



# BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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## MEMORANDUM

**DATE:** June 15, 2017  
**TO:** Boston Region MPO  
**FROM:** Anne McGahan and Michelle Scott, MPO Staff  
**RE:** Scenario Planning Recommendations for Next LRTP

### 1 INTRODUCTION

Scenario planning—that is, the process of analyzing outcomes from specific actions in a potential future environment—is a tool to explore and identify preferred future transportation and land use scenarios for the region. This tool can have multiple applications for the Boston Region Metropolitan Planning Organization's (MPO) transportation planning and programming activities. To develop the Long-Range Transportation Plan (LRTP), for example, the MPO has and will continue to use scenario planning to discern how certain investment strategies can help the MPO meet its goals. The MPO can also use scenario planning as part of its performance-based planning and programming (PBPP) process, in order to set achievable targets and estimate the degree to which various strategies could improve performance of the region's transportation system.

In this memorandum, we discuss important aspects of scenario planning and suggest ways we could use it in creating the MPO's next LRTP (Task Four of the FFY 2017 LRTP Work Plan). We describe the MPO's past use of scenario planning, explain how it can fit into the LRTP development process, and recommend specific scenarios for analysis in the near term.

We anticipate that the MPO will adopt its next LRTP in early 2019. During the LRTP development process, the MPO can engage in multiple rounds of scenario planning, depending on planning needs, areas of interest, and the development schedule. In initial rounds, staff can explore ideas and issues in a relatively unconstrained way, and can test tools and analytical methods. In later phases, the MPO can incorporate new or updated data, reflect new information from LRTP outreach and Needs Assessment updates, and apply financial constraints. The MPO can also adjust its methods as staff enhances its scenario planning skills and identifies lessons learned during early rounds of scenario testing.

For an initial scenario planning exercise, we suggest two sets of transit-oriented investment actions (see Section 3):

1. **Transit Expansion:** Test Groups of Transit Projects from a Universe of Projects
2. **Transit Reliability and Modernization:** Test Outcomes of Changes to Transit Operations

The MPO may choose to explore additional scenarios prior to the final development of the next LRTP, or for other ongoing planning purposes—such as PBPP analyses.

## 2 THE SCENARIO PLANNING PROCESS

### 2.1 Scenario Planning’s Role in LRTP Development

The information gleaned from scenario planning may be used to support various stages of the LRTP and PBPP planning process (see Table 1).

**TABLE 1**  
**LRTP Stages and Scenario Planning**

<b>LRTP and PBPP Activity</b>	<b>Support from Scenario Planning</b>
Set goals and objectives	<ul style="list-style-type: none"> <li>• Clarify and update existing goals and objectives</li> <li>• Use information on outcomes to determine if new goals or objectives are needed</li> </ul>
Assess transportation system condition and capacity and determine existing and future needs	<ul style="list-style-type: none"> <li>• Examine identified needs, and the outcomes of addressing them</li> <li>• Identify additional needs</li> </ul>
Recommend projects and strategies	<ul style="list-style-type: none"> <li>• Examine potential outcomes of various program and project investments in future environments</li> </ul>
Monitor performance and set or adjust targets	<ul style="list-style-type: none"> <li>• Examine how various project and program investments may help achieve performance targets</li> <li>• Use information about outcomes to set reasonable targets</li> </ul>

LRTP = Long-Range Transportation Plan. PBPP = Performance-based planning and programming.

### 2.2 Aspects of Scenario Planning

Scenario planning makes it possible to:

1. Portray one or more possible future conditions, shaped by various **contextual factors**, in which the MPO will take action to improve the transportation system.
2. Show the possible **outputs** and **outcomes** of various MPO **policy and investment actions** in these future contexts.

A scenario is made up of a specific set of contextual factors and actions. The MPO can use various analytic tools, such as the regional travel demand model set, to project potential outputs and outcomes of specific MPO actions in a particular scenario environment.

**Contextual factors** are the characteristics of the future environment. These factors can include demographic characteristics, land use, transportation system features and policies, transportation trends, travel behavior, and climate and energy use patterns. For example, the MPO has a set of demographic and land use assumptions that were used in past scenario planning activities as well as for its most recently adopted LRTP—*Charting Progress to 2040*.

**MPO policy and investment actions** can include distributing MPO Regional Target funds across existing investment programs or creating new types of funding programs to improve the transportation system.

