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2019

LOWER MYSTIC REGIONAL WORKING GROUP

Planning for Improved Transportation and Mobility in the Sullivan Square Area

ACKNOWLEDGMENTS

This work was the result of more than two years of collaborative effort among the many stakeholders involved in planning for the future of the Sullivan Square area. This study was funded by $550,000 in **MassDOT** planning funds and $250,000 from the **Encore Boston Harbor** resort casino. These funds were used to pay for staff time from **Metropolitan Area Planning Council (MAPC) and Central Transportation Planning Staff (CTPS),** as well as facilitation consultants from the **Consensus Building Institute**, who were selected in a competitive procurement administered by MAPC.

LOWER MYSTIC REGIONAL WORKING GROUP

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- City of Boston
- City of Everett
- City of Somerville
- MassDOT
- Metropolitan Area Planning Council

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- MA Gaming Commission
- Executive Office of Housing & Economic Development
- MassPort
- Office of Congressman Capuano
- Encore Boston Casino

TECHNICAL SUPPORT AND FACILITATION

- Central Transportation Planning Staff
- Metropolitan Area Planning Council
- Consensus Building Institute

massDOT Massachusetts Department of Transportation

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CONTENTS

ACKNOWLEDGMENTS.....1

EXECUTIVE SUMMARY.....5

INTRODUCTION.....11

STUDY PROCESS.....21

COMPREHENSIVE SCENARIOS.....35

ACCESS TO OPPORTUNITY MEASURES.....45

FUNDING OPTIONS.....49

KEY FINDINGS.....55

RECOMMENDATIONS.....59

IMMEDIATE NEXT STEPS.....70

LIST OF APPENDICES.....71

TABLE OF FIGURES

FIGURE 1. STUDY AREA IMPROVEMENTS 8
FIGURE 2. STUDY AREA MAP 14
FIGURE 3. EXISTING CONDITIONS: TOTAL INTERSECTION DELAY (AM PEAK PERIOD) 16
FIGURE 4. 2040: TOTAL INTERSECTION DELAY (AM PEAK PERIOD) 16
FIGURE 5. RESIDENTIAL AND COMMERCIAL PIPELINE 17
FIGURE 6. POTENTIAL DEVELOPMENT CHANGE 17
FIGURE 7. MAP OF TRANSPORTATION ANALYSIS ZONES 23
FIGURE 8. SURVEY QUESTION #1 26
FIGURE 9. SURVEY QUESTION #2 27
FIGURE 10. SURVEY QUESTION #9 27
FIGURE 11. EMPLOYMENT CHANGE: PLANNED GROWTH SCENARIO 2010-2040 34
FIGURE 12. HOUSEHOLD CHANGE: PLANNED GROWTH SCENARIO 2010-2040 34
FIGURE 13. PROPOSED BUS ROUTES 37
FIGURE 14. HIGHWAY OPTIONS 39
FIGURE 15. TRANSIT OPTIONS 40
FIGURE 16. SELECT BICYCLE/PEDESTRIAN CONNECTIONS 41
FIGURE 17. EXAMPLE OF COMPLETE STREETS 42
FIGURE 18. COMPARING OPTIONS 44
FIGURE 19. CUMULATIVE EMPLOYMENT OPPORTUNITIES 45
FIGURE 20. EMPLOYMENT ACCESS: WALK-ACCESS TO TRANSIT MAP 46
FIGURE 21. LABOR FORCE ACCESS: WALK-ACCESS TO TRANSIT MAP 47
FIGURE 22. EMPLOYMENT ACCESS: SINGLE OCCUPANT VEHICLE MAP 48
FIGURE 23. STUDY AREA IMPROVEMENTS 59

EXECUTIVE SUMMARY

The time has come to tackle the transportation crisis in Sullivan Square and its vicinity. Whether one is a resident or visitor, driver, biker, or pedestrian, bus rider or Orange Line commuter, traveling to and through the area is frequently congested, chaotic, and frustratingly unreliable. Yet despite these challenges, new development is increasingly attracted to the assets and opportunities that exist there. The area around Sullivan square is poised to be one of the state's premier growth centers, creating thousands of homes and producing millions in tax revenue.

Over the last two years, 11 public agencies with a variety of responsibilities have worked together to develop a comprehensive picture of future growth around Sullivan Square, and solutions to the area's travel woes. The Lower Mystic Regional Working Group concluded that the primary answer to overcoming the area's transportation challenges amidst its ongoing growth is the robust expansion of public transit services, to be supplemented by other transportation infrastructure improvements and coordinated with changes in local development policies that will support the modal shift from private vehicles to public transit, walking and cycling.

This report describes the process the Working Group used to evaluate dozens of options and select those with the best potential for improving travel conditions. It also identifies the next steps for putting the strategy into action through more detailed studies and the creation of funding mechanisms to pay for needed improvements. The problem is serious, the analysis is thorough, and the results are clear. Now is the time to make serious changes to improve Sullivan Square and its environs.

THE **WORKING GROUP**

In 2014, the Massachusetts Gaming Commission approved the Encore Boston Harbor proposal for a large gaming facility in Everett. The announcement created both excitement and concern in nearby neighborhoods and communities. Chief among the concerns was the impact that the resort, now known as Encore Boston Harbor, would have on traffic and congestion.

While the gaming facility will generate substantial new traffic in the area, there are numerous other developments that have been recently built, permitted, or planned, all of which will add more travel demand in the area. Cumulatively, these developments and districts could accommodate as many as 55,000 new jobs and 27,000 new homes, generating millions of dollars in state and local tax revenue while also helping to ease the region's housing crunch. The collective impacts, both positive and negative, would span multiple municipalities, and the corresponding transportation needs would not be effectively or efficiently addressed through project-by-project mitigation strategies. Serving this new growth requires a comprehensive, regional approach that treats each new development, including Encore Boston Harbor, as one component of the area's transformation.

The Lower Mystic Regional Working Group (Working Group) was called for by the Massachusetts Secretary of Energy and Environmental Affairs, Matthew Beaton, and established by Massachusetts Secretary of Transportation, Stephanie Pollack, to assess the impact that new projected growth in the Sullivan Square area may have on travel conditions, and to identify potential solutions.
The Working Group consists of the Massachusetts Department of Transportation; the cities of Boston, Everett, and Somerville; and the Metropolitan Area Planning Council (MAPC). These five stakeholders were designated as the decision-making body for the Working Group. Additionally, other parties – including the Executive Office of Housing and Economic Development, the Massachusetts Gaming Commission, the Office of the Attorney General, Massport, the Office of Congressman Michael Capuano, and Encore Boston Harbor – are active participants providing their input and knowledge.

THE **PROCESS**

The Working Group conducted a two-year planning process that analyzed numerous transportation infrastructure elements and policies aimed at reducing auto trips.

The process utilized a detailed quantitative modeling approach to test different scenarios of infrastructure and policies under future conditions in the year 2040.

The tested scenarios were then compared to both current conditions and future conditions without any of the transportation improvements, using metrics such as congestion at intersections, auto mode share, transit ridership, access to jobs, and greenhouse gas emissions. The analysis focused on the future development and transportation facilities in a five-square mile area spanning the Charlestown neighborhood of Boston as well as parts of Somerville and Everett. Transportation modeling services and facilitation were provided by the Central Transportation Planning Staff and the Consensus Building Institute, respectively.

The Working Group hosted two large public meetings, eight focus groups, an online survey, and an interactive website to solicit input from the public to help identify the transportation elements to study and model. This public input was combined with Working Group member ideas and staff technical analysis to identify various public transit, highway, and bicycle and pedestrian improvements for modeling. The analysis also tested parking policies designed to limit the number of auto trips generated by new development in the area. The scenarios were broken into eight model runs with a final modeled scenario that combined the most promising transportation elements. The scenarios also included a future development pattern that is much denser than today, while maintaining a similar demographic profile.

THE **KEY FINDINGS**

The Lower Mystic area is one of Massachusetts' biggest growth centers.

Planned residential and commercial growth could lead to 27,000 new households and 55,000 new jobs in the study area, with the gaming facility making up just a fraction of potential travel demand. Collectively, this future growth could meet 5% of the state's housing needs and accommodate 20% of projected statewide employment from 2010-2040, but not without challenges. That much growth could add almost 500,000 new daily trips to and from the study area by 2040 (a 34% increase from 2010), straining the transportation system in the future.

The most promising solution to traffic congestion is to reduce vehicle trips.

The study assessed various ideas for relieving roadway congestion in the Lower Mystic area, including multiple on- and off-ramp configurations and conversion of the I-93 HOV lane to general purpose use. While some of these options may provide localized congestion relief, it's not evident that they provide an overall net benefit to roadway conditions across the study area. The report's analysis indicates that the greatest benefits to traffic congestion can be achieved by reducing the amount of auto travel to and from the area, through a combination of improved transit services and transit-oriented parking policies.

The MBTA Orange Line is the backbone of mobility in this area.

The MBTA is currently purchasing new train sets and making improvements to increase frequency and capacity on the Orange Line by 40%. Even with these improvements, more service may eventually be needed if major developments and improved feeder bus service require more capacity than is already planned for. It is prudent to monitor development and ridership trends to ensure that capacity improvement efforts are underway well before the system is over capacity. It may be possible to achieve three-minute headways, attracting 24,000 new riders and reducing auto mode share by two percent in the study area.

Improved local bus service offers a large return on investment and a short implementation timeline.

Most of the study area is beyond walking distance to the Orange Line or commuter rail stops. Adding substantially more frequency to existing bus routes, while also speeding their trips through dedicated lanes and priority signals, could generate 100,000 new daily transit trips and reduce the number of car trips by 4%.

Bus rapid transit (BRT) in a dedicated right-of-way offers tremendous mobility and equity benefits at an intermediate cost and implementation timeline.

A promising option studied is a BRT line extending from the Silver Line terminus in Chelsea through Everett, with two branches connecting directly to Kendall Square and North Station. Using a mix of exclusive and priority lanes, this service could attract 36,400 riders daily, generate 5,200 new daily transit trips, and reduce auto mode share in the study area by 1 percent.

Land use policies are essential components of a sustainable transportation system.

The most significant benefits occur when new or substantially improved transit service is paired with transit-oriented parking policies such as market-rate commuter parking or the reduction of residential parking requirements. These strategies together could reduce, by 45,000, the number of single-occupant vehicle trips to and from the study area, resulting in a 5 percent reduction in auto mode share.

A complete walking and biking network requires new connections both large and small.

The study evaluated shared-use paths, complete streets improvements, and pedestrian bridges over the Malden and Mystic rivers. To be successful, these regional connections should be complemented by a pedestrian- and bike-friendly local street network.

THE **RECOMMENDATIONS**

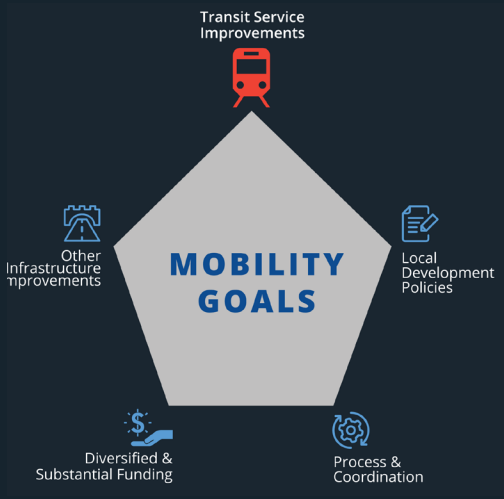
To improve transit options and experience, reduce travel times, decrease traffic congestion, improve access to jobs, and enhance quality of life, the Working Group concluded that a systematic and holistic approach to transportation for this area is essential. The Lower Mystic Regional Working Group recommends the robust expansion of public transit services as the most meaningful solution and significant action that can be taken to ensure a more desirable transportation future for the study area. Specifically, the Working Group recommends investing in the Orange Line to reduce wait times and congestion; expanding local bus services to provide more diverse and reliable transit options; and investing in Bus Rapid Transit to connect the area to key job centers. To support the full utilization of these improved transit services, regional entities and municipalities should coordinate the expansion of transit with the adoption and implementation of local development plans and policies, such as reduced parking requirements, that support walkable, transit-oriented, mixed-use, mixed-income growth in the Study Area.

In addition, roadway improvements such as a redesigned Rutherford Avenue may help liberate capacity for additional bus and BRT service on roadways and highways. Other actions intended to work in concert with transit service expansion and local development policies include infrastructure improvements for complete streets, paths, and trails, exploration of increased funding from traditional and innovative sources, and processes to ensure ongoing collaboration and coordination among the Commonwealth, the MBTA, regional agencies, municipalities, and private land owners.

Figure 1. Study Area Improvements

STUDY AREA IMPROVEMENTS

To improve the transit experience, reduce travel times, decrease traffic congestion, improve access to jobs, and enhance the area's quality of life in the Study Area, the Lower Mystic Regional Working Group concluded:



Transit is Key

- Invest in the Orange Line to ensure capacity is sufficient to meet future demand
- Improve local bus services through additional routes, dedicated lanes, and priority signals
- Extend Bus Rapid Transit from Chelsea Station through Everett and Sullivan Square to Kendall Square and North Station.

