing Adversity

If causation has been established, the recipient must then determine whether the protected population would be affected more adversely by the practice in question than would the non-protected population. A typical measure involves comparing the potential impact to the protected population to the potential impact to the non-protected population.

Establishing Practical Significance

Finally, the recipient must determine if the protected population would be affected significantly more adversely than the non-protected population. The purpose of disparate impact regulations is to identify differences between the two populations that are practically significant, not to ensure that there are no differences between the impact to the protected population and the non-protected population. Courts have generally shied away from developing a strict definition of when an adverse effect is practically significant in all situations.[9]

The four-fifths rule is one standard that has been used to determine practical significance. The rule was developed by the Equal Employment Opportunity Commission in 1972 to examine employment discrimination by looking at hiring rates. It was later codified in 1978. The four-fifths rule states that there would be a disparate impact if the practice in question would adversely affect the protected population at least 20 percent more than the non-protected population. The basis

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[6] "Protected population" refers to the minority population in the context of disparate impact or the low-income population in the context of disproportionate burden.

[7] Department of Justice, *Title VI Legal Manual: Section VII*, 18.

[8] Department of Justice, *Title VI Legal Manual: Section VII*, 27.

[9] Department of Justice, *Title VI Legal Manual: Section VII*, 26.

for this rule is that a difference of 20 percent is considered significant enough to demonstrate unintentional discrimination. While this rule has been used across various areas of public life, the rule is not universal.[10]

Some courts have accepted strong evidence of causation as evidence of practical significance as well. In some of these circumstances, courts have found that proof of statistical significance was sufficient to constitute practical significance even when the difference was below the 80 percent threshold.[11] For example, statistical evidence of differences between the protected population and non-protected population in the use of testing in hiring may be sufficient to violate disparate impact regulations. In some cases, the evidence of causation may be so obvious that there is no need for further testing of practical significance.[12] Still other courts have accepted other approaches, such as the use of two or three standard deviations beyond the mean as a way to establish both causation and practical significance.[13]

It can be instructive for the MPO to consider cases other than transportation, like those described above, but they should not replace a thorough consideration of how best to identify disparate impacts in transportation planning. Agencies involved with complicated long-term planning decisions may not be held to the same standard used by other recipients where fewer interests are weighed during decision making.[14] It is important that the MPO develop its own methodology that is based on sound planning and statistical evidence.

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[10] Department of Justice, *Title VI Legal Manual: Section VII*, 25.

[11] Ibid. See also *Groves v. Alabama State Board of Education*, 776 F. Supp. 1518, (M.D. Ala. 1991); *Richardson v. Lamar County Board of Education*, 729 F. Supp. 806 (M.D. Ala. 1989). These decisions discuss the benefits and drawbacks using several different approaches to proving a disparate impact violation. Relying on the use of multiple tests, *Groves* states that "the racial pattern of success and failure … has both practical and overwhelming statistical significance."

[12] Department of Justice, *Title VI Legal Manual: Section VII*, 24–6. For example, the Department of Education's Department of Civil Rights guidance for standardized tests suggests that demonstrating statistical significance, as part of the test for causation, is sufficient to prove the presence of a disparate impact.

[13] Department of Justice, *Title VI Legal Manual: Section VII*, 25. See, for example, *Richardson, 729* F. Supp., at 817, in which the court used three different formulas to test for disparate impact: the four-fifths rule, the number of standard deviations, and statistical significance.

[14] *Darensburg* at 1054 wrote: "It is one thing to require statistical proof of a correlation between job performance and IQ, but would be quite another to require regional planning agencies engaged in the kind of complicated, long-term planning and funding processes at issue here to provide such studies for their multi-faceted decisions involving a host of variables." (*Darensburg v. Metropolitan Transportation Commission*, 611 F. Supp. 2d 994, [N.D. Cal. 2009].) *NY Urban League* employs a similar argument in reference to the Metropolitan Transportation Authority's proposal to raise fares by 20 percent across all transit modes it operated. (*New York Urban League v. State of New York*, 71 F.3d 1031 [2d Cir. 1995)].)