Performance measures are used to track the **outputs** and **outcomes** of interactions between these contextual factors and MPO actions.

Table 2 lists contextual factors; and Table 3 lists possible MPO policy and investment actions. Each table provides examples; and the MPO may continue to add items to each list throughout the scenario planning process. In Section 4, we discuss performance measures for understanding outputs and outcomes.

**TABLE 2**  
**Potential Contextual Factors**

Contextual Factor	Details and Examples	MPO Consideration
Demographics	Includes population, household, and employment characteristics for the region.	<i>Charting Progress to 2040</i> used demographics based on assumptions in MAPC's MetroFuture land use plan.
Land use	Involves allocating demographic data into residential, commercial, institutional, open space, and other land uses. Accounts for the density of these uses.	Land use allocation uses the MPO's land use model (CubeLand) and information from MAPC's MassBuilds tool. <sup>1</sup>
Transportation system features	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Highway network roadway conditions</li> <li>• Fixed-route transit network, and service characteristics</li> <li>• Shuttle services</li> <li>• Availability of shared-use mobility services (e.g., TNCs and bike share)</li> <li>• Availability of AV/ CV technology</li> <li>• Residential parking regulations</li> <li>• Employer parking fees</li> </ul>	<p><i>Charting Progress to 2040</i> reflected the existing MBTA fixed-route transit system, MetroWest, Cape Ann, and other regional transit agencies' transit systems, and some transportation management association shuttle services.</p> <p><i>Charting Progress to 2040</i> did not account for TNCs that are currently in operation, residential parking regulations, and employer parking.</p>
Transportation trends and travel behavior	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Household vehicle ownership</li> <li>• Personal-miles traveled or vehicle-miles traveled</li> <li>• Mode share</li> <li>• Transportation system reliability (consistency or dependability)</li> </ul>	<p>Some of these factors were included in the <i>Charting Progress to 2040</i> scenarios, and are accounted for in the current travel demand model set. These factors could be altered in future scenarios.</p> <p>Reliability was not accounted for in the <i>Charting Progress to 2040 scenarios</i>, or in the current model set.</p>
Policies and finances	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Estimates of Regional Target funding</li> <li>• Other funding for transportation</li> </ul>	<p><i>Charting Progress to 2040</i> scenarios assumed that \$2 billion in regional target funding would be available over the 25-year life of the plan.</p>
Climate and Environment	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Sea level rise</li> <li>• Flooding</li> </ul>	<p>These factors were not accounted for in <i>Charting Progress to 2040</i>.</p>

AV/ CV = Autonomous vehicle/ connected vehicle. MAPC = Metropolitan Area Planning Council. TNC = Transportation network company (for example, Uber and Lyft).

<sup>1</sup> MAPC's MassBuilds tool is a development database that inventories development in the region that is completed, proposed, or under construction.

**TABLE 3  
Potential MPO Actions**

<b>Potential MPO Action</b>	<b>Details and Examples</b>	<b>MPO Consideration</b>
Distribute funding across existing MPO investment programs	Current MPO investment programs: <ul style="list-style-type: none"> <li>• Intersection Improvements</li> <li>• Complete Streets Roadway Improvements</li> <li>• Bicycle Network and Pedestrian Connections</li> <li>• Community Transportation/ Parking/ Clean Air and Mobility</li> <li>• Major Infrastructure</li> </ul>	These programs were created as part of <i>Charting Progress to 2040</i> .
Create new investment programs	Programs that potentially could support: <ul style="list-style-type: none"> <li>• Transit state-of-good repair</li> <li>• Climate-adaptation transportation projects</li> <li>• Transit-oriented development-related transportation projects</li> <li>• Bus rapid transit-related roadway improvements</li> </ul>	
Fund projects from other planning processes	<ul style="list-style-type: none"> <li>• MassDOT LRTP</li> <li>• MBTA Focus40 Plan</li> <li>• MassDOT/ MBTA CIP</li> </ul>	In past LRTPs, the MPO funded portions of the Green Line Extension and Assembly Square station.
Fund projects that would support defined networks	<ul style="list-style-type: none"> <li>• Bay State 100 [bikeway] network</li> <li>• CTPS (or other agency-defined) bicycle network</li> </ul>	In past LRTPs, the MPO funded portions of defined bicycle networks.
Fund projects or implement policies identified in MPO or other agency studies	Projects potentially could fund recommendations from MPO studies, such as: <ul style="list-style-type: none"> <li>• Addressing Priority Corridors from the LRTP Needs Assessment</li> </ul>	

CIP = Capital Investment Plan. CTPS = Central Transportation Planning Staff. LRTP = Long-Range Transportation Plan. MassDOT = Massachusetts Department of Transportation. MBTA = Massachusetts Bay Transportation Authority. MPO = Boston Region Metropolitan Planning Organization.