Transit needs transit-oriented local development policies to flourish

- Substantially reduce the amount of parking in new residential developments within walking distance to transit
- Enact innovative transportation demand management policies to limit single-occupant vehicle commuter trips to and from major new job centers in the Lower Mystic area
- Ensure the Lower Mystic area remains accessible to people across the socio-economic spectrum, while minimizing displacement of current residents
- Create a regional Transportation Management Association (TMA)

Transit improvements can be complemented by additional road and path improvements

- Continue to develop the regional active transportation network with bicycle lanes and pedestrian paths and bridges
- Ensure all local roadways incorporate Complete Streets elements

Substantial but diversified investment is needed

- Seek comprehensive funding sources to implement this study's recommendations, including innovative means of financing
- Align developer transportation mitigation with this study's recommendations

Regional coordination is critical

- Continue Working Group coordination to ensure continued progress on implementation
- Jointly consider further study of Orange Line spur to Everett, I-93 northbound on-ramp at City Square, and modifications to the I-93 southbound HOV lane

IMMEDIATE **NEXT STEPS**

There is much work to be done to improve the transportation situation in the Lower Mystic Area. As noted above, transformation of the area will entail a wide variety of strategies—transit expansion, service improvements, transportation demand managements strategies, and land use policies—that will work synergistically to achieve a more sustainable future. These efforts must begin immediately, and should occur concurrently and in a coordinated fashion. In order to focus the short term efforts, the Working Group recommends the following immediate next steps for 2018 and 2019.

- Conduct a planning process to assess the feasibility and prepare conceptual designs for transit improvements recommended in this report. The process should further detail bus and BRT routes, model and refine interactions among local bus routes, bus rapid transit, and the Orange Line, and how they link and are sequenced with enactment of local parking and other transportation demand management policies.
- Coordinate these recommendations with other current and near-term future planning processes such as Focus 40, the MBTA Bus Service Delivery Plan, Rail Vision, MetroCommon2050 (MAPC's new regional planning process), and municipal planning efforts.
- Develop municipal plans to implement progressive and forward-looking parking policies for both residential and commercial uses.
- Identify ways to coordinate individual development project mitigation funds for regional investment, including transit, and/or designing a regional transportation mitigation process.
- Work to incorporate these recommendations, where appropriate, into future MEPA certificates for development in this area.
- Meet on a periodic basis to discuss and track implementation of these recommendations. A near-term priority will be coordinating around expected transportation-related construction in this region. Additionally, further explore and implement funding innovations that can address immediate needs and begin incremental improvements.

INTRODUCTION

In September 2014, the Massachusetts Gaming Commission voted to approve the Encore Boston Harbor proposal for a large gaming facility in Everett. The announcement created both excitement and concern in nearby neighborhoods and communities. Chief among the concerns was the impact that the resort, now known as Encore Boston Harbor, would have on traffic and congestion, especially in Sullivan Square and the Charlestown neighborhood of Boston. This area, which contains regionally significant transportation hubs and corridors, is already facing major challenges: I-93 is very heavily congested during rush hour, local roadways are congested, intersections such as Sullivan Square are hazardous for pedestrians, and the Orange Line is often so crowded at Sullivan Square that riders have to wait on the platform for a train with more capacity to arrive.

While Encore Boston Harbor will be a large trip generator, there are numerous other developments that have been recently built, permitted, or planned, all of which will add more travel demand to the region's mobility infrastructure.

These development areas include:

- Assembly Square redevelopment, Somerville
- Redevelopment in Sullivan Square and along Rutherford Avenue, Boston
- Commercial Triangle redevelopment, Everett
- Union Square redevelopment, Somerville
- Brickbottom redevelopment, Somerville
- Cambridge Crossing (formerly North Point), Cambridge

These development districts are consistent with adopted state, regional and municipal plans and policies. Several have received state-level environmental permitting and been assigned mandatory mitigation measures through the MEPA process. Cumulatively, these districts will create millions of square feet of new commercial space and tens of thousands of housing units.

Current plans could accommodate as many as 55,000 new jobs and 27,000 new homes, generating millions of dollars in state and local tax revenue while also helping to ease the region's housing crunch. The collective impacts, both positive and negative, would span multiple municipalities, and the corresponding transportation needs would not be effectively or efficiently addressed through project-by-project mitigation strategies.

Serving this new growth requires a comprehensive, regional approach that treats each new development, including Encore Boston Harbor, as one component of the area's transformation.

On August 28, 2015, the Massachusetts Secretary of Energy and Environmental Affairs (EEA), Matthew Beaton, issued a Massachusetts Environmental Policy Act (MEPA) certificate regarding the Encore Boston Harbor project. The certificate outlined a series of transportation commitments required of Encore Boston Harbor, which include a transit subsidy to the Massachusetts Bay Transportation Authority (MBTA) for the project's anticipated impacts on Orange Line operations, improvements to area intersections and corridors expected to experience a deterioration in traffic operations, the introduction of water transportation connections to parts of Boston, shuttle bus service to the Wellington and Malden Center Orange Line stations, and other transportation demand management interventions.

The certificate recognized that while these mitigation requirements will help to mitigate the impacts associated with the resort, they are insufficient to serve the growing transportation needs associated with all the development proposed or planned for the area. Therefore, the certificate also called for the establishment of a Regional Working Group to "assess and develop long-term transportation improvements that can support sustainable redevelopment and economic growth in and around Sullivan Square."

Pursuant to the MEPA certificate, the Secretary of Transportation convened the Lower Mystic Regional Working Group (Working Group) in November of 2015, to examine development and transportation in the area surrounding the Encore resort and Sullivan Square. As convened, the Working Group consists of MassDOT; the cities of Boston, Everett, and Somerville; and the Metropolitan Area Planning Council (MAPC). These five stakeholders were designated as the decision-making body of the Working Group. Additionally, other parties – including the Executive Office of Housing and Economic Development, the Massachusetts Gaming Commission, the Office of the Attorney General, Massport, the Office of Congressman Michael Capuano, and Encore Boston Harbor – are active participants providing their input and knowledge.

The certificate also called for a process to at a minimum:

- assess existing conditions, planned improvements and reviewed and permitted development
- identify planned development and potential build-out
- identify critical infrastructure and study alternatives
- consider funding resources and equitable allocation of project costs.

Technical services supporting the Working Group were provided by CTPS, a public agency which acts as the staff to the Boston Region Metropolitan Planning Organization (Boston MPO); MAPC; and the Consensus Building Institute (CBI). CTPS provided transportation modeling of future conditions. MAPC provided land use and socioeconomic projections and analysis. CBI acted as an independent facilitator to help guide the study process and enable the Working Group to make decisions.

The Working Group was imagined as a new type of forum for multi-jurisdictional planning to achieve several objectives.

One key objective is to minimize and mitigate traffic congestion in the study area.

As the focal point of transportation infrastructure in the study area, Sullivan Square's traffic woes are of particular importance for the residents of Charlestown and commuters from all modes. Not surprisingly, local concerns about traffic and congestion are common barriers to growth across the study area; the Working Group seeks to ensure that robust housing and economic development can occur without adversely impacting existing residents' mobility.

Another key objective was to bring new and progressive modeling and planning tools to bear to support data-driven decision making.

Through this process, the Working Group has viewed the area's needs through a multimodal framework. While reducing congestion is important, the ultimate measure of a transportation network is whether it provides residents and workers with good options for getting around to places they need to go. This objective of "accessibility"—ease of access to jobs, schools, friends, and shopping—leads to different approaches than one just aimed at reducing automobile delay. At the end of the section on scenarios, this report examines the accessibility benefits of a few of the studied scenarios.

Over the past two years, the Working Group has assessed existing conditions, inventoried planned and potential development in the area, identified a wide variety of policy interventions and infrastructure improvement options that could help to improve transportation conditions, tested those options using technical forecasting models, and selected a set of recommendations for implementing the most promising and practical ideas.

Recommendations do not become reality on their own. The MEPA permitting process that created the Working Group required only study of issues and did not require or mandate implementation actions or funding mechanisms. As such, another objective of this effort is to create implementation guidance and identify key next steps, as well as the roles of the various stakeholders. The project has also identified a suite of funding options, including those that extend beyond current transportation planning and funding processes.

This report summarizes the findings of the Working Group and recommendations for meeting this challenge. There is no silver bullet for solving the study area's transportation issues, nor will one party be primarily responsible; instead, an effort among multiple stakeholders is required to implement a variety of multimodal infrastructure and policy initiatives.

THE **STUDY AREA**

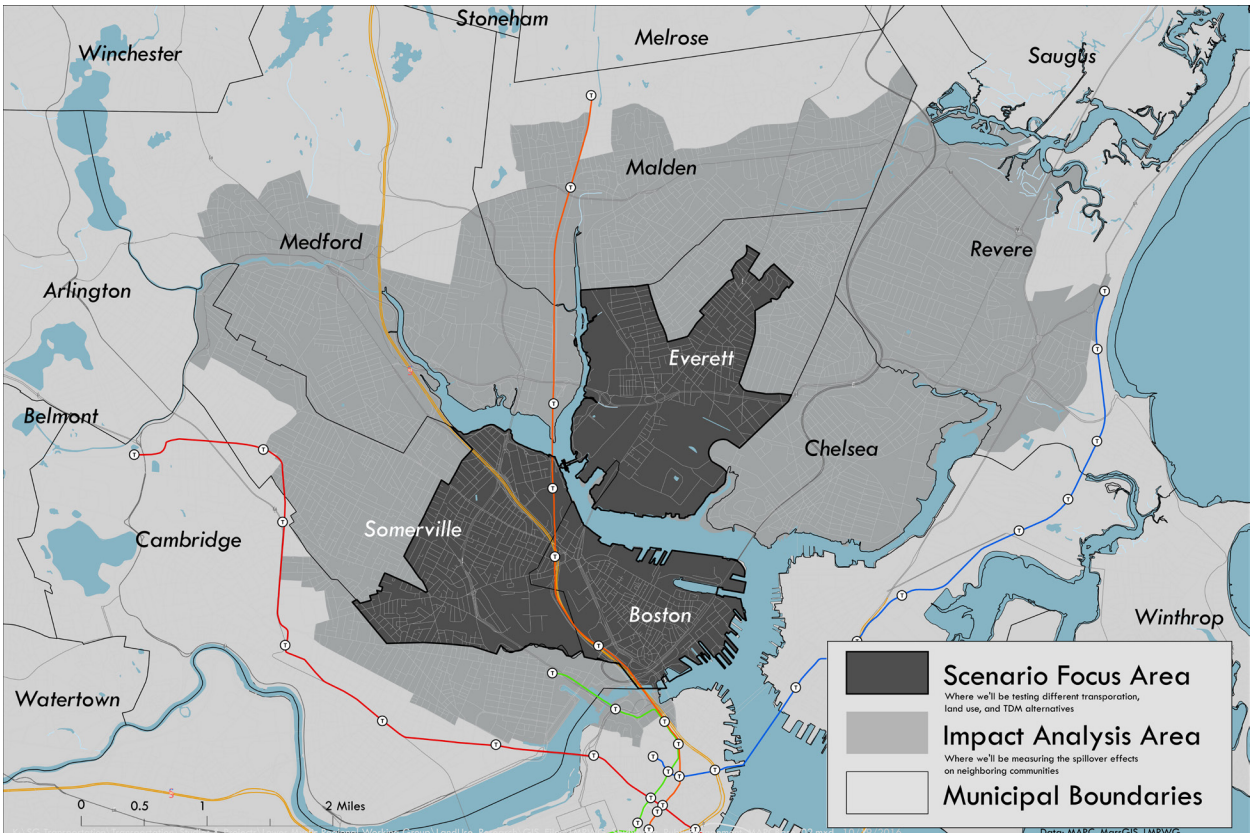
One of the Working Group's first tasks was to define the geographic scope of analysis. Working Group members were committed to a focused approach for the immediate area of concern, while also recognizing that transportation improvements would have spillover effects into nearby neighborhoods and communities. After some deliberation, the Working Group adopted a nested structure for the study area.

The Focus Area covers an area of roughly five square miles (3,500 acres) in the immediate vicinity of the Encore resort and Sullivan Square. The Focus Area includes most of the major development districts listed above and was also the focus for most of the transportation infrastructure improvements studied during the project. The Focus Area is also contained within the three participating municipalities.

Recognizing that the impacts of major redevelopment and transportation improvements may have spillover effects that will affect a larger area, the Working Group also defined a larger Impact Analysis Area, which includes the Focus Area along with other portions of the participating cities and five abutting municipalities.

The geographic units of the study areas are Transportation Analysis Zones (TAZs), which are small geographic areas to serve as the units of analysis for regional travel demand modeling. For the study area, these zones are generally one square mile in size, and are crafted to conform to the nearby transportation network and natural features. The entirety of the Boston MPO region is divided into TAZs.

Figure 2. Study Area Map



THE CHALLENGE FACING THE LOWER MYSTIC AREA **TODAY AND TOMORROW**

The study area is one of Massachusetts' most important economic assets. The cities of Boston, Everett and Somerville have made progressive and ambitious commitments to alleviate the regional housing shortage by planning and permitting new real estate development, have adopted local ordinances to ensure permanently affordable housing is produced by for-profit developers, and have directed major local funding to modernize local utility and transportation infrastructure in support of that growth. State policy and regional planning initiatives managed by MassDOT, MAPC and the Boston Region MPO all call for walkable, mixed-use, affordable growth in the Sullivan Square area.

There is no doubt that the transportation situation in the Impact Analysis Area is already challenging. There are an estimated 1.9 million daily trips to and from the area, and many more passing through on I-93 and other major transportation corridors. The Encore resort's MEPA filings project an additional 20,000 daily vehicle trips. For four hours every weekday morning, the average speed on I-93 southbound from Medford to Charlestown is less than 22 miles per hour. Of the 79 intersections analyzed in the Impact Analysis Area, 18 are already operating at a Level of Service of 'F' or worse during morning and/or evening commute times, which means intersection delays of 80 seconds or more. There are 925 crashes per year in the Impact Analysis Area, including 81 crashes involving bicycles or pedestrians.