EJ Guidance

The EJ EO directs every federal agency to make environmental justice part of its mission. In response, the United States Department of Transportation (USDOT) EJ Order describes how the agency incorporates EJ principles into its programming, policy, and planning decisions. The current Order was issued in May 2012. It states that the USDOT must identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations. These responsibilities are passed on to FTA, FHWA, and recipients. Adverse effects can be any impact related to the practice in question, including social, economic, and environmental effects, such as emissions, access to employment, and travel time. An adverse effect is defined as an effect that

- is predominantly borne by a minority population and/or a low-income population; or
- will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the nonminority population and/or non-low-income population.[15]

FTA released its most recent EJ guidance in 2012 and FHWA did so in 2015. Both agencies require MPOs to identify and address potential disproportionately high and adverse effects of their transportation investments on minority populations and low-income populations. They both provide guidance on how an analysis might be conducted, and recommend balancing the adverse effects with the positive effects to see whether the net result would be positive for EJ populations. However, they do not state how a recipient should determine when an adverse effect is considered disproportionately high and adverse.

2   DEVELOPING THE DRAFT LRTP DI/DB POLICY

2.1   History of the MPO's LRTP DI/DB Policy

Released in 2015, *Charting Progress to 2040* was the first LRTP in which the MPO used a DI/DB policy (which was in draft form) to assess the MPO-funded projects in the LRTP Recommended Plan that can be modeled for potential disparate impacts and disproportionate burdens. That policy used the four-fifths rule and stated that, for any impact, if the protected population was projected to receive at least 20 percent fewer benefits or 20 percent more of a burden than

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[15] United States Department of Transportation, Department of Transportation Order 5610.2(a): Final DOT Environmental Justice Order, (2012), last modified June 28, 2017, www.fhwa.dot.gov/environment/environmental_justice/ej_at_dot/orders/order_56102a/.

the non-protected population, respectively, there would be a potential future disparate impact or disproportionate burden.

In *Charting Progress to 2040,* several metrics were evaluated for potential impacts, which fell into three categories: accessibility, mobility, and air quality. MPO staff encountered shortcomings with the analysis. First, very small and likely insignificant differences between the impacts on protected and non-protected populations were labeled as disparate impacts or disproportionate burdens. Second, there was limited evidence that a threshold of 20 percent indicated that an impact met the DOJ guidance described above.

As a result, staff committed to further pursuing a more robust DI/DB policy to use in subsequent LRTPs that would

- reflect the uncertainty inherent to the travel demand modeling process that is used to conduct the DI/DB analysis to ensure that the impacts identified are not due to model uncertainty; and

- identify when potential impacts would be practically significant.

These changes would not only better align the DI/DB Policy with federal guidance but would also ensure that the MPO allocates resources to address real and meaningful impacts. In addition, staff saw an opportunity to engage the public in the development of a new policy that would ensure that the policy reflected their interests.

2.2   Developing the Policy

MPO staff is pursuing a two-phased effort to develop the DI/DB Policy; this memo describes the first phase. The first phase took place in 2018 and 2019; the second phase will begin in FFY 2020. Staff aims to develop a policy that complies with federal guidance, is informed by public input, and addresses the shortcomings of the DI/DB Policy used for *Charting Progress.* For the first phase, during the spring and summer of 2018, staff undertook a public engagement process to solicit stakeholder input into crafting the policy. Staff presented the results to the MPO board members on October 4, 2018 to update the board on staff progress and receive its input.

Staff also systematically reviewed federal guidance from the FTA, FHWA, and the DOJ regarding disparate impact and EJ requirements. During the fall and winter, staff then synthesized this research and the public input to update the DI/DB analysis methodology, revise the metrics that would be analyzed for potential disparate impacts and disproportionate burdens, and quantify uncertainty in the travel demand modeling process. Subsequently, staff

developed a new draft DI/DB policy that incorporated all of this input into the draft policy. It was presented to the MPO on May 2, 2019, to get member input on the draft policy and to relay staff's plans for phase two. Members commented on the need to address how the DI/DB analysis would balance the potential benefits and burdens that may result. This issue is addressed in the draft DI/DB Policy. The MPO supported staff's use of the draft policy for *Destination 2040*, which is the current LRTP, and the planned continued efforts to update the policy in phase two*.*