## 2.3 Past MPO Scenario Planning Activities

In developing the current LRTP, *Charting Progress to 2040*, MPO staff used scenario planning to consider two different approaches to addressing mobility needs during the next 25 years. We focused on a specific question related to a proposed objective within the MPO's Capacity Management and Mobility goal:

“Should the MPO give priority in a congestion reduction program to major arterials and express highways throughout the region which serve transit and/or existing population and places of employment?”

The alternative to focusing on these primarily high-cost roadway projects would be to concentrate on lower-cost, often multimodal types of investments.

To study this issue, the MPO looked at a scenario that had a large percentage of Regional Target funding dedicated to major arterial and express highway projects, otherwise referred to as high-cost capital (or major infrastructure) investment projects. It also looked at a scenario that focused on lower-cost operations and management projects, such as intersection improvements and Complete Streets projects on arterial roadways.

This *Charting Progress to 2040* scenario planning process used the following contextual data:

- **Demographics and Land Use:** Demographic information based on MAPC's MetroFuture regional plan and a land use allocation based on CubeLand, and the MassBuilds tools
- **Transportation System Features:** The regional roadway network and the MBTA transit system, as reflected in the 2040 No-Build network for *Charting Progress to 2040*<sup>2</sup>

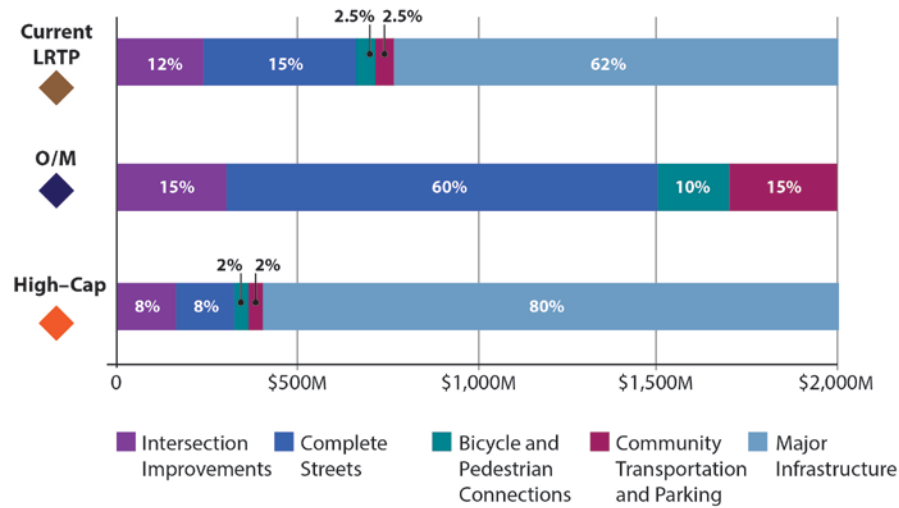
Figure 1 depicts distribution of funds across a number of investment programs according to the following three scenarios (which staff examined using the same contextual background):

1. **Current LRTP:** Reflects the funding plan in *Paths to a Sustainable Region* (the MPO's previous LRTP, called “Current LRTP” in the figure)
2. **High-Cap:** Targeted funds to high-cost capital investment projects
3. **O/M:** Targeted funds to lower-cost operations and management (O/M) projects

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<sup>2</sup> For planning purposes, the 2040 No-Build network was structured around the 2012 Base Year and projects that were constructed between 2012 and 2015, as well as those that were currently under construction, and those programmed in the first year of the 2015–2018 Transportation Improvement Program.

**FIGURE 1**  
**Funding Distribution Scenarios in *Charting Progress to 2040***



MPO staff next analyzed various performance measures, and determined that the O/M scenario, which focused on lower-cost projects, was more effective at addressing a diverse set of MPO goals. It also provided more opportunities to distribute Regional Target funding throughout the MPO region, as opposed to concentrating it in a few specific locations. As a result of these analyses, the MPO implemented a series of investment programs—including those for Complete Streets roadway improvements, intersection improvements, bicycle and pedestrian infrastructure improvements, and community transportation—within each of the five-year programming time bands in the LRTP.