The situation for transit riders and pedestrians is no better. Roughly 23,000 southbound commuters board the Orange Line between Oak Grove and Sullivan Square from 6 AM to 9 AM. As a result, morning rush hour Orange Line ridership exceeds capacity between the Sullivan Square and State Street Stations, meaning trains are overcrowded and sometimes result in passengers waiting for the next train to arrive so they can get on. Many of the nearly sixty bus routes in the area, which collectively serve 13,300 transit riders per day, are similarly overcrowded.

There are good reasons to believe that the transportation network will become even more stressed in the coming decades. In addition to Encore Boston Harbor, the area is likely to see a substantial amount of development between now and 2040. Numerous property owners and developers have proposed new housing and commercial development, attracted by the area's proximity to Downtown Boston, Kendall Square, and other destinations; the improved access provided by the Green Line Extension now under construction; as well as the substantial supply of low-density and somewhat underutilized industrial properties.

The municipalities in the area are also actively planning for further development through local area plans and rezoning efforts to guide new growth. Everett has completed a Lower Broadway rezoning and is currently beginning a redevelopment plan for the Commercial Triangle area. Somerville adopted a Comprehensive Plan under Massachusetts law in 2012 that identifies the Brickbottom, Inner Belt, and Union Square areas as sites for transformational development, and a master developer has already been chosen for Union Square. MAPC and Boston developed a preliminary plan for redevelopment of the Sullivan Square area to take advantage of redevelopment opportunities that may be unlocked by reconstruction and redesign of Rutherford Avenue. Overall this level of growth has many positives, including more housing and job opportunities for the region.

The following maps illustrate the intersection delay and level of service at key intersections during the morning rush hour. Level of service is a measure used to assess traffic flow based on traffic flow. The first map depicts the current conditions. The bottom map shows conditions in 2040, based upon projected growth and improvements already planned. Without additional interventions, traffic conditions will likely worsen between now and 2040.

Figure 3. Existing Conditions: Total Intersection Delay (AM Peak Period)

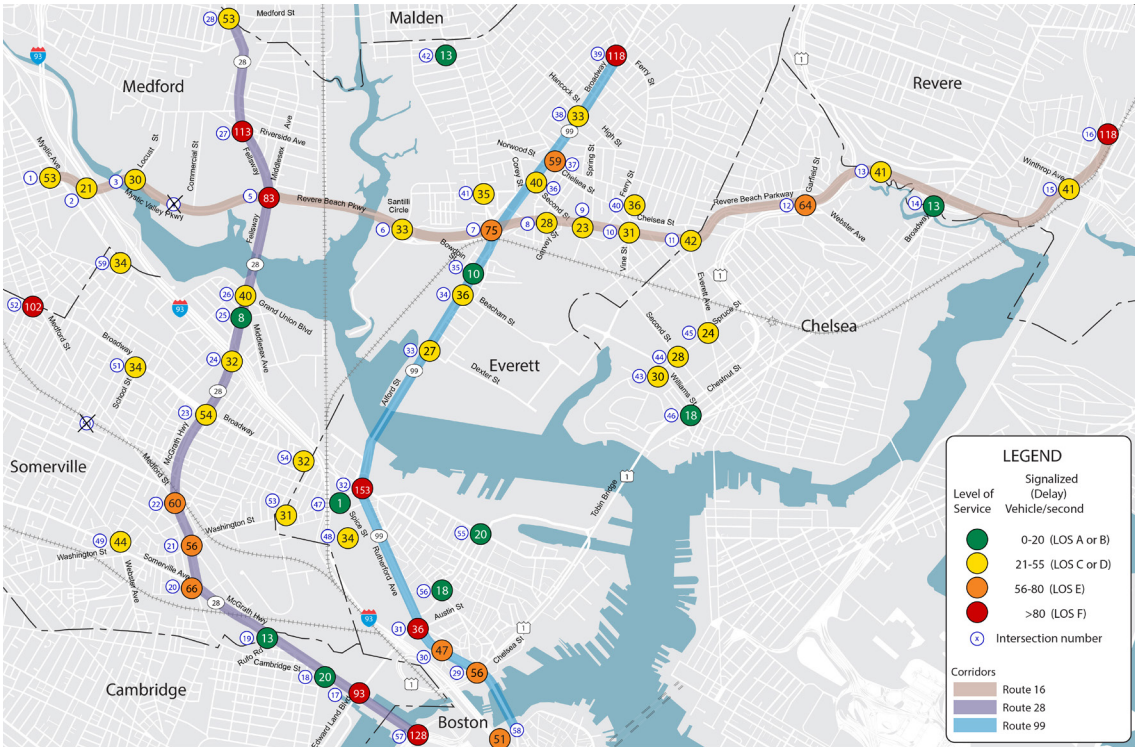


Figure 4. 2040: Total Intersection Delay (AM Peak Period)

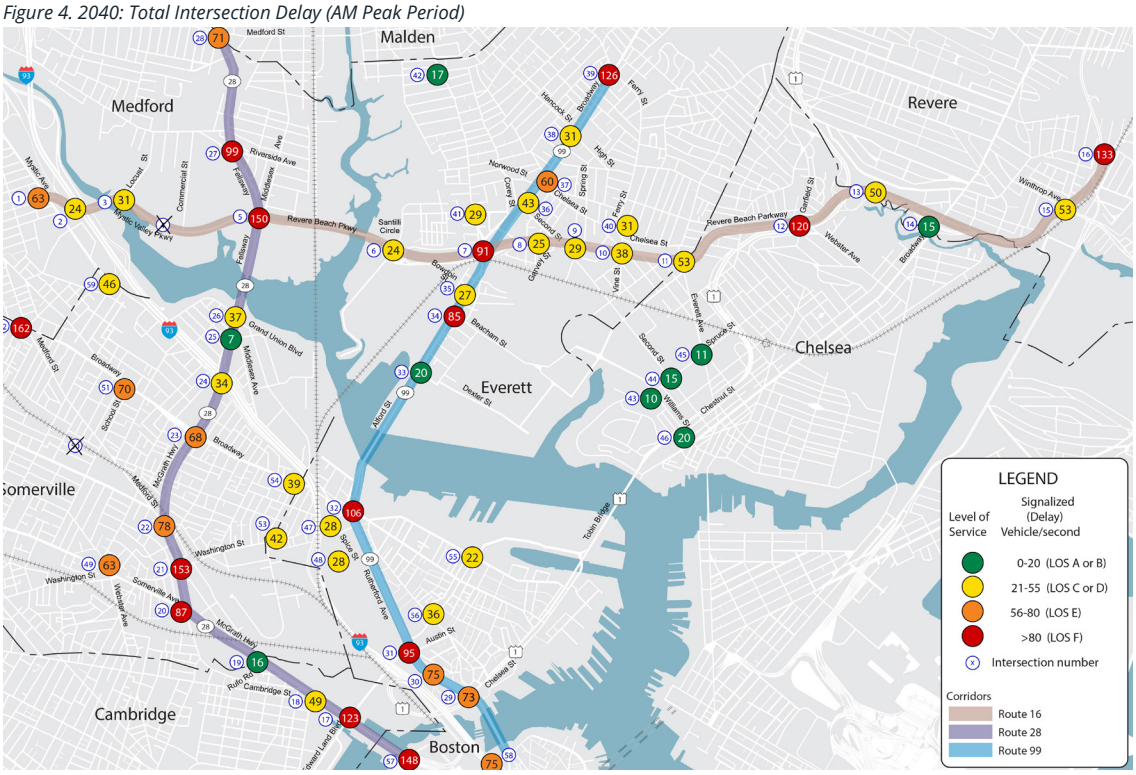


Figure 5. Residential and Commercial Pipeline

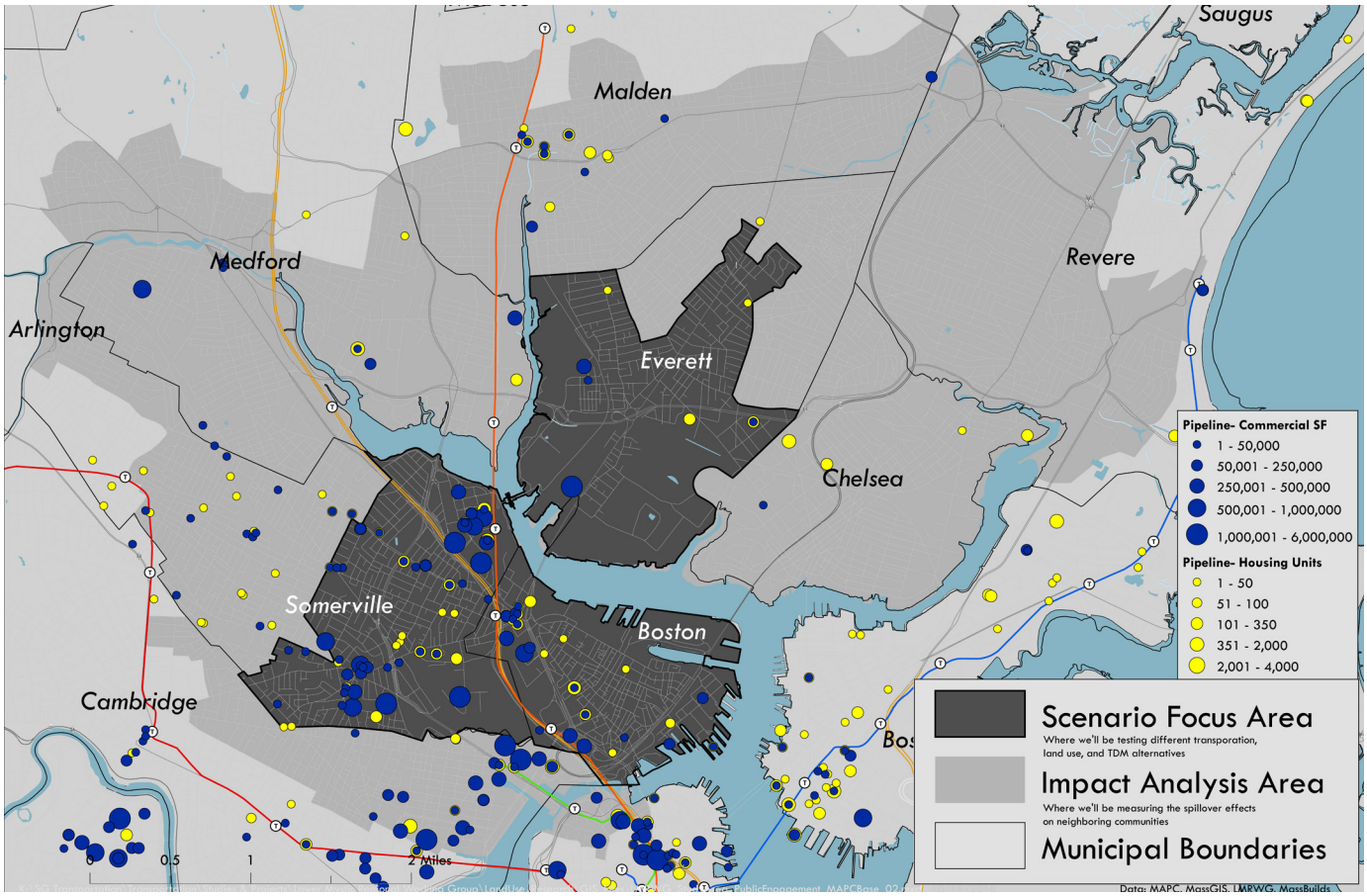


Figure 6. Potential Development Change (Planned Growth Scenario)

PROJECTONS FOR IMPACT ANALYSIS AREA:
Potential Development Change

	Households	Population	Jobs	Total Daily Trips
2010	122,475	302,273	137,151	1,098,041
2040	174,982	395,998	212,445	1,473,547
Growth %	43	29	55	34

TRANSPORTATION **IMPROVEMENTS ALREADY UNDERWAY**

Fortunately, there are efforts already underway to address some of the area's transportation challenges.

The MBTA has procured 152 new Orange Line cars, which will be fully operational by 2022, and is making signal and track improvements with the goal of increasing the frequency of train service on the Orange Line.

Once the new cars are fully deployed, the Orange Line "headways" during peak periods (the time interval between each train) will be reduced to four and a half minutes, down from the current headways of six minutes. In combination with train cars that can carry more passengers and trains that will require less maintenance, the improvement in frequency will increase the capacity of Orange Line service by 40% during peak periods.

Pursuant to license requirements imposed by the Massachusetts Gaming Commission, Encore Boston Harbor will also be funding a series of transportation improvements to offset anticipated impacts from users of the gaming and resort facility. Refer to Appendix 3 for the Section 61 Findings for a detailed list of these improvements.

The City of Everett has partnered with the MBTA to establish dedicated bus lanes on Broadway (Route 99) ***from Glendale Square to the casino site.***

This project has required the elimination of roughly 200 parking spaces controlled by the City and reflects an unprecedented commitment to bus mobility and transportation equity in the metro region. Over the first 12 months of operations, the MBTA reports 20% travel time savings for the six bus routes using this corridor.

The City of Boston is also advancing plans for reconstructing a narrower Rutherford Avenue, with a bike path, and a reconfiguration of the intersections in Sullivan Square.

While the Working Group was in the early stages of its process, the City of Boston, after a thorough public engagement process separate from the Working Group, selected a preferred design for the Rutherford Avenue/Sullivan Square Project. This design seeks to accommodate both local and regional interests; improve access and safety for bicyclists and pedestrians; creates dedicated bus lanes; and allow for the redevelopment of Sullivan Square. The Working Group incorporated this design for Rutherford Avenue into all subsequent model runs and scenarios.