Public Input

MPO staff undertook an intensive public engagement effort so that public input would directly inform the policy. Staff convened a stakeholder working group and one public workshop to solicit input from the public at large. The goals of the outreach were twofold:

- For the stakeholder working group to reach a consensus on a recommendation for the DI/DB policy
- To get input from stakeholders and the general public on transportation impacts that affect the region. The input was used to update the metrics that are assessed for disparate impacts and disproportionate burdens

There were also several ancillary goals. One was to educate participants in the stakeholder working group, which included four MPO board members, about the purpose of a DI/DB policy and why the MPO should have one. Another goal was to hear from the public and stakeholders about their specific concerns regarding the development and implementation of a DI/DB policy, as well as the MPO's approach to transportation equity as a whole. The final goal was to build trust with members of the public by involving them early and ensuring transparency of the MPO's decision-making process around developing the policy.

Three stakeholder working group meetings were held between May and July of 2018, and a public workshop was held in June 2018. Stakeholders consisted of four MPO members and eight stakeholders who work with traditionally underserved populations. The latter eight stakeholders included neighborhood groups, human service agencies, and transportation advocacy groups, and represented a range of different perspectives and constituencies in the Boston region. The meetings were discussion based, and stakeholders provided input about the most important transportation impacts that affect the region and how the DI/DB policy could identify disparate impacts and disproportionate burdens.

Stakeholders raised several concerns that influenced their recommendations. First, several were concerned that allowing any difference between the impacts

on the protected and non-protected populations would perpetuate inequities. Second, most felt they needed more information about the practical implications of choosing one threshold for determining a disparity over another. Finally, several stakeholders thought the MPO should set a separate threshold for each metric to reflect the magnitude of change that would meaningfully affect people. For example, a 10 percent increase in carbon monoxide emissions may be more harmful than a 10 percent increase in travel time, and they wanted the thresholds to reflect that. In light of these considerations, the stakeholders provided the MPO with a two-part recommendation:

1) The MPO should further work to identify appropriate thresholds for each metric. Until those are determined, if the MPO's analysis shows that the protected population would likely be more adversely than the non-protected population, it should be labeled as a potential disparate impact or disproportionate burden.

2) The MPO should report on the analysis for each metric, in addition to stating whether they may be disparate or disproportionate based on the DI/DB policy.

The current draft DI/DB Policy follows the working group's recommendation. In phase two, staff will identify thresholds for each metric in order to determine practical significance for each metric. Staff will also provide more information in the LRTP on the results of the DI/DB analysis.

Stakeholders' concern about perpetuating current inequities in the transportation system is a legitimate issue. However, addressing this concern is beyond the scope of the DI/DB Policy. As the Supreme Court has ruled, disparate impact regulations only address those impacts that have been or are projected to be caused by an action undertaken by the recipient. This means the DI/DB Policy only applies to impacts that are projected to result from the MPO's funding decisions once the projects are built, not impacts that result from the existing transportation network. The MPO has other policies that address transportation equity-related concerns and can choose to develop new policies that address these issues.

Selecting Metrics for Evaluation

MPO staff received input from stakeholders and participants in the public workshop on impacts that could be analyzed for disparate impacts and disproportionate burdens. Staff categorized the impacts by those that the MPO currently has the tools to analyze, those that require more staff investigation before they can be analyzed, and those that are not applicable in the LRTP DI/DB analysis because (1) they do not align with federal requirements, (2) data

are unavailable, and/or (3) they do not result from the implementation of the LRTP projects. Appendix B shows the impacts in each of these categories. Stakeholders were then asked to prioritize the impacts that the MPO currently has the tools to analyze in *Destination 2040*. In order of most important to least important, their priorities were the following:

1. Access to jobs
2. Access to health care
3. Transportation network connectivity
4. Access to public transit at off-peak hours
5. Congestion
6. Emissions (carbon monoxide and particulate matter)
7. Travel time to work
8. Mode share