### 3 STAFF PROPOSALS FOR THE NEXT ROUND OF SCENARIO ANALYSIS

This section describes MPO staff’s proposals for scenario planning for the early development phase of its next LRTP (anticipated adoption in 2019). Staff can use the experience and results from this initial phase to inform how it may want to conduct subsequent rounds of scenario planning—when new or updated demographics, financial, and other information becomes available, for example—before developing the final LRTP.

#### 3.1 Proposed Theme

As discussed above, the MPO scenarios analyzed for *Charting Progress to 2040* focused on highway, bicycle, and pedestrian travel in the region. Staff recommends that the initial round of scenarios for the next LRTP focus on transit.

Going forward, we expect demand for transit to grow even if no major changes are made to the region’s transit system. The travel demand model results for

*Charting Progress to 2040* show that there were 898,000 transit person-trips in the Boston Region MPO area in 2012; and this is projected to increase to 1.1 million by 2040. Further, there were 1.2 million *unlinked transit trips* in 2012; projected to increase to 1.6 million in 2040.<sup>3</sup> These transit forecasts show that 57 percent of trips would take place on the rapid transit system, 8 percent on commuter rail, 34 percent via bus (including local express and bus rapid transit networks) and 1 percent on ferries. Moreover, when MPO staff conducted public outreach on transportation needs for *Charting Progress to 2040*, people throughout the region highlighted the importance of investments to improve transit availability and reliability.

In addition, the MPO recently completed its Core Capacity Constraints study, which identifies capacity constraints on the Orange Line, Red Line, and branches of the Green Line now and in the future. The study showed that increased demand would be a direct consequence of many new development projects that will feed into the transit system in the core of the Boston Region MPO area.

Many of the MPO's adopted objectives focus on or relate to transit (see Table 4).

**TABLE 4**  
**MPO Goals and Transit-related Objectives**

<b>MPO Goal</b>	<b>Transit-related Objectives</b>
System Preservation	<ul style="list-style-type: none"> <li>• Maintain and modernize transit assets throughout the system</li> </ul>
Capacity Management and Mobility	<ul style="list-style-type: none"> <li>• Improve the reliability of transit</li> <li>• Increase automobile and bicycle parking capacity and usage at transit stations</li> <li>• Increase percentage of population and places of employment within one-quarter mile of transit stations and stops</li> <li>• Improve access to and accessibility of transit</li> </ul>
Clean Air and Clean Communities	<ul style="list-style-type: none"> <li>• Reduce greenhouse gas emissions and other transportation-related pollutants*</li> </ul>
Transportation Equity	<ul style="list-style-type: none"> <li>• Target investments to areas that benefit a large percentage of low-income and minority populations*</li> </ul>
Economic Vitality	<ul style="list-style-type: none"> <li>• Respond to the mobility needs of the 25–34 year-old workforce*</li> <li>• Prioritize transportation investments that serve targeted development sites*</li> </ul>

\* Transit service may help to accomplish this objective.

<sup>3</sup> An “unlinked” trip is an individual trip on any single transit vehicle; a single journey, often composed of many unlinked trips on multiple vehicles, is a “linked” trip.



Another reason to focus on transit for this initial scenario planning exercise is that in *Charting Progress to 2040*, the MPO only provided funding for its four O/M-oriented investment programs<sup>4</sup> in the last two five-year time bands of the LRTP (2031–2035 and 2036–2040). The MPO did not allocate future funding to the Major Infrastructure program during these time bands because it awaited the completion of several relevant processes:

- The Commonwealth’s Project Selection Advisory Council (PSAC) had not yet delivered its recommendations for a project prioritization process for MassDOT to use when developing its Capital Investment Plan (CIP).
- MassDOT’s CIP for both highway and transit projects had not been released.
- MassDOT was just beginning to develop *Focus 40*, its 25-year transit investment plan (formerly the Program for Mass Transportation).

The MPO wanted to determine if there were projects in these planning documents that it would want to fund with its Regional Target funding. Since adopting *Charting Progress to 2040* in May 2015, PSAC developed its project evaluation process, which is one of the tools used to score projects for potential inclusion in a MassDOT CIP. MassDOT has also developed two CIPs and expects to complete *Focus 40* this year.