The Boston MPO has programmed the McGrath Highway and McCarthy Overpass in Somerville and Cambridge on its Long-Range Transportation Plan for construction as early as 2022.

This corridor was originally built to serve regional commuting traffic between Boston and suburbs to the north. The current plans call for a four-lane cross section with six lanes at key intersections, with separated bike facilities and several pedestrian improvements.

*MassDOT will soon be reconstructing the **North Washington Street Bridge** between Charlestown and Boston's North End, to include separated cycle tracks, wider sidewalks, and the addition of a bus-only lane in the southbound direction.*

*The **Green Line Extension** through Somerville (currently under construction) is anticipated to be complete by the end of 2021.*

The project will extend the Green Line from Lechmere to Union Square along one branch and serve five stations in Somerville before terminating at College Avenue along a second branch. The project is anticipated to serve approximately 45,000 daily riders in 2030, allowing for the projected reduction of nearly 26,000 daily vehicle miles traveled from local and regional roadways.

Despite these major improvements in the pipeline, it is clear that more must be done to address current transportation challenges and to meet the needs of future development. Furthermore, it is essential to look at transportation improvements in a regional context, to avoid simply moving transportation problems elsewhere.

STUDY PROCESS

In order to address the study area's substantial transportation challenges and enable sustainable housing and economic growth into the future, the Working Group took a comprehensive approach to evaluate the collective impact of potential future developments and analyzed a wide range of potential solutions. Future transportation conditions were assessed against a variety of metrics—not just automobile congestion but also transit capacity, job accessibility, bike and pedestrian travel, greenhouse gas emissions, cost, and feasibility. The effort also incorporated input from diverse stakeholders, collected through various methods (meetings, surveys, focus groups) throughout the process.

Over the course of the project, the Working Group and its technical staff created over a dozen distinct 'scenarios' testing different assumptions about future development patterns, new transportation infrastructure projects, new transit services, and future transportation demand management policies. The group selected various combinations of ideas to model in order to consider the interactions among different choices, given that travelers alter their behavior based on a number of considerations. The Working Group chose a selection of the most promising improvements to compile into a final "package" of distinct infrastructure and policy improvements for implementation or further study. The Working Group also investigated methods of financing the desired infrastructure improvements through a variety of innovative methods.

TECHNICAL **METHODS AND TOOLS**

CTPS & MAPC provided technical support to the Working Group.

This process sought to advance the collaboration between and innovation among these two agencies key to Greater Boston's transportation planning. Transportation modeling is complex because it must seek to simulate the future behavior of hundreds of thousands of people, making individual choices, that collectively use and affect the multi-modal, transportation network. While conditions, costs, and decision factors may change in the future, these models nevertheless provide our most robust estimates of future behaviors and conditions. This section lists key inputs and methods employed during the study process.

MAPC collected information about recent housing and economic developments, projects in the development pipeline, and municipal area plans or rezoning proposals in the Focus Area and nearby neighborhoods. This work was accomplished through the open source development inventory contained in MAPC's tool www.massbuilds.com, as well as through in-person interviews with municipal planning staff and review of existing planning documents. These efforts were intended to quantify the amount, type, and timing of likely or potential future development in the area.

MAPC used its existing Land Use Allocation Model to create updated projections of population, households, and employment for the study area. This model is an econometric simulation of how households and firms compete for available real estate supply, and simulates the interactions between land use, transportation improvements, and new development as these forces transform the urban area. Information about future development served as an input to the model, effectively "seeding" it with information about developments in the pipeline and enhancing consistency between model results and anticipated growth. The land use projections include estimates of future year households (by size, number of workers, and income) as well as future employment (by sector).

The land use projections as well as the travel demand model (described below) use "TAZs" as the unit of analysis. TAZs are smaller geographic areas than municipalities, crafted to conform to the nearby transportation network and natural features as well as encompass the entirety of the Boston MPO region.

CTPS used its Regional Travel Demand Model to project the number of trips coming to, from, through, and within the Impact Analysis Area; the origins and destinations of those trips (at the TAZ level); the travel mode that is likely to be taken (automobile, transit, walking, etc.); and the particular route or service that they are forecast to choose (e.g., specific roadways or bus routes.) When predicting what mode will be used for a particular trip, the model accounts for the cost of travel (tolls, parking, transit fares) as well as the likely travel time and traveler characteristics, such as automobile ownership. The model uses a detailed representation of the roadway network that includes individual turning lanes, on-ramps and off-ramps, bus-only lanes, bus routes, and pedestrian/bike-only links. Transit service details include the location of specific stops and stations, schedules, and actual travel speed (which may differ from schedules if buses are traveling in congested conditions.) All these details can be modified to represent potential or proposed improvements to transportation infrastructure and services. This model is based on a household travel survey conducted in 2011 and uses industry-standard methods and TransCAD, a travel demand modeling software, to estimate travel demand and behavior. The model incorporates the most up-to-date information about roadways and transit services and is calibrated to match actual traffic counts as of 2016. Results from the model can be used to estimate total miles traveled; percent of trips by each mode; and the greenhouse gas emissions and other pollutants associated with automobile travel in the study area. The model is best suited for understanding trips at a regional level. Trips within a TAZ, as well as many bicycle and pedestrian trips, are not assigned to specific routes and segments; therefore, the benefits of bicycle and pedestrian improvements may be underestimated in the model.

To assess the impact of increasing congestion at individual intersections, CTPS used Synchro, a leading traffic analysis software package. Synchro simulates the movements of individual vehicles as they travel down a roadway or through an intersection, using outputs from the regional travel demand model as the basis for the routes that will be simulated. The model produces estimates of how long it takes for the average vehicle to pass through an intersection, accounting for the levels of traffic and anticipated signal timing. These results are reported for each intersection and each individual "turning movement" (straight, left turn, right turn), as "seconds of delay," which are generalized into a "Level of Service" (LOS) grade from A through F. The highest Level of Service (A) means that the average vehicle experiences less than ten seconds of delay for a given turning movement. Level of Service F indicates delays of 80 seconds or more. Average travel speeds, length of intersection queues, and total travel time through the area are also estimated.

To identify problematic or dangerous intersections and entrance/exit ramps, CTPS used Transmodeler, a traffic simulation software that visualizes flow and signal operations. Like Synchro, Transmodeler simulates individual vehicles and is useful for assessing congestion on highways such as I-93 as well as the vehicle-to-vehicle interactions that take place at on- and off-ramps. The tool produces estimates of traffic flow, travel time, speed, and weaving/merging movements.

MAPC also implemented new tools to assess how potential improvements might affect economic opportunity for local residents and businesses. Using land use projections combined with the outputs of the regional travel demand model, MAPC estimated how many jobs a local resident could reach in a specified amount of time, and how many workers could get to employers in the Lower Mystic Impact Analysis Area. This "accessibility analysis" is intended to measure whether proposed changes would expand or diminish the number of work opportunities and labor markets available to area residents and employers.

Figure 7. Map of Transportation Analysis Zones

COMMUNITY **ENGAGEMENT**

Through surveys, public meetings, discussions with local stakeholder groups and organizations, and social media outreach, the Working Group sought input from a wide variety of stakeholders who live, work, or otherwise spend time in the Lower Mystic area.

The goals of the community engagement process included:

- Increasing community awareness regarding the Working Group's existence, activities, and goals
- Understanding the community's concerns, visions, and priorities related to moving around the Lower Mystic area
- Soliciting ideas to improve travel in the Lower Mystic area
- Informing the Working Group's choices about what to study and recommend

Photos from September 2017 Public Forum

The Working Group hosted seven focus groups in Boston, Everett, and Somerville in the winter and spring of 2017. Attendees at these meetings included residents, advocates, and other stakeholders in a smaller, discussion-style setting. The Working Group also hosted two large public forums, one in November 2016, attended by more than 70 participants, and a second in September 2017, attended by over 100 participants. These forums allowed a broad audience to solicit information and provide feedback through an open house format, formal presentation, small group discussions, and question-and-answer sessions. For those unable to attend the in-person events, the Working Group released an online survey in fall 2016, which received almost 400 responses.

The Working Group received wide-ranging feedback from community members. Several major themes emerged regarding challenges and opportunities for improving transportation and mobility in the Lower Mystic area. The breadth of feedback indicated that there was not perfect consensus among stakeholder groups about preferred strategies and recommendations. Some participants wanted major infrastructure improvements (e.g., new subway lines), while others focused on incremental improvements (e.g., increases in bus frequency). Some participants felt all improvements should be focused on transit and bicycle/pedestrian infrastructure, whereas others felt that vehicular roadway improvements should be prioritized.

However, several clear themes emerged from the community engagement process:

- Improvements for bicycle and pedestrian travel, including a major emphasis on improved safety;
- Expanding transit options and creating incentives to reduce automobile usage;
- Improving operations of travel routes for automobile commuters and reducing congestion on local roads;
- Improving and expanding transit service to under-served areas, particularly Everett.

A public survey was also distributed at the beginning of the study (See Appendix 10). The survey results showed strong consensus for strategies for reducing traffic, followed by improving pedestrian/bicycle travel, reconfiguring Sullivan Square street patterns, and improving the Orange Line. Notably, the lowest priority related to finding open on-street parking spaces easily.

Figure 8. Survey Question #1

KEY CHART: WHAT MAKES IT HARD TO GET AROUND THE SULLIVAN SQUARE AREA TODAY? CHOOSE TOP THREE (3)

Answered: 132

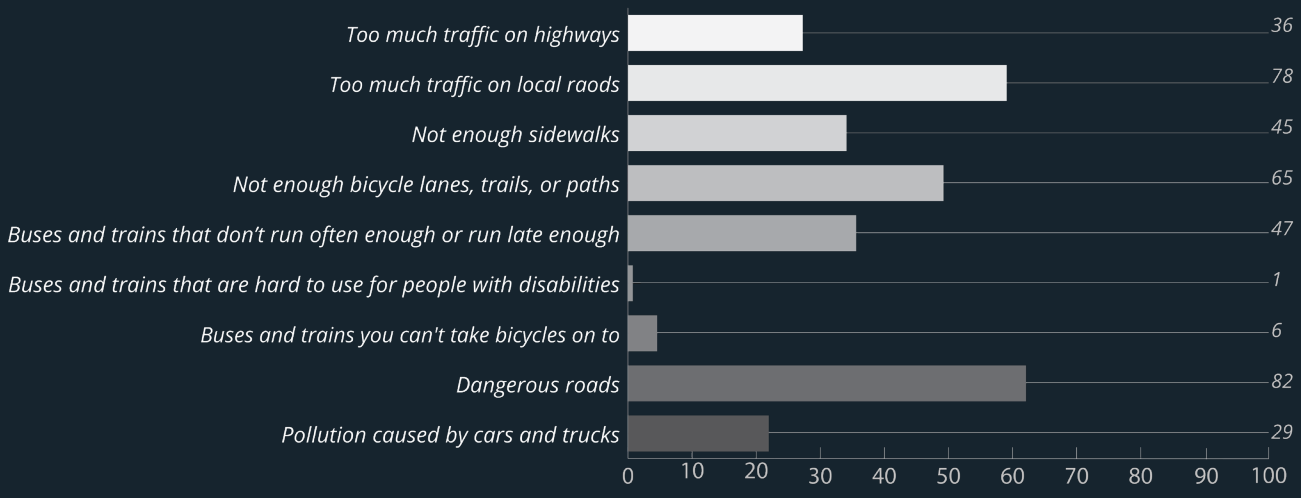


Figure 9. Survey Question #2

KEY CHART: WHAT WOULD YOU LIKE TO SEE BY 2030? CHOOSE TOP THREE (3)