MPOs have latitude in selecting metrics to evaluate for disparate impacts and disproportionate burdens. Title VI is expansive in its language regarding what constitutes an adverse effect: under the law, protected classes may not "be excluded from participation in, denied benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." USDOT Title VI implementing regulations further state that recipients may not deny a person any service or benefit, nor afford a person opportunities to participate or receive any service or any benefit that is different from those afforded to others.[16] Given this expansiveness, DOJ's *Title VI Manual* recommends employing a broad definition of adversity or harm. This not only provides regulators with important context, but also informs the development of an appropriate remedy if the recipient is found to be noncompliant.[17]

USDOT's EJ Order is more specific about what constitutes an adverse effect. It states that adverse effects are those related to public health, the environment, and other interrelated social and economic effects.[18] FTA and FHWA EJ guidance provide examples of these effects, such as emissions, travel time, congestion, safety, economic vitality, environmental degradation, and access to transportation options. As with adverse effects described under Title VI, adverse effects under the EJ EO may include the denial, reduction, or delay of benefits (such as a decrease in transportation options) or the imposition of burdens (such as increased exposure to pollution).

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[16] Nondiscrimination in Federally Assisted Program of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964, 49 C.F.R. § 21.5(b)(1)(i)(ii)(vi), (1970).

[17] Department of Justice, *Title VI Legal Manual: Section VII*, 12–3.

[18] United States Department of Transportation, "DOT Environmental Justice Order 5610.2(a)."

The *Title VI Legal Manual* describes some instances where a recipient's practice causes a mix of benefits and burdens and where the alleged harm may be difficult to quantify. This is the case with the MPO's LRTP DI/DB analysis, given the wide range of both beneficial and adverse impacts that typically result from transportation projects. In this situation, the DOJ recommends that if there is a potential disparate impact violation, FTA and FHWA, as the investigating agencies, consider whether the benefits of the practice in question offset the adverse effects.[19]

Over the development of several LRTPs, the MPO has analyzed several metrics to identify potential impacts of the MPO-funded projects on minority and low-income populations (although, prior to *Charting Progress to 2040*, the impacts were not assessed for potential disparate impacts and disproportionate burdens). The metrics have fallen into three categories: accessibility metrics (including access to healthcare facilities, jobs, and higher education), mobility metrics (including travel time), and environmental metrics (including air quality). MPO staff updated these metrics in response to input received from public outreach, and in the fall of 2018 established a preliminary set of metrics to analyze for disparate impacts and disproportionate burdens.

Metrics are evaluated using a regional travel demand model that analyzes the effects of the transportation network on each population. One scenario is run in which the transportation network in the horizon year of the LRTP (for *Destination 2040,* this is 2040) includes the MPO-funded projects (build scenario) and another scenario is run in which the transportation network in the horizon year does not include the projects (no-build scenario). Travel behavior, land use, and demographic assumptions are held constant across both scenarios, so that the difference between the no-build and build scenarios represents the projected impact of the projects.

The draft DI/DB Policy does not include metrics because they will likely be updated more frequently than the policy itself based on advancements in analysis techniques and further input from the public and the MPO. Over the next several years, staff will begin to assess the feasibility of analyzing those impacts that were marked as needing more investigation (see Appendix B).

Quantifying Model Uncertainty

Like any attempt to forecast the future, travel demand modeling is subject to uncertainty. The model is a complex assembly of data inputs, assumed travel behaviors, statistical relationships, and algorithms. Forecasting error, a statistical measure of the difference between a forecasted value for a metric and its "true"

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[19] Department of Justice, *Title VI Legal Manual: Section VII*, 14–6.

value, is unknown for the unobserved future; however, an interval of values can be estimated (upper and lower bounds), with a high degree of confidence, within which the true value of the metric should lie.