Using information from these various plans and processes, the MPO could potentially flex highway funding to transit to support specific transit projects or as part of a transit investment program. The MPO also could use its target funding for roadway investments that benefit bus transit more aggressively, including implementation of transit signal priority and bus lanes.

### 3.2 Proposed Near-Term Scenarios

For this initial phase, staff proposes two sets of transit-related scenarios that could support discussion and help the MPO to prioritize investments in the next LRTP.

1. **Transit Expansion Scenario**—Test Groups of Transit Projects from a Universe of Projects
2. **Transit Reliability and Modernization Scenario**—Test Outcomes of Changes to Transit Operations

We seek feedback from MPO members about whether to analyze one or both sets of scenarios; and if both sets are of interest, then which set to analyze first.

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<sup>4</sup> The MPO’s four O/M investment programs include Intersection Improvements, Complete Streets, Bicycle Network and Pedestrian Connections, and Community Transportation/ Parking/ Clean Air and Mobility.

The two scenarios emphasize different aspects of three broad goals of MassDOT and MBTA investments, as described in the current CIP: reliability, modernization, and expansion, which overlap with several MPO goals: safety, system preservation, and capacity management and mobility.

The two sets of proposed scenarios will have several features in common:

- Both will describe what the region—including its transportation system—is expected to look like in 2040.
- Both will assume the demographics and baseline land use assumptions that were used in *Charting Progress to 2040*.
- Neither of the scenarios will reflect financial constraints. The goal for this initial set of scenarios is to ask *what if* questions and explore the potential results of programming certain types and amounts of transit projects, to see how much these investments may advance performance measures related to the MPO's goals and objectives.

### *Set 1: Transit Expansion Scenario—Test Groups of Transit Projects from a Universe of Projects*

While developing *Charting Progress to 2040*, the MPO staff created a Universe of Projects list to identify all potential projects and programs that could be considered for inclusion in the LRTP. The Universe of Projects listed 26 transit projects; examples include busways, the South Station Expansion project, and urban rail projects. The scenarios in this group would examine the results of programming transit projects beyond those that *Charting Progress to 2040* (and its Amendment) recommended.

Table 5 illustrates possible scenarios in this set. One scenario would include an expanded transit network that draws from the *Charting Progress to 2040* Universe of Projects list. When constructing this scenario, staff will review this list and coordinate with MassDOT to determine whether transit projects in the *Charting Progress to 2040* Universe have been included in *Focus 40*, or other plans. We will also coordinate with MassDOT and transit providers in the region to determine if other projects should be added to the list. Staff could also explore the outcomes of land use changes that would interact with this expanded transit network. To do this, staff would change land use assumptions for these model runs, such as by allocating transit-oriented development around existing or new transit stations. Other scenarios could reflect implementation of parking fees in commercial areas, residential parking policies, or other policies.

**TABLE 5**  
**Set 1: Transit Expansion Scenario**

<b>Action</b>	<b>Contextual Factors</b>		
	<b>Demographic and Land Use</b>	<b>Policies and Finances</b>	<b>Transportation System Features</b>
Maintain Current LRTP Programming	<i>Charting Progress to 2040</i> allocation	No financial constraint	2040 LRTP recommended highway and transit network <sup>5</sup>
Expand Transit Network	<i>Charting Progress to 2040</i> allocation	No financial constraint	2040 LRTP recommended highway network  Updated transit network
Expand Transit Network  (Reflect TOD-oriented Land Use)	Modified land use allocation—TOD focus	No financial constraint	2040 LRTP recommended highway network  Updated transit network
Updated Transit Network  (Reflect TOD Land Use and Supportive Policies)	Modified land use allocation—TOD focus	No financial constraint  Parking minimum requirements and/or parking fees	2040 LRTP recommended highway network  Updated transit network

LRTP = Long-Range Transportation Plan. TOD = Transit-oriented development.

Other scenarios could include subsets of transit expansion projects, based on cost or other characteristics, to provide information on how different investments may affect performance.

***Set 2: Transit Reliability and Modernization Scenario—Test Outcomes of Changes to Transit Operations***

In this set of scenarios, staff would analyze the potential transportation outcomes of investments designed to modernize transit infrastructure and improve reliability, as opposed to expanding the reach of the system.