Answered: 132

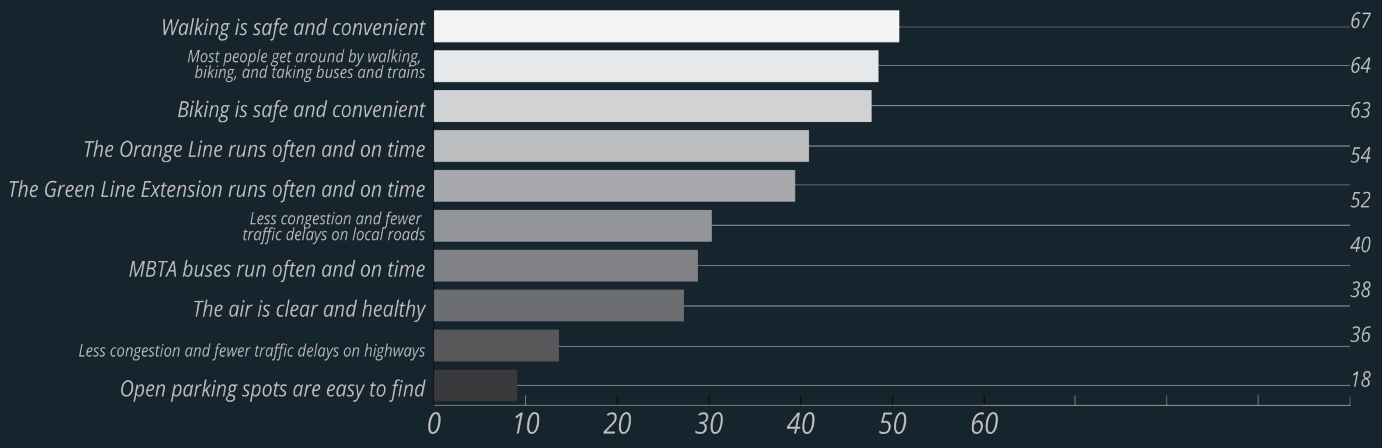
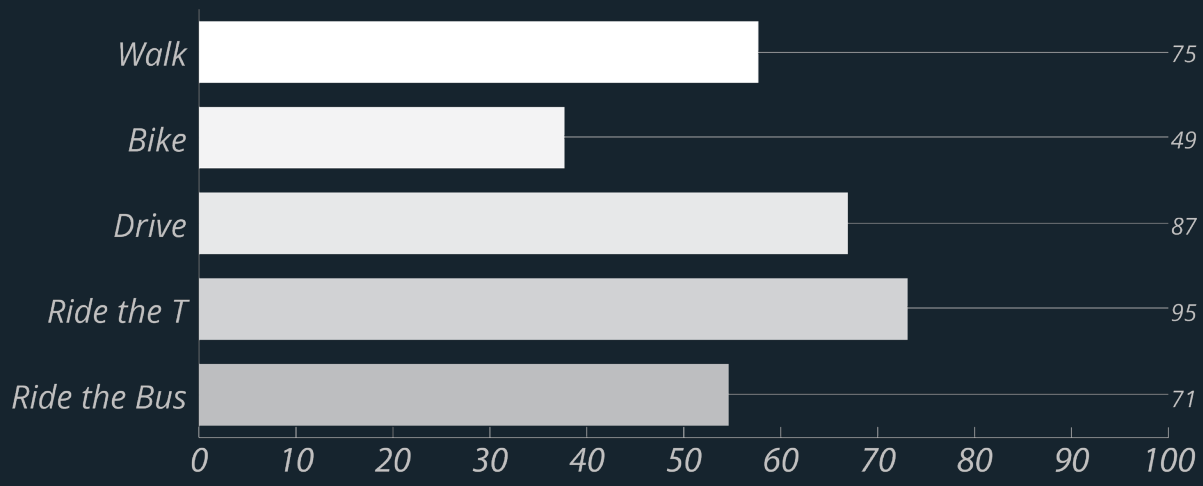


Figure 10. Survey Question #9

KEY CHART: HOW DO YOU MOVE AROUND THE SULLIVAN SQUARE AREA? SELECT ALL THAT APPLY.

Answered: 130 **Skipped: 2**



IMPROVEMENTS AND STRATEGIES **THAT WERE TESTED**

The community engagement process identified an abundance of ideas for transportation improvements, services, and policies that could change transportation conditions in the area for the better. The Working Group and technical staff also identified a wide range of ideas, all of which were qualitatively assessed for utility, cost, and feasibility. Unfortunately, not all these ideas could be rigorously modeled, so the Working Group undertook an internal process to select a set of improvements or policies to test and group into discrete scenarios. These ideas were incorporated into the travel model in addition to all of the ongoing transportation projects described earlier. This section describes each of the new infrastructure, policy, and service ideas that were tested as part of this process.

ROADWAY **IMPROVEMENTS**

Rutherford Avenue:

In 2012 Boston developed a new design for Rutherford Avenue and Sullivan Square, focused on an entirely at-grade street network. However, the 2014 decision by the Massachusetts Gaming Commission to license Encore Boston Harbor in nearby Everett, and the associated increase in projected corridor traffic, led the City of Boston to reconsider these plans. When the Working Group project commenced, the City of Boston was examining various alternatives for Rutherford Avenue and Sullivan Square. These alternatives utilize underpasses, create a solely surface road network, or support some combination of the two. Because that process was occurring concurrently with the Lower Mystic process, the Working Group technical staff tested two options as part of the first several model runs. The first option was the surface approach that had been previously incorporated into the most recent Long-Range Transportation Plan (LRTP) adopted by the Boston MPO in 2015; the second option included one northbound and two southbound underpass lanes to alleviate surface traffic at Sullivan Square, and a four-lane (two northbound, two southbound) underpass at the Austin Street intersection. In advance of these two model runs, the Working Group decided to defer to the City's decision-making process and to adopt the City of Boston's preferred alternative. In May 2017 the City of Boston announced it was proceeding with the "underpass option." Upon the City's decision, the Working Group incorporated this underpass design for Rutherford Avenue into all subsequent model runs.

New I-93 northbound on-ramp at City Square:

A new on-ramp to I-93 northbound could provide motorists from the City Square area of Charlestown and the North End of Boston an opportunity to directly get onto I-93 north instead of having to travel on Rutherford Avenue through Sullivan Square for I-93 northbound access. Technical staff tested multiple iterations of the on-ramp with varying location and access points in order to optimize operations. The initial ramp tested entailed a single ramp located across from City Square, utilizing an existing unused 'spur' that was never completed. Later iterations entailed a two-part ramp that could be accessed directly from City Square or adjacent to the entrance to the Route 1 North on-ramp.

I-93 northbound off-ramp at Sullivan Square:

A reconfigured off-ramp could provide a direct connection from I-93 north to Route 99 and the Alford Street Bridge, eliminating the need for Everett-bound motorists to travel through Sullivan Square. The concept that was tested entailed a new ramp passing over or in front of the existing transit station at Sullivan Square, and then connecting to Route 99 via a signalized intersection or flyover.

Converting the I-93 southbound high-occupancy vehicle (HOV) lane to a general traffic lane:
Currently the HOV lane is not utilized to its full capacity and converting this to a general purpose lane could provide an increase to I-93 southbound capacity. However, it would also have the negative effect of increasing travel times for buses and carpools currently using the HOV lane. A change in state environmental regulations would also be required to eliminate the HOV designation.

TRANSIT **IMPROVEMENTS**

Bus route improvements:
The Working Group assessed the benefits of improvements to existing bus routes 85, CT2, 87, 88, 90, 99, 104, 105, 106, 109, 110, and 112. Improvements were classified as either "minor change" (i.e., greater frequency) or "major change" (altering routes).

New bus routes:
A variety of new routes were tested, including limited stop service between Everett to downtown Boston, a new Lechmere to Kendall Square shuttle, a new Assembly Square to Lechmere route (Route 92A), and a new CT4 route, connecting the Sullivan Square and Kendall stations. These new bus routes could operate as MBTA services or as a private fleet as part of a Transportation Management Association.

Bus-only lanes:
Following the success of a recent pilot effort in Everett, the study evaluated potential impacts of permanent bus-only lanes on Broadway between Ferry Street and Alford Street Bridge in Everett and on First Street, Binney Street, and Third Street in Cambridge.

Improved Orange Line frequency:
This improvement would reduce peak period headways from four and a half minutes to three minutes on the Orange Line. Achieving three-minute headways would likely require an additional 78 cars beyond what has currently been ordered (230 total cars), as well as a new signal system, upgrades in power supply, and an expanded maintenance facility at Wellington.

New bus rapid transit services:
Everett currently lacks rapid transit options to Downtown Boston, Kendall Square, and the Seaport district. New bus rapid transit service could provide additional transit access between Everett, Cambridge, Charlestown, and Somerville. This idea would provide two additional routes. One would be a new service from Glendale Square in Everett, which is a major population center in the City, and would connect to North Station via Sullivan Square along Broadway and Rutherford Avenue. The second alignment would build off of the Silver Line (although service may be distinct from the Silver Line) from the Chelsea Station terminus and connect to Kendall Square and North Station, both via Sullivan Square using a combination of streets, dedicated bus lanes, and the commuter rail right-of-way.

Sullivan Square commuter rail stop:
A new commuter rail station at Sullivan Square would provide a new transfer point for North Shore commuters using the Newburyport/Rockport Commuter Rail line. It would create an opportunity to transfer to the Orange Line and the bus routes that serve Somerville and Cambridge, providing North Shore commuters potentially faster access to Assembly Square, a redeveloped Inner Belt in Somerville, and Kendall Square.

Orange Line spur from Sullivan Square through Everett:
This major infrastructure project would parallel the existing Newburyport/Rockport Commuter Rail ROW from Sullivan Station northward to Route 16 before entering a tunnel with a terminus near Glendale Square. Possible stations could be located at Everett Square, Sweetser Circle, Glendale Square, and Gateway Center. Because of the multi-billion dollar cost of creating this line, several permutations were tested by examining the effects of a different number of stations and length of the extension.

Rivers Edge Station:
A new Orange Line station was considered between Wellington and Malden Center.

Green Line Extension Phase II:
The Green Line Extension currently under construction was initially planned to extend all the way to the Mystic Valley Parkway in Medford. For cost and feasibility reasons the Green Line Extension is now planned to terminate at College Avenue. A station at Mystic Valley Parkway continues to be considered and is currently undergoing environmental review by MassDOT.

TRANSPORTATION DEMAND **MANAGEMENT POLICIES**

Transportation demand management (TDM) refers to a suite of policies intended to reduce travel demand by single occupancy vehicles. TDM measures can include subsidized transit passes, employee shuttle buses, incentives to travel by alternative means (carpool, transit, bike), providing showers and locker rooms at work, and other ideas which encourage residents and employees of an area to not travel using a single occupancy vehicle. Because it was not feasible to model all possible TDM measures, technical staff focused on a few key elements.

Reduced residential parking requirements:
The study evaluated the effect of lower residential parking supply for new residential development in the scenario focus area by creating a lower ratio of parking spaces to housing units. However, due to the difference in density, transit access, and current resident mode share, the ratio varied across the focus area municipalities and neighborhoods. Based on consultation with the municipal planning staff and current plans of each community, the technical staff assumed a range of 0.5 to 0.95 spaces per unit for new residential developments. In the Focus Area, the number of vehicles per household in new developments was changed from 1.03 in the Planned Growth scenario to 0.87 in Charlestown, from 1.23 to 1.13 in Everett, and from 1.10 to 0.81 in Somerville.

Charging market rates for commuter parking:
The Working Group wanted to test strategies to require new commercial developments to reduce the amount of free parking for employees. This idea was modeled after the City of Cambridge's Parking and Transportation Demand Management ordinance. As part of Cambridge's policy, developers must identify specific actions they will take to reduce auto trips to their site, which can include subsidized transit passes, providing a payment to employees who do not drive, charging market rate parking fees, or other measures. In order to model this type of policy, the study evaluated the effect of higher daily commuter parking prices in projected high growth zones in the Focus Area as a proxy. The sites include the Commercial Triangle in Everett, Union Square, Brick Bottom, and Assembly Row in Somerville, and Sullivan Square in Charlestown. The technical team researched comparable locations in Metro Boston,

WATER **TRANSPORTATION**

The need for improved water services was also raised. While the Working Group acknowledges water transportation as an emerging potential transportation mode, it was not included as one of the improvement scenarios due to the complexity of incorporating it in the regional travel demand model. The Encore resort, however, has committed to providing water transportation service as part of their MEPA certificate, and a separate process has begun to comprehensively study water transportation in the metropolitan Boston area.

with a focus on Kendall Square in Cambridge because of its proximity to the study area and development patterns that may serve as a template for commercial growth in the study area. Consequently, the technical staff applied a $22 daily rate (in 2016 dollars) as a proxy for what the non-subsidized market rate may be in 2040 for both employees and visitors who drive to those areas.

Telecommuting/Flex commuting policies:
Telecommuting and alternative work schedules can reduce the number of work trips in the study area, especially during rush hour. The focus was on job sectors that may not require workers to be physically on site and assumed a quarter of commuters within these job sectors work remotely or off peak once per week. See Appendix 4 for additional details regarding this research.

ACTIVE TRANSPORTATION **IMPROVEMENTS**

Complete Streets:
Continued implementation of complete streets throughout the study on main roads (sidewalks, crosswalks, separated/traditional bicycle lanes, etc.).

Mystic River pedestrian bridge:
This bridge would connect Assembly Station and Encore Boston.

Rivers Edge pedestrian bridge:
This bridge would connect a potential Rivers Edge Station on the Medford/Malden line with Everett, across the Malden River.

LAND USE **PROJECTIONS**

Assumptions about future land use are a critical input into the travel demand model. MAPC prepared two distinct land use projections for modeling purposes. These projections varied in the amount, location, and timing of development in the study area. The first projection was a minor modification of the land use forecasts used for the most recent Long-Range Transportation Plan (LRTP) adopted by Boston MPO in 2015. The second projection – the planned growth scenario – incorporates even more recent information about planned development and municipal goals for development, thereby providing a more accurate picture of market trends and local visions. In both cases, most of the adjustments to the land use model inputs were concentrated in the Scenario Focus Area, though these changes also had ripple effects throughout the region due to the need to maintain a regional control total. These two scenarios are described below.

SCENARIO 1: THE MODIFIED LRTP LAND USE PROJECTION

The **Modified LRTP Land Use Projection** was a slight modification of the land use projections used for the 2015 LRTP. It is common practice for MassDOT studies to use the land use from the most recent LRTP as a starting point for modeling. In this case, MAPC modified the projections slightly based on information about recent development. Specifically, MAPC modified the distribution of housing and nonresidential growth within each of the three cities (Boston, Somerville, and Everett) without changing the total population, households, and employment forecast for each municipality in 2040. The Modified LRTP Land Use Projection entails a substantial amount of growth in the Scenario Focus Area: a 38% increase in households and a 36% increase in employment.