During the fall of 2018 and winter of 2019, MPO staff conducted a study to estimate the forecasting error for each of the preliminary metrics that resulted from the public outreach process. This preliminary set of metrics was used to estimate forecasting error:

- Accessibility
    - Number of jobs within a 60-minute auto trip
    - Number of jobs within a 60-minute transit trip
    - Number of retail jobs (proxy for access to amenities, such as shopping, banking, etc.) within a 30-minute auto trip
    - Number of retail jobs (proxy for access to amenities such as shopping, banking, etc.) within a 60-minute transit trip
    - Healthcare services, weighted by hospital beds, within a 20-minute auto trip
    - Healthcare services, weighted by hospital beds, within a 40-minute auto trip
    - Number of two- and four-year institutions of higher education, weighted by enrollment, within a 20-minute auto trip
    - Number of two- and four-year institutions of higher education, weighted by enrollment, within a 40-minute transit trip
- Mobility
    - Transit production time: average door-to-door travel time for all transit trips produced in transportation analysis zones (TAZ) within the MPO region
    - Average door-to-door travel time for all transit trips attracted to TAZs within the MPO region
    - Average door-to-door travel time for all auto trips produced in TAZs within the MPO region
    - Average door-to-door travel time for all auto trips attracted to TAZs within the MPO region
- Environmental
    - Carbon monoxide emissions per square mile
    - Congested vehicle miles traveled per square mile

The general approach was to test the regional travel demand forecasting model's sensitivity to changes in key model inputs, which the MPO staff judged to be the main drivers of uncertainty in the model system and thus affect how it responds to a build scenario analysis. (See Appendix A for the inputs used to test model sensitivity.) First, staff discussed and agreed on plausible minimum and maximum values for each input under a hypothetical LRTP scenario (typically plus or minus 20 to 50 percent from current values). Next, staff ran the regional modeling system 30 times, systematically varying the values of these key inputs according to a rigorous experimental design, and collecting data on how the output metrics change with each model run. For each run, staff calculated the metrics separately for the protected and non-protected population groups weighted by their respective populations in each geographic zone in the modeling system.

Using the results of these 30 runs as a sample of system performance, staff were then able to correlate statistically how the output metrics change when the key input variables are varied, developing a much simpler, predictive tool—a linear meta model—that provided an instant estimate for the value of a metric for a given set of values for the key inputs. This meta modeling approach was essential to making this study tractable; the computational time required to run the full regional travel model can take many hours for a single pass and may span as many as two days with feedback loops, which are used to ensure stable results. In contrast, staff were able to run a set of meta models for each metric and population group thousands of times in a matter of minutes, each run using a different combination of inputs, within their expected ranges of values. The results were a bell-shaped distribution of values for each metric, stratified by the four population groups (minority, nonminority, low-income, and non-low-income populations).

Staff used these distributions of predictions to derive forecasting error intervals, based on a 95-percent confidence interval. This was performed for each metric for each of the four population groups. The resulting forecasting error intervals were expressed as the maximum variation (positive or negative) from the mean value of the distribution that should be expected due to uncertainty. To make forecasting error intervals generalizable for applied analysis, staff assumed symmetry about the mean value, for each metric taking the average of the absolute values of the positive and negative deviations and expressing this as a single absolute percentage error. This error could then be used as part of the draft DI/DB Policy to establish causation and adversity and identify those impacts that are likely due to implementation of the LRTP and not model uncertainty.

The results of this study showed that some of the metrics on the preliminary list would not be appropriate to analyze for disparate impacts and disproportionate

burdens because they have too much uncertainty—in particular, all highway accessibility metrics. This is because of the broad highway network coverage beyond the MPO, the wide range of trip options due to the built-out nature of the highway network, and high uncertainty in some of the 2040 estimates of input data, such as future job locations. On the other hand, transit accessibility metrics showed very low uncertainty due to the constrained nature of the transit network and walk accessibility. The mobility and environmental metrics also showed reasonably low uncertainty. As a result of this work, staff decided to use all of the preliminary metrics—except access to jobs, healthcare facilities, and higher education by highway trips—as the final set of metrics that would be analyzed for disparate impacts and disproportionate burdens in *Destination 2040*'s DI/DB analysis.