Two of the scenarios in this group would examine the differences in transportation system metrics and outcomes based on what we assume about how the transportation system operates today. In one scenario, staff would model transit service according to current published schedules. In another, staff would

<sup>5</sup> This model run will begin with the highway and transit network in the recommended *Charting Progress to 2040* LRTP. This includes all projects funded through the MPO’s Regional Target program and the statewide program.

model transit service by updating the travel demand model set to reflect monitored headways that account for delays and cancellations, and actual frequencies and run-times. Data from MBTA operations about on-time arrivals would be used. Though transit operations would attempt to reflect current conditions, demographic and land use assumptions for both scenarios would reflect *Charting Progress to 2040* land use allocations.

MPO staff would then construct and analyze a third scenario that would reflect upgrades that modernize or improve the reliability of the transit system. These types of improvements could make it possible to offer more consistent service and potentially reduce transit headways or increase system capacity. Staff would select modernization and reliability-oriented projects from the updated LRTP Universe of Projects or other sources. The outcomes of these improvements would then be compared to the outcomes under the scenarios that reflect assumptions about how the transit system currently operates. Table 6 illustrates the scenario analyses in this set.

**TABLE 6**  
**Set 2: Transit Reliability and Modernization Scenario**

Action	Contextual Factors		
	Demographics and Land Use	Policies and Finances	Transportation System Features
Maintain Current LRTP Programming  (Reflect Published Transit Operations)	<i>Charting Progress to 2040</i> allocation	No financial constraint	2040 LRTP recommended highway network  Current transit operations plan
Maintain Current LRTP Programming  (Reflect Unreliable Transit Operations)	<i>Charting Progress to 2040</i> allocation	No financial constraint	2040 LRTP recommended highway network  Operating under unreliable conditions
Invest in Modernized Transit  (Reflect Transit Operations with Improved Infrastructure)	<i>Charting Progress to 2040</i> allocation	No financial constraint	2040 LRTP recommended highway network  Improved and reliable transit operations

LRTP = Long-Range Transportation Plan.

As in Set 1, other scenarios in this group could include subsets of transit reliability projects to provide information about how different investments may affect performance. A “modernized and reliable” transit operation network could also act as a springboard for future analyses relating to transit network improvements. Staff could also apply additional contextual factors to these scenarios—such as by trying to affect sea level rise and flooding—to consider the impacts these changes might have on transit operations.

### 3.3 Considerations for Future Scenario Planning

Staff considered available tools and data, and current planning initiatives, when recommending actions and contextual factors to include in the aforementioned sets of transit-related scenarios. However, staff is coordinating with MassDOT, MAPC, and other planning agencies on updating some of the contextual factors that will be used to develop the new LRTP, as well as topics that could be explored in future rounds of scenario planning.

#### *Demographics Updates*

Staff proposed to incorporate demographic information that was used in *Charting Progress to 2040* (and its Amendment) in the scenarios described above. However, staff is currently working with MassDOT, MAPC, and transportation managers for the other MPOs in the Commonwealth to update the demographic projections to be used in the next LRTP. These updated projections will reflect the same decennial census information and milestone years (2020, 2030, and 2040) that were used in *Charting Progress to 2040*. The updated projections will use new American Community Survey data for birth, death, migration, and other rates and trends, which will be carried forward to the milestone years.

Staff will continue to apprise the MPO as we move through the demographics projections process. When this process is completed, we will ask the MPO to adopt the preferred demographic and land use projections for the region. These projections will be the basis of future scenarios and ultimately will be used in the final LRTP adopted in 2019.

#### *Land Use Updates*

Staff proposed to incorporate the same land-use information that was used in *Charting Progress to 2040* (and its Amendment) in the scenarios described above, except in the Transit Universe of Projects scenario set. As cited in Table 2, demographic data, based on projections, is allocated into residential, commercial, institutional, and other land uses. This process accounts for the density of different land uses in different locations. MAPC will soon begin updating the MetroFuture regional plan, which covers land use, housing, environmental, and other planning areas. The MetroFuture update likely would

not be complete before the MPO will need to adopt the next LRTP; however, staff will continue to monitor the process and include relevant information as it becomes available.

### *Financial Context*

As mentioned previously, these sets of scenarios do not assume any financial constraints. In later phases, the MPO may wish to include estimates of available transportation funding as contextual factors in scenario analyses. Staff expects to receive the most concrete funding estimates in federal fiscal year 2019, which is when the MPO, and other transportation planning agencies in the region, will receive their funding estimates to support the transportation system during the life of the plan.