SCENARIO 2: THE PLANNED GROWTH LAND USE PROJECTION

The **Planned Growth Land Use Projection**, the scenario that the Working Group decided to use as the baseline to which to compare the other alternatives, incorporates newer and more extensive information about development in the pipeline and municipal plans for rezoning and redevelopment in the area. As described above in the section on technical methods, MAPC collected information about individual developments, estimated the development capacity (in terms of housing units and nonresidential square footage) of municipal local area plans, and input those assumptions into the Land Use Allocation Model. In contrast to the Modified LRTP projection, Planned Growth is not constrained by preexisting totals for each municipality, so these new assumptions in the Planned Growth projection about development activity and zoning capacity in the study area result in higher levels of growth for each municipality overall. Since the regional totals for population and employment growth remain fixed, the difference is made up for by reduced growth in other areas outside of the Lower Mystic study area. The exact distribution of growth within the Focus Area as well as adjustments elsewhere in the region is all determined by MAPC's land use allocation model based on development and zoning inputs; it is not specified directly by technical staff.

By relying on municipal goals for development without the constraint of municipal control totals, the Planned Growth projection anticipates a substantially higher level of growth than the Modified LRTP land use projection. Within the Scenario Focus Area, the Planned Growth projections anticipate an additional 27,000 housing units between 2010 and 2040—nearly doubling the number of households in the Focus Area—and enough commercial space for 55,000 new jobs, equivalent to 140% growth over 2016. In terms of household and employer characteristics, the Planned Growth projections anticipate a growth in smaller households, and about 80% growth in the number of workers living in the area. The largest employment gains would be in retail, leisure and hospitality.

The Working Group decided to use the Planned Growth projections as the land use conditions on which to model the alternatives described below. If the level of growth outlined in the Planned Growth projections occurs, the Lower Mystic Area would become one of Massachusetts' most significant housing and employment growth areas. The most recent statewide projections used by MassDOT anticipate a growth of 246,873 jobs statewide between 2010 and 2040, and MAPC has projected a need for approximately 500,000 housing units statewide over that same period. Our modeling indicates that the Focus Area alone could accommodate 22% of statewide employment growth and 5.4% of statewide housing unit growth over that thirty-year period.

Figure 11. Employment Change: Planned Growth Scenario 2010-2040

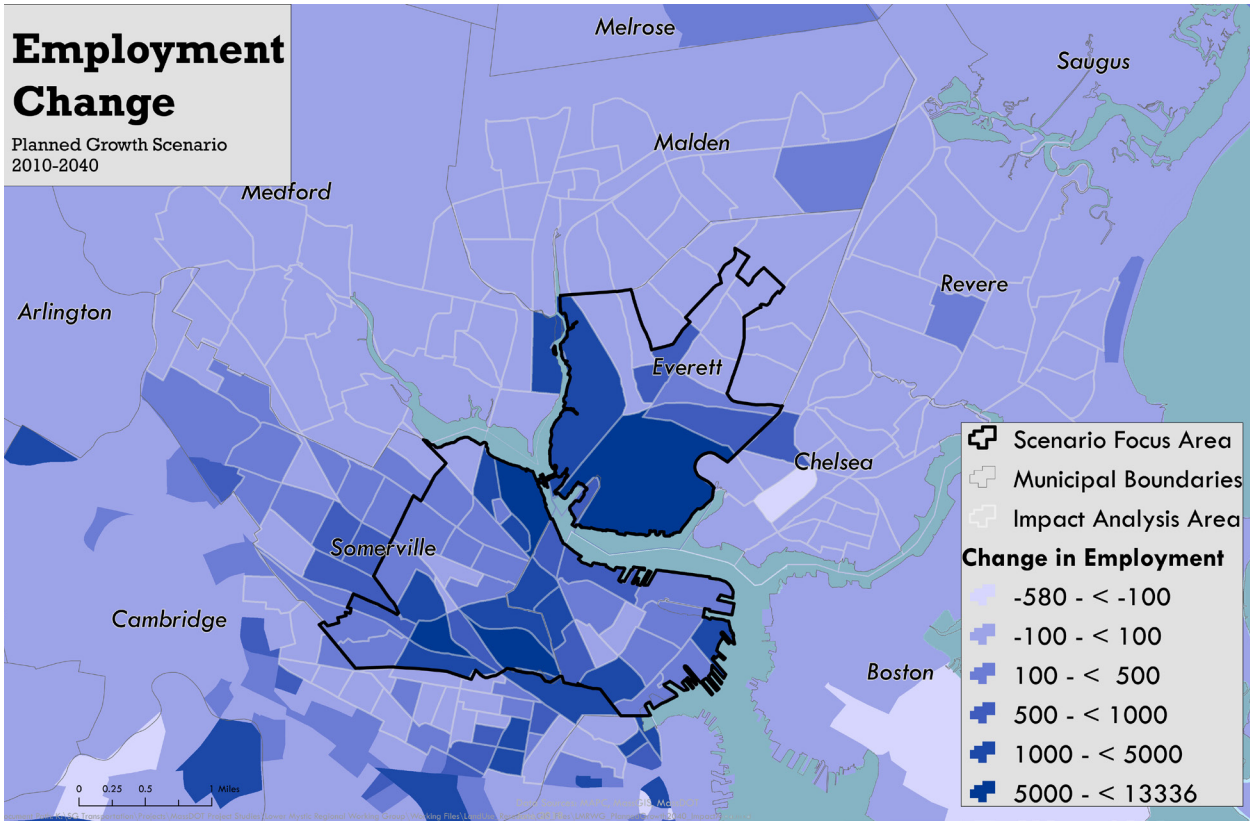
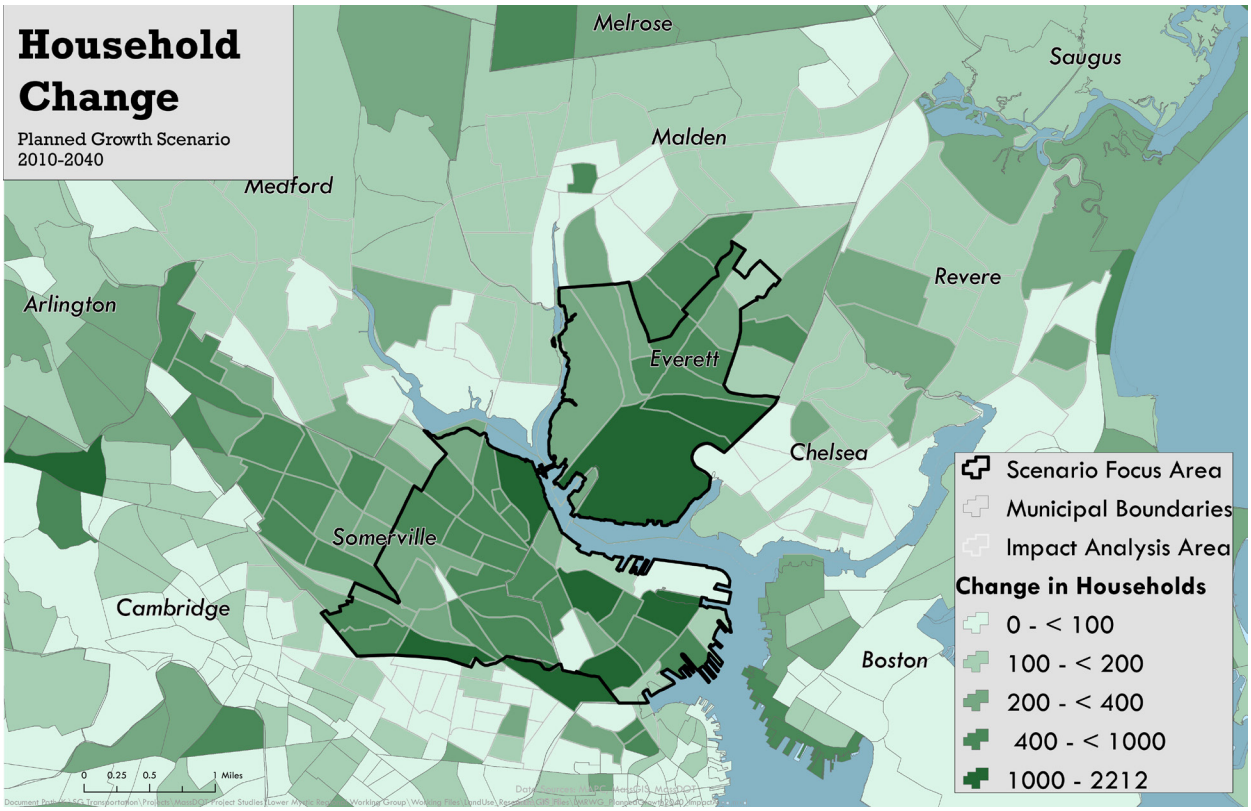


Figure 12. Household Change: Planned Growth Scenario 2010-2040



COMPREHENSIVE SCENARIOS

In order to better understand the interaction among land use, transportation improvements, and other policies, the Working Group developed and tested more than a dozen different "scenarios" of future conditions. Each scenario encompasses a specific set of assumptions about land use, transportation improvements, and policies selected to distinguish the impacts of individual interventions or reveal the interactions between different actions. Every scenario described here was evaluated using the regional travel demand model, and most were also assessed using the Synchro and Transmodeler tools that provide intersection-level detail. Due to time and budget constraints, the accessibility analysis was performed for only the base year (2016) and two future year scenarios.

The results from all of the scenarios were evaluated by the Working Group. Based on this information, the Working Group selected a set of the most promising options to incorporate into a final "package" scenario. The results of that final scenario indicate the improvements that could be achieved if all of the Working Group's recommendations are adopted. This section summarizes the elements that were included in each scenario as well as general observations about the results.

BASELINE MODEL: **LONG-RANGE TRANSPORTATION PLAN "NO BUILD"**

This scenario uses the Modified LRTP Land Use projections and includes all of the transportation improvements that were incorporated in the Boston MPO's 2040 LRTP, adopted in 2015. The LRTP is the long-range, comprehensive transportation planning document for the Metropolitan Boston region. It is common practice for MassDOT planning projects to use this baseline set of projects as the reference point for future modeling. Such scenarios are sometimes referred to as a "no-build" scenario, even though they may still anticipate building quite a lot. Transportation improvements included as part of the LRTP include improving headways (i.e., more frequency) on the Orange Line from six minutes to four and a half minutes during peak periods, the Green Line Extension Phase I, and Encore Boston Harbor mitigation measures. This scenario also included the surface option for Rutherford Avenue, as it had been programmed in the LRTP. See Appendix 5 for a comprehensive list of LRTP projects.

This model scenario indicates that travel demand is likely to increase substantially in the study area, and travel conditions are likely to become more challenging, with substantial increases in the total number of trips and the amount of auto travel. Congestion at the area's intersections would deteriorate substantially. The number of trips taken by transit is likely to grow, though with limited increases in transit capacity it is likely that overcrowding on buses and trains will worsen.

SCENARIO 1:
PLANNED GROWTH
"NO-BUILD"

Scenario 1 uses the same set of transportation improvements assumed for Scenario 1 but incorporates the Planned Growth land use projection developed by MAPC based on the current development pipeline and municipal plans.

As described above, the Planned Growth projections include a substantially higher amount of both housing and commercial development in the Focus Area. As a result, it should come as no surprise that overall travel demand and congestion is higher than in the LRTP No-Build Scenario. Compared to the 2016 base year, the Planned Growth No-Build scenario would see growth of 375,000 trips to and from the Impact Analysis Area daily, an increase of 34% over 2016 conditions. With no additional mitigation above and beyond what is already planned, transportation conditions would worsen substantially. Vehicle miles traveled in the Impact Analysis Area would rise by 12% over 2016 levels, and 27 of the 79 major intersections would be at or below a 'F' Level of Service during the morning and/or evening commute (up from 18 in 2016). Orange Line ridership would increase by 22%. The Working Group agreed to use the Planned Growth conditions as the land use inputs for all of the subsequent scenarios modeled.

SCENARIO 2:
PLANNED GROWTH
NO-BUILD WITH SULLIVAN SQUARE UNDERPASS

Scenario 2 utilizes the same land use and transportation system assumptions as Scenario 1, but this scenario incorporates the City of Boston's proposal for underpasses at Sullivan Square and Austin Street.

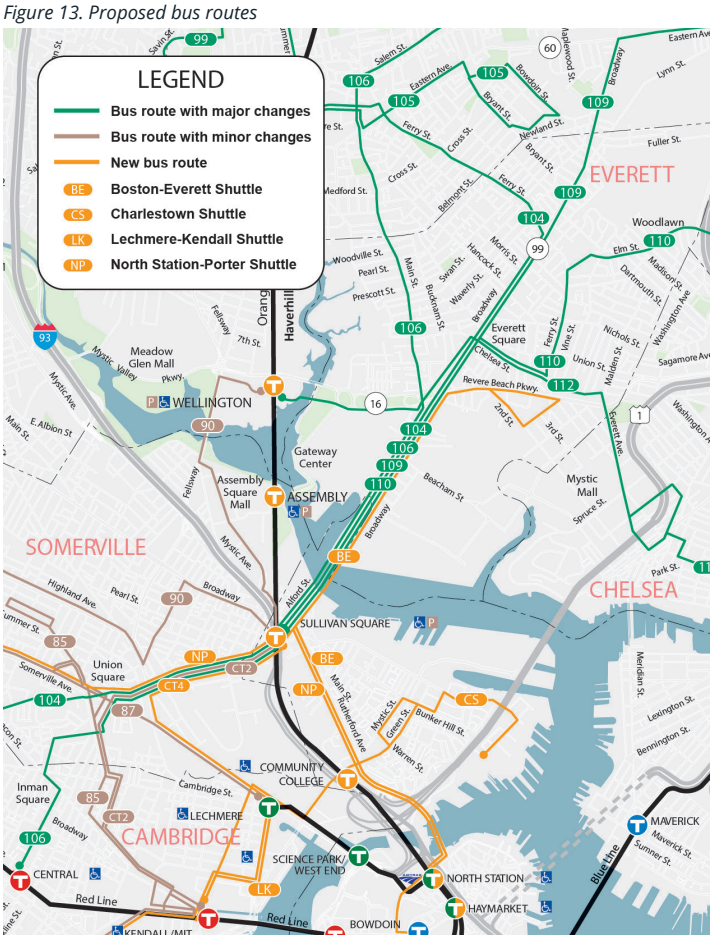
Since the underlying land use assumptions are the same as Scenario 1, there are no differences in the amount of trip-making in the Focus Area. Results of the Synchro model show that the underpass approach does improve congestion somewhat at Sullivan Square, Austin Street, and City Square; with the underpass, all of those intersections would be operating at a level of service of 'E' or better. Across the entire study area, 25 of the 79 major intersections would remain at an 'F' level of service in the morning and/or afternoon commute. Results showed minor differences between Scenarios 1 and 2 with regard to area-wide traffic flows or congestion. As conditions along Rutherford Avenue saw some traffic relief, the model documented a 'backfilling' effect in which regional traffic is redirected to take advantage of the new capacity. As a result, the total VMT in the Focus Area is marginally higher with the underpass as compared to the surface option, by 0.95% to 1.14% during rush hours. Model results indicated no difference in conditions on I-93.