3   CONDUCTING A DI/DB ANALYSIS USING THE DRAFT DI/DB POLICY

3.1   Approach to Identifying Potential Disparate Impacts and Disproportionate Burdens

The MPO's process for identifying and addressing disparate impacts and disproportionate burdens in the LRTP consists of three steps

1. applying the draft DI/DB Policy to identify potential future disparate impacts or disproportionate burdens;

2. providing a justification for implementing the policy or practice in question (for disparate impacts) or by determining that there is a substantial need for the policy or practice for public interest (disproportionate burdens) if potential future disparate impacts or disproportionate burdens are identified; and

3. determining if there are any alternatives that could be implemented that would have fewer disparate impacts or disproportionate burdens.

In this process, impacts on minority and low-income populations are analyzed separately, and the MPO's approach to addressing disparate impacts and disproportionate burdens reflects the regulatory differences between Title VI and the EJ EO.

Applying the LRTP draft DI/DB Policy is the first step in this process. It meets both Title VI and EJ mandates. By establishing a DI/DB policy, the MPO will meet these requirements in a clear and consistent manner. Because of the similarities between these mandates, the Policy uses the same methodology to assess disparate impacts and disproportionate burdens even though the analyses are completed separately for each protected population. When final, the DI/DB Policy will consist of a three-part analysis:

1. **Establish causation:** For each metric, determine if the LRTP investments would likely impact the protected population.

2. **Establish adversity:** If causality is established, determine if the impact would adversely affect the protected population more than the non-protected population.

3. **Establish practical significance:** If adversity is established, determine if the difference in the projected impact between the protected and non-protected population is practically significant.[20]

The methodologies for the first two parts have been developed through phase one and are part of the current draft DI/DB Policy. Establishing practical significance will be completed in phase two. There are several reasons for this approach:

- **Establishing causation, adversity, and practical significance meets federal disparate impact and EJ guidelines.** The draft DI/DB policy addresses each of these factors. Forecasting error estimated for each metric is used to establish both causation and adversity. Doing so accounts for model uncertainty and avoids false findings of disparate impacts or disproportionate burdens, which will help the MPO avoid using resources to address them. Finally, the thresholds that will be developed as part of phase two will establish practical significance.

- **It clearly shows FTA, FHWA, and the public how the MPO identifies potential future disparate impacts and disproportionate burdens.** Providing this clarity should reduce the likelihood of a federal investigation with regards to potential Title VI violation. It will also provide the public with a transparent rationale and process about how the MPO identifies potential disparate impacts and disproportionate burdens.

- **It addresses the two concerns with the draft policy used in *Charting Progress to 2040.*** MPO staff wanted this policy to address two concerns with the one used in *Charting Progress to 2040,* (1) that the sensitivity of the travel demand model can lead to small and potentially insignificant changes being labeled as disparate impacts or disproportionate burdens, and (2) that there is limited evidence that shows that one threshold is better than another when evaluating practical significance in transportation

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[20] See also Peresie, "Toward a Coherent Test for Disparate Impact Discrimination" for more on the argument for having distinct analyses to address each step as a part of identifying potential disparate impacts. (Jennifer L. Peresie, "Toward a Coherent Test for Disparate Impact Discrimination," *Indiana Law Journal* 84, no. 3 [2009]: 773.)

planning. The first concern is addressed by factoring modeling uncertainty into the draft policy. The second will be addressed in phase two.

3.2   Applying the DI/DB Policy

This section describes how the current draft DI/DB Policy is applied, as well as the final step that will be developed after phase two is completed. An example of hypothetical model outputs of average regionwide travel time is used to show how the analysis is done. Model results represent regionwide weighted averages; for example, travel time represents the average travel time for the entire minority population in the region.

The MPO's draft DI/DB Policy for the LRTP only applies to the impacts that may result from projects in the Recommended Plan that can be modeled, which are those that change the capacity of the transportation network. Projects funded under the other MPO investment programs are analyzed as part of the Transportation Improvement Program.

Step One: Establish Causation

To establish causation, for each metric, staff multiplies the percent error by the no-build result to get the maximum absolute value of a change in the metric (forecasting error margin) that could be the result of model uncertainty. The no-build scenario result is then subtracted from the build scenario result to get the projected impact of the projects on each population. The absolute value of the projected impact is compared to the absolute value of the metric's forecasting error margin. If the absolute value of the projected impact is greater than the absolute value of the forecasting error margin, there likely would be an impact to that population and causation would be established.