### *Other Considerations*

When developing the proposals discussed in Section 3.2, staff considered a third scenario, regarding restructuring the existing MBTA bus service, acknowledging that bus service could be a cost-effective way to meet projected transit demand in the future. There have been minimal changes to the region's bus routes in recent decades; and revisions to this network may help the system run more efficiently or attract new riders.

Staff learned that MassDOT will be evaluating the overall MBTA bus network as part of a study that will build off of *Focus 40* efforts. MassDOT will conduct an in-depth analysis of all existing routes using MBTA ridership, transfer, and on-time performance data. This will include a major civic engagement effort designed to solicit input from stakeholders in communities with MBTA bus service. The purpose of the redesign will be to better match existing resources to demand and demonstrate the resources needed to meet demand today and into the future. Once MassDOT's work is completed, the MPO may consider other scenarios that could help the MPO identify locations where potential roadway improvements, such as exclusive bus lanes, could be incorporated.

## 4 POTENTIAL PERFORMANCE MEASURES

Table 7 provides a list of performance measures that could be examined for the proposed transit scenarios listed above. An asterisk denotes performance measures that were used in the scenarios in *Charting Progress to 2040*.

**TABLE 7**  
**Potential Performance Measures for Scenario Planning**

<b>Performance Measure Category</b>	<b>Potential Measures</b>
Safety	<ul style="list-style-type: none"> <li>• Impact on high crash locations</li> </ul>
System Preservation	<ul style="list-style-type: none"> <li>• Number of miles of track added or improved</li> <li>• Miles of pavement improved for the bus network</li> <li>• Number of projects addressing areas vulnerable to extreme conditions</li> <li>• Miles of roadway affected by extreme conditions including those that affect transit</li> <li>• Number of bridges improved</li> </ul>
Capacity Management and Mobility	<ul style="list-style-type: none"> <li>• Daily transit trips★ (by transit mode)</li> <li>• Change in mode share</li> <li>• Vehicle hours traveled (VHT)★</li> <li>• Vehicle miles traveled (VMT)★</li> <li>• Non-motorized trips★</li> <li>• Change in travel time</li> <li>• Hours of congestion</li> <li>• Access to transit (population and employment)</li> <li>• Peak loads on transit</li> <li>• Number of miles of track added</li> <li>• Number of bus routes improved or added</li> <li>• Number of multi-modal connections improved or added</li> </ul>
Clean Air/Clean Communities	<ul style="list-style-type: none"> <li>• Kilograms of CO<sub>2</sub> reduced per day★</li> </ul>
Transportation Equity	<ul style="list-style-type: none"> <li>• Access to transit (population and employment) for minority, low-income, and other potentially disadvantaged or underserved populations</li> <li>• Number of projects in minority and low-income areas★</li> </ul>
Economic Vitality	<ul style="list-style-type: none"> <li>• Number of projects providing access to targeted development areas★</li> <li>• Number of projects that serve areas of concentrated development</li> <li>• Cost savings based on VMT and VHT</li> </ul>

★ Measure used in the scenarios in *Charting Progress to 2040*.

The MPO will continue to develop its PBPP process concurrent with this initial round of scenario planning. Where practicable, MPO staff will use scenario planning as an opportunity to test methods for analyzing relevant federally required performance measures. Through the PBPP process, MPO staff may also identify and examine other measures of interest that could apply to these scenarios.

## 5 TOOLS AND DATA FOR SCENARIO PLANNING

MPO staff plan to use many of the same analytical tools that we used as part of *Charting Progress to 2040*. We will continue to use our upgraded regional travel demand model set to analyze many of the performance measures, in conjunction with CubeLand, as applicable.

Staff plans to use other “off-model” tools and data to analyze other measures that cannot be analyzed using the travel demand model. These may include geographic information systems, data from transit asset management tools being developed by the MBTA and regional transit agencies, transit service planning information, data from the LRTP Needs Assessment, and the MPO’s All-Hazards Planning application.

## 6 NEXT STEPS FOR SCENARIO PLANNING

We seek MPO members’ feedback and concurrence on the proposals for this initial round of scenario analysis, including whether any of the proposed sets of scenarios should receive top priority. We will incorporate the MPO’s feedback into this scenario planning exercise. During summer and fall 2017, we will model the first set of scenarios and analyze the outputs and outcomes. We will report back to the MPO regarding results, lessons learned, and discuss the next steps in the scenario planning process and LRTP development.

AM/MS/am