As described previously, when the City decided to adopt the underpass configuration through its community engagement process, the Working Group agreed to include it in all of the subsequent scenario modeling.

SCENARIO 3:
BUS IMPROVEMENTS AND TRANSPORTATION DEMAND MANAGEMENT

This scenario incorporated the Planned Growth land use projections and all of the No-Build improvements, along with improvements to existing bus routes, new bus routes, bus-only lanes, expansion of Complete Streets, and all of the transportation demand management policies described above (reduced residential parking requirements, market rate commuter parking, and telecommuting/flex commuting policies).

Figure 13. Proposed bus routes



This scenario entails a substantial amount of new bus service. It would add 4,100 revenue miles per day over all the proposed service expansions (triple what is provided today), and an additional 560 revenue hours per day. Specific bus routes that were adjusted, added, or provided with bus-only lanes are described above. When the Working Group was determining what elements to include in this Scenario, the City of Boston had not yet made a final determination regarding its preferred configuration of Rutherford Avenue. Therefore, two scenarios were modeled: Scenario 3S, with the surface option, and 3U, with the underpass option.

The combination of increased transit service along with substantial TDM policies would result in significant mode shift: there would be an additional 150,000 transit trips daily, and 30,000 additional transit trips during rush hour. Model results project a 150% increase in bus ridership on targeted routes, with the most significant increases occurring on the Everett-to-Boston routes, the proposed CT4, and Route 110. The Orange Line would experience a 10% increase in boardings, with the largest increases occurring at Sullivan Square (50% increase) due to the large number of 'feeder buses' that provide connections to the rapid transit system at Sullivan Square. However, this increase in demand is likely to exceed capacity on the Orange Line at Sullivan Square and on some of the new bus routes. The share of trips made by walking and biking would increase by 1-2%, with the biggest changes occurring during off-peak times.

As a result of improved transit access and reduced automobile availability, automobile travel in the area is reduced, and intersection conditions are correspondingly improved. Comparison of the results from Scenarios 3S and 3U show that, as compared to the surface option, the underpass option reduces congestion and increases vehicle throughput on Rutherford Ave by 1.4% to 2.1%, but has little to no effect on congestion elsewhere in the Impact Analysis Area.

SCENARIO 4:
PARKING RESTRICTIONS SENSITIVITY TESTING

Scenario 4 involved a pair of model runs that included most of the elements that were included in Scenario 3 but was structured so that the Working Group could isolate the impact and benefit of the parking policies that were included in that scenario assuming the same transit options. Scenario 4.1 included all the elements of Scenario 3U (underpass option), with the exception of the proposed market-rate pricing for commuter parking in the major employment growth areas. Scenario 4.2 included all the elements of Scenario 3U, with the exception of the reductions in residential parking availability and corresponding automobile ownership. With this approach, the technical team could determine what fraction of the improvements observed in Scenario 3 were attributable to the changes in the two different parking policies.

The results of these scenarios show that commercial parking pricing has the most significant effect on AM and PM transit mode shares, accounting for 40% to 70% of the mode shift observed in Scenario 3. Residential parking reduction policies account for about 10% of the shift to transit. Put together, these findings indicate that, in the absence of progressive parking policies, improvements to transit service in the area will have only 20% to 50% of their potential benefit. Parking policies can multiply the mode shift benefits of new transit service by a factor of two to five.

SCENARIO 5:
RAMPS AND LANES

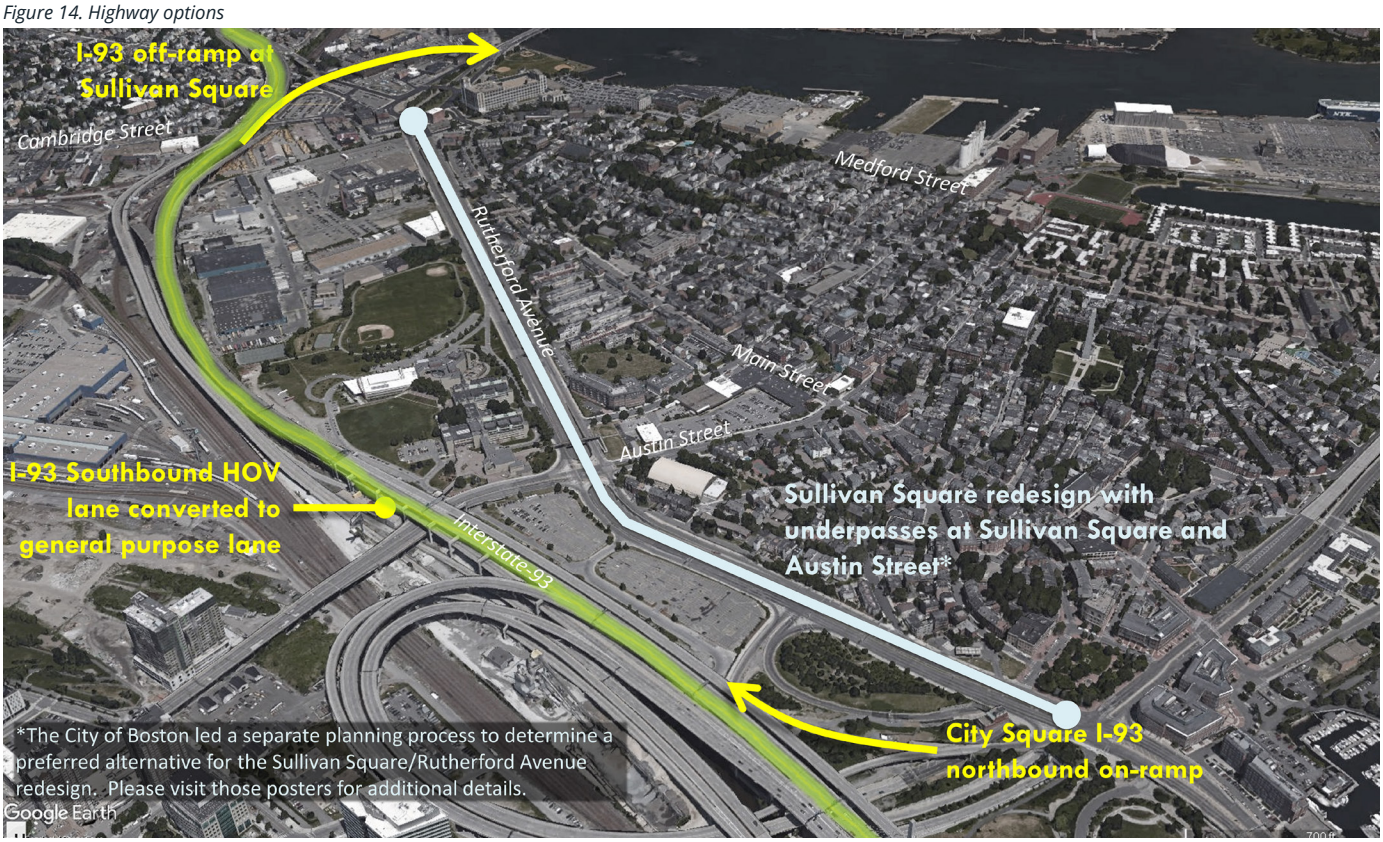
This scenario tested the benefits of three substantial roadway capacity projects: a northbound I-93 on-ramp at City Square, an I-93 off ramp at Sullivan Square connecting directly to Alford Street, and the conversion of the HOV lane on I-93 to a general purpose lane. A variant of this scenario (5.1) was also run, omitting the I-93 off-ramp at Sullivan Square.

The Synchro results from Scenario 5 demonstrated a moderate decrease in traffic delay in the Sullivan Square area during the morning peak periods; however, further south on Rutherford Avenue near City Square and also in Everett along Broadway between the Alford Street Bridge and Revere Beach Parkway, moderate increases in delays were observed. This suggests that the improved traffic flow in Sullivan Square moved the bottlenecks to other parts of the Focus Area. The evening peak period experienced similar traffic delays in Everett and near City Square with no change in Sullivan Square. The effects were similar for Scenario 5.1, although Sullivan Square saw a slight increase in delay during the AM peak hour.

Disaggregating the three components provides additional insight into the results. Although converting the HOV lane to a general purpose lane is relatively inexpensive, the modeling suggests that the effects would worsen traffic conditions through the Impact Analysis area, increasing delays in Sullivan Square and along Broadway. The Working Group noted that removing this HOV lane would likely increase the bus travel time for any buses traveling on I-93 South, the riders of which now benefit from a congestion-free HOV lane. There were no mode shift benefits, and the primary beneficiaries are to existing morning vehicle trips originating from points further north along I-93. There was some improvement in weaving and merging due to the conversion. The I-93 off ramp at Sullivan Square would improve traffic conditions in Sullivan Square but, in addition to its high cost and complexity, would have negative impacts on the area's future development given the land taken up for the ramp itself. There was also limited use, with primary benefits to existing PM vehicle trips.

Because of continued interested in the City Square on-ramp, additional modeling was performed to test multiple iterations, including eliminating the left-hand turn coming from the North End, moving the location of the ramp further north, and testing on-ramps at both locations that merge prior to joining I-93. The results from the latter test suggest a minor improvement along Rutherford Avenue and Sullivan Square, but additional study is needed to better quantify the benefit to Rutherford Avenue and potential impacts to I-93 as merging traffic onto the highway creates weaving.

Figure 14. Highway options

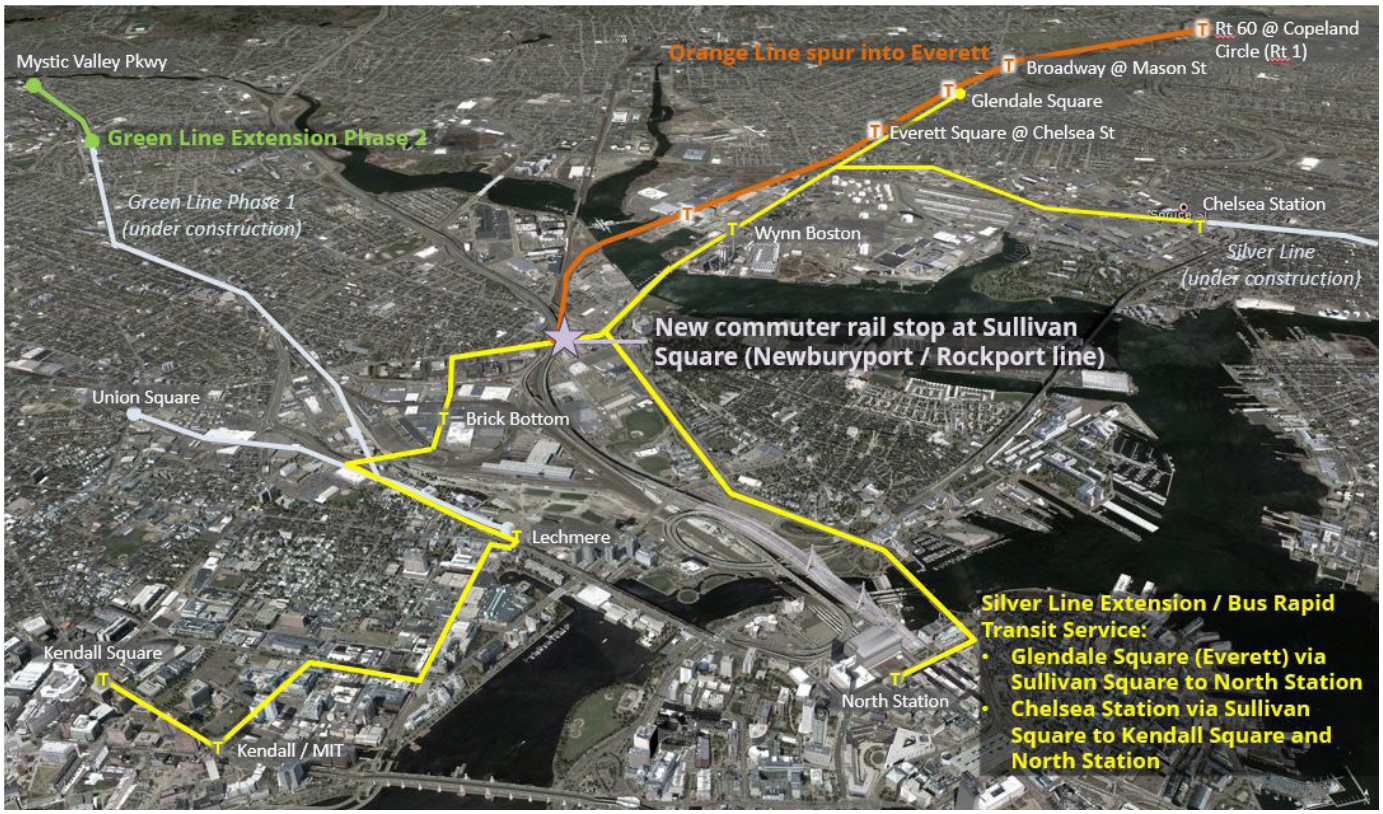


SCENARIO 6:
BUSES AND TRAINS

This scenario examined the benefits of major fixed route transit expansions. Specifically, it included a bus rapid transit extension from the new Silver Line terminus at Chelsea Station and from Glendale Square in Everett to North Station and Kendall Square; the Green Line Extension Phase II to Mystic Valley Parkway (Route 16); and a new commuter rail stop at Sullivan Square. These results were tested with (6.1) and without (6.0) the residential and commercial parking constraints described above, to help assess the extent to which parking policy can help transit investments achieve their full potential.