Table 1 shows hypothetical results from the travel demand model of travel time, and the projected change between the no-build and build scenarios.

Table 1
Hypothetical Example of DI/DB Analysis for Travel Time

Population	Scenario	Average Travel Time (Minutes)	Projected Impact (Minutes)
Regionwide minority population	No-build	10	NA
	Build	12	2
Regionwide nonminority population	No-build	20	NA
	Build	22	2

DI/DB = Disparate Impact and Disproportionate Burden. NA = not applicable.

Then the following calculations are done for each population:

Minority Population

Where the forecasting error margin for travel time is ±1 minute:

1) Calculate the travel time impact: Build scenario minus No-build scenario = 12 minutes minus 10 minutes = +2 minutes

2) Comparison of the absolute value of the projected impact to the absolute value of the forecasting error margin: |2 minutes| > |1 minute|

3) Result: Since 2 minutes is greater than 1 minute, the impact would likely be due to the MPO-funded projects in the Recommended Plan.

Nonminority Population

Where the forecasting error margin for travel time is ±3 minutes:

1) Travel time impact: Build scenario minus No-build scenario = 22 minutes minus 20 minutes = +2 minutes

2) Comparison of the absolute value of the projected impact to the absolute value of the forecasting error margin: |2 minutes| < |3 minutes|

3) Result: Since 2 minutes is less than 3 minutes, the impact would likely be due to the MPO-funded projects in the Recommended Plan.

Step Two: Establish Adversity

For any metric for which causation is established, the projected impact on the protected population is compared to that on the non-protected populations to determine whether the protected population would be more adversely affected than the non-protected population. If the adverse effect on the protected population is greater, it would be projected to bear a disproportionate share of the impact. For some impacts (such as travel time) an increase from the no-build to build scenarios indicates a burden and a decrease indicates a benefit, while for other metrics the reverse is true (such as access to jobs).

Using the draft policy, any impact that is projected to adversely affect the protected population more than the non-protected population, and where the MPO can be confident that this is not due to model uncertainty, would be a potential future disparate impact or disproportionate burden.

In the example above, the MPO region's minority population would likely experience an increase in regionwide travel time, whereas the MPO region's nonminority population would not. The analysis also shows that this would not be due to model uncertainty. Therefore, the minority population would be projected

to experience a greater burden than the nonminority population. This would indicate a potential future disparate impact. The thresholds developed in phase two will be added to the draft DI/DB Policy to indicate whether the minority or low-income population is likely to be affected significantly more than the nonminority or non-low-income population.

Step Three: Establish Practical Significance

Thresholds that determine practical significance will be developed in the second phase of this work, which will begin in FFY 2020. This work will explore the magnitude of changes in various transportation impacts (such as an increase in travel time or carbon monoxide emissions) that would meaningfully affect protected populations. This work is expected to produce specific thresholds for each metric that is analyzed for disparate impacts and disproportionate burdens. These thresholds will indicate the percentage more of a burden or less of a benefit that would indicate that the impact would be significantly high and adverse for the minority or low-income population, as required by federal guidance. The DI/DB Policy will be revised to reflect the results of phase two.

4   CONCLUSIONS AND NEXT STEPS

This memo describes the first phase of the MPO's development of a draft DI/DB policy that will be used to evaluate the MPO-funded projects in the LRTP Recommended Plan that can be modeled. It describes federal guidance for identifying and addressing potential disparate impacts and disproportionate burdens that may result from MPO investments, input from the DI/DB public engagement process, and work undertaken to quantify travel demand model uncertainty. It then describes how the MPO staff used that information to develop the MPO's three-step method for identifying potential disparate impacts and disproportionate burdens. The current draft policy covers the first two parts—establishing causation and adversity—that were developed in the first phase of this work; the third part, establishing practical significance, will be developed in phase two.

This draft DI/DB Policy balances the input received from the public, the interests of the MPO board, and the concerns of travel forecasting, while complying with federal Title VI and EJ guidance. As the MPO staff moves on to phase two, the policy will be updated to reflect staff's findings and continued feedback from the MPO. The work that staff has completed up to this point represents a solid foundation with which to continue this work, while providing the MPO with a DI/DB Policy with which to use going forward.

APPENDIX A: INPUTS USED TO ASSESS THE UNCERTAINTY IN THE TRAVEL DEMAND MODELING PROCESS

1. Auto operating costs
2. Transit fares
3. Toll costs
4. Value of time
5. Household sizes
6. Job locations
7. Transit mode bias
8. Walk and bike mode bias
9. Trip length sensitivity
10. Transit wait times and walk sensitivity
11. Transit service frequency
12. Park-and-ride lot supply
13. Roadway capacities
14. Congestion-delay sensitivity
15. Peak spreading factors
16. Work trip generation
17. Non-work trip generation
18. Truck trip generation

APPENDIX B: IMPACTS IDENTIFIED DURING PUBLIC ENGAGEMENT

Table B-1
Transportation Impacts Identified at the Second Working Group Meeting and the Public Workshop

Impacts that could be assessed in the short term (0–3 years)	Impacts that could be assessed in the long term (3–5 years)	Impacts that are not applicable[3]
• Access to commuter rail stations[1] • Access to healthcare facilities[1] • Access to public transit service at off-peak hours[1,2] • Access to recreational space[1,2] • Access to retail jobs[1] • Carbon monoxide emissions[1] • Commuter rail use[1] • Congestion[1,2] • Mode share[1,2] • Particulate matter emissions[1] • Time spent transferring[1,2] • Access to jobs by public transit[2] • Transportation network connectivity[1,2] • Travel time to work[2]	• Access to active transportation options[1,2] • Availability of structured bicycle parking[2] • Availability of transportation options[1] • Access to public transit in the suburbs[2] • Access to transportation for people with disabilities[1,2] • Bicycle and pedestrian safety[1] • BRT effects on travel time[2] • Climate change impacts and resiliency[1] • Cost of bikeshare memberships relative to household income[1] • Cost of transportation as a function of household income[1,2] • Density increases near transportation investments[1] • Frequency of public transit service[1,2] • Health effects after displacement[1] • Major roads dividing neighborhoods[2] • Impact of transportation on real estate prices[1] • Improvements to transit[1] • Increase in TOD density near transportation investments[1] • Maintenance funding[2] • New housing near public transit investments[1] • North-south connections[2] • Other air quality impacts[2] • Parking availability[1] • Reliability of public transit and paratransit[1,2] • Reverse commute options[1] • Safety[2] • TNCs impact on transit[2] • Transportation access and options available to the elderly[1]	• Disconnect between projects and what the public wants[1] • Enforcement of traffic rules[2] • Excessive parking requirements[2] • Gentrification[2] • Greenway maintenance[2] • Impact of the Big Dig on willingness to undertake large transportation projects[1] • Impact of the transportation system on all aspects of life[1] • Impacts of new technology[2] • Lack of proactive transportation planning[1] • Lack of revenue generation[1,2] • Lack of support for transportation in the Massachusetts legislature[1] • Legible and people-focused wayfinding[1] • Noise[2] • Ownership of different vehicle types[1] • Partnerships between transportation agencies and private companies[2] • Political will[1] • Regulation of ridesharing and TNCs[1,2] • Reliability of public transit in inclement weather[1] • Transit timing[1,2] • Uneven distribution of advocacy between wealthier and poorer communities[1] • Use of zero-emissions vehicles[1]

- Transportation connections between communities[2]
- Transportation costs after displacement[1]
- Transportation network connectivity[1]

[1] Impacts identified by stakeholders
[2] Impacts identified by members of the public
[3] Impacts in this column are not applicable to the Long-Range Transportation Plan Disparate Impact and Disproportionate Burden analysis because they do not align with federal requirements, accurate data are unavailable, and/or they involve impacts that the MPO-funded projects in the Recommended Plan do not affect.
BRT = bus rapid transit. TNC = transportation network company. TOD = transit-oriented development.