The new bus rapid transit routes were well-utilized, with 28,000 boardings without parking restrictions and 36,000 boardings with the parking restrictions. Combined with the parking restrictions, these routes led to a 3% drop in automobile mode share in the impact analysis area (1% drop without parking change). These routes also reduced traffic delay in Sullivan Square and other key intersections throughout the Impact Analysis Area.
The new Mystic Valley Parkway station that would be constructed as an additional extension to the Green Line project was modestly utilized. Peak period boardings were 2,600 in Scenario 6, but since many of these riders were switching from bus trips, the net gain was only 390 new transit riders. With the parking restrictions, the model projects 4,000 boarding, including 1,600 new riders. There was little impact, however, on congestion in the Focus Area, including Sullivan Square.

Figure 15. Transit Options



The new commuter rail station resulted in 400-600 daily boardings (without and with parking restraints) and improves connectivity to buses heading to Cambridge and Somerville. As with the Green Line Extension Phase II, there was little impact on traffic improvements in Sullivan Square.

SCENARIO 7:
RIDE, WALK, BIKE

This scenario assumed continued implementation of Complete Streets components throughout the study area on main roads, including 27 miles of sidewalk improvements and 42 miles of bike facilities (bike lanes and separated bike lanes) in the Focus Area, as well as safety improvements for pedestrian travel (e.g., crosswalks and accessibility improvements). It also included two larger infrastructure projects: a pedestrian bridge between Assembly Station and Encore Boston Harbor over the Mystic River, and another pedestrian bridge between a proposed Rivers Edge Station Orange Line station on the Medford/Malden line and Everett over the Malden River. The Rivers Edge Station was also modeled as part of this scenario, along with Orange Line headway improvements from four and a half to three minutes.

Figure 16. Select Bicycle/Pedestrian Connections

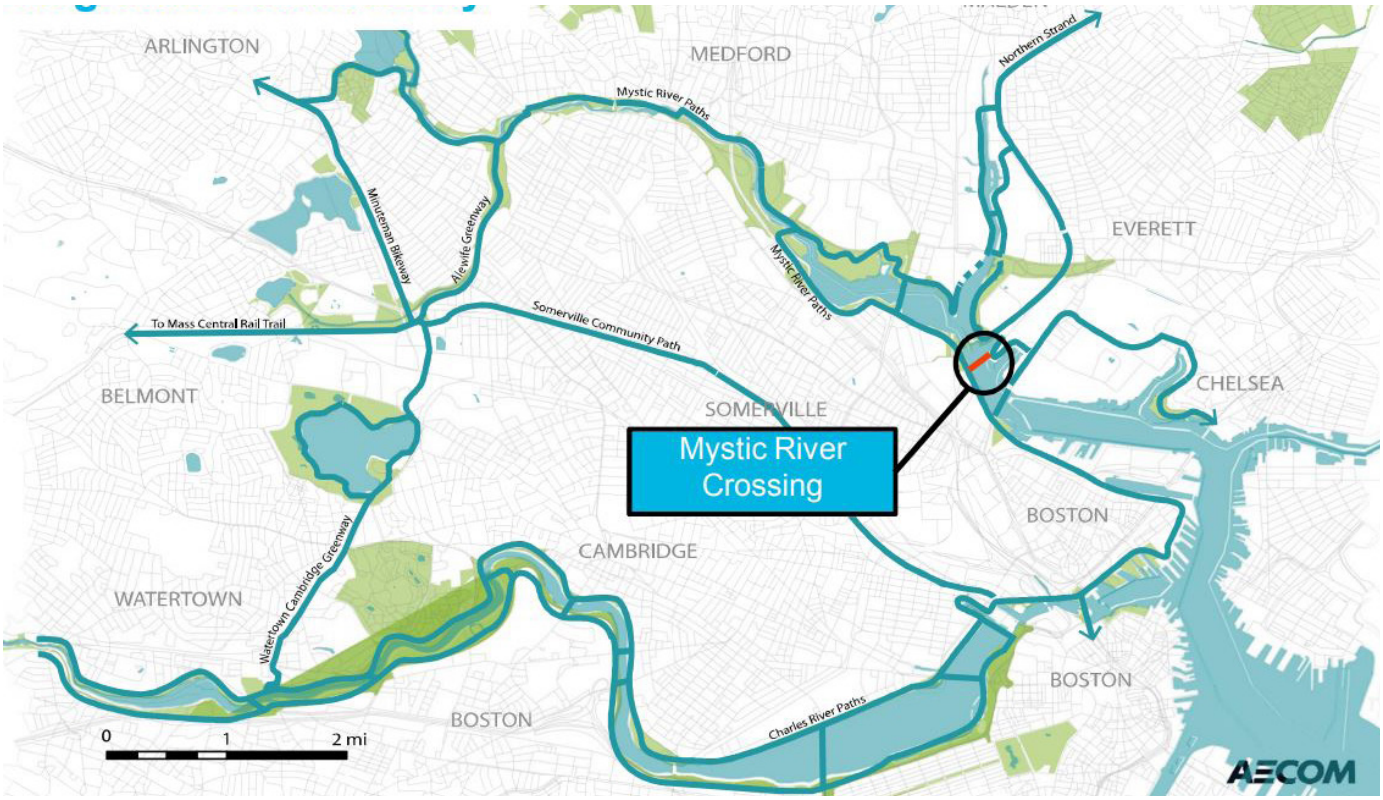


Figure 17. Example of Complete Streets

The Orange Line headway improvements had one of the greatest positive impacts among all the elements modeled as part of the study. According to the model, daily boardings increased by 12,100 and new transit trips increased by 8,000. It also led to a 2% reduction in automobile usage in the Impact Analysis area with reduced traffic delay in Sullivan Square and other locations.

Implementing Complete Streets – which were assumed in each scenario from Scenario 3, excluding the Ramps and Lanes Scenario – had minor effects on traffic conditions according to the model. New daily transit trips increased by 200, presumably because transit became more accessible from pedestrians and bicyclists. Similarly, the pedestrian bridges increased new transit trips by a further 300 trips. There was a negligible effect on mode share; however, the Working Group acknowledged that such improvements have many benefits that cannot be modeled – safer biking and walking, and the ability to make more, shorter, non-motorized trips within TAZs, for instance.

The Rivers Edge Station resulted in 500 boardings, but Malden and Wellington Station experienced a slight decline in boardings as the Rivers Edge Station likely siphoned off some of these boardings.

SCENARIO 8:
ORANGE LINE SPUR

This scenario included a potential spur of the Orange Line from Sullivan Square through Everett to Route 60 in Revere (including a structured commuter parking garage), coupled with headway improvements to three minutes along the main trunk of the line (resulting in six-minute headways along the Oak Grove and new spur branches). An Orange Line spur could create close to 40,000 new daily transit trips, including those from nearby communities traveling to a terminus near Route 1. According to the modeling, the potential spur could reduce automobile mode share by 5%, diverting approximately 35,000 daily automobile trips. Morning peak City Square and Broadway traffic would decrease by 2% and Sullivan Square traffic would reduce by 1%. Traffic on the Tobin Bridge would be reduced by 3%.

Technical staff estimated that the full extension could cost $5 billion or more. In order to examine less costly options, the Orange Line Spur was modeled with two and three stations as well. In both of these models, automobile shares reduced by 4%. Again, traffic improved, although less along Broadway than with the five-

station model. This option, including its shorter variant, would cost billions of dollars to construct (this was the most expensive element tested in this study). The Working Group determined that, given budgetary constraints in today's environment as well as the MBTA's focus on maintenance, an Orange Line spur was less likely to be constructed in the near- to mid-term.

FINAL PACKAGE SCENARIO

Following the evaluation of Scenarios 1 through 8, the Working Group selected the most promising elements and combined them into a "package" scenario of the most feasible recommendations given previous modeling runs. This scenario includes the following elements (all previously described):

- Orange Line headway improvements to 3 minutes
- Two overlapping BRT routes extending from Chelsea Gateway to Kendall Square and from Downtown Everett/ Glendale Square to North Station, along the existing commuter rail right of way, with 10 minute headways on each branch.
- Selected local bus improvements (a subset of those modeled in Scenario 3) that complement but do not duplicate the proposed BRT service. The following routes would see improved frequencies and modified routes: 85, CT2, 87, 88, 90, 99, 104, 105, 106, 109, 110, and 112. This scenario also includes the bus-only lanes described previously.
- Transportation Demand Management and parking reduction strategies
- Active Transportation Improvements: Mystic River bicycle/pedestrian bridge, Northern Strand connection across Route 16, Malden River bicycle/pedestrian bridge, Somerville Community Path.
- New on-ramp to I-93 northbound from Rutherford Ave near City Square and at the existing Route 1 on-ramp and at City Square

This final package scenario demonstrates substantial improvement in transportation conditions as compared to the Planned Growth No-Build (Scenario 1). Overall, the number of person trips to and from the Impact Analysis Area is about 8% higher than in Scenario 1, and 45% higher than the 2016 base year conditions. The increase in person trips can be explained by the reduction in auto availability, which results in a higher number of local trips being made.

As a result of decreased auto availability and improved transit service, many more trips are made by transit. The transit share in the Impact Analysis Area is 36.5%--six percent higher than Scenario 1 and ten percent higher than the 2016 base year. Within the Scenario Focus Area closest to Sullivan Square, the transit mode share is projected to be 44% of all trips. Daily Orange Line ridership would be approximately 38,600 trips higher than in Scenario 1, and the three minute headways would provide the capacity sufficient to accommodate that additional demand without overcrowding the system. In the final package scenario, the new bus rapid transit is projected to see daily ridership of 13,400 trips on the route from Glendale Square to North Station, and 27,600 trips on the route from Chelsea Gateway to Kendall Square. Overall local bus ridership would be higher than Scenario 1 by 55,000 riders daily.

Conditions in the Package Scenario would improve for drivers as well. Only 21 major intersections would be at or below an "F" level of service, as compared to 27 in Scenario 1 (though still up from 18 failing intersections in 2016).

SUMMARY OF IMPROVEMENTS

The figure below breaks down the various elements modeled, highlighting approximate costs and several of the key metrics the Working Group used to assess the various improvements, including change in mode share, and the effects of traffic at key intersections, green house gases.

Figure 18. Comparing Options

2040 PERFORMANCE MEASURES *Arrow indicates whether higher or lower values are more desirable*	New Transit Trips ↑	Capital Cost ↓	Annual Operating Cost ↓	Auto Share ↓	Transit Share ↑	Changes in McGrath Traffic Delay[1] ↓	Changes in Broadway Traffic Delay[1] ↓	Changes in Sullivan Sq. Traffic Delay[1] ↓	Changes in City Sq. Traffic Delay[1] ↓	GHG in Study Area (Kilograms) ↓	Constructability[2] ↓
Bus Improvements & TMA Shuttles	102,000	$ 205,000,000	$ 23,572,000	-4%	4%	-1	0	-1	-1	-229,250	4
Bus Improvements & TMA Shuttles with TDM Policies[3]	147,000	$ 205,000,000	$ 23,572,000	-5%	5%	-3	-1	-2	-2	-336,440	5
Bike/Pedestrian Improvements	200	$ 10,000,000	$ -	0%	0%	0	0	0	0	-500	3
Bike/Pedestrian Improvements with TDM Policies[3]	300	$ 10,000,000	$ -	0%	0%	0	0	0	0	-700	4
Work from home	-200	$ 10,000,000	$ -	0%	0%	0	0	0	0	500	1
Work from home with TDM Policies[3]	-400	$ 10,000,000	$ -	0%	0%	0	0	0	0	1,000	1
I-93 – Convert HOV To General Purpose	-200	$ 100,000	$ -	0%	0%	-1	1	1	0	500	5
I-93 – City Square Northbound On-Ramp	0	$ 46,900,000	$ 3,400	0%	0%	0	0	0	1	0	6
I-93 – Sullivan Square Northbound Off-Ramp	0	$ 62,700,000	$ 5,300	0%	0%	0	1	-1	0	0	8
Silver Line / Bus Rapid Transit Extensions	4,000	$ 310,000,000	$ 17,514,000	-1%	1%	0	-1	-1	-1	-9,500	6
Silver Line / Bus Rapid Transit Extensions using commuter rail right-of-way	5,200	$ 312,000,000	$ 31,800,000	-1%	1%	0	-1	-1	-1	-9,000	6
Silver Line / Bus Rapid Transit Extensions TDM Policies[3]	8,000	$ 310,000,000	$ 17,514,000	-3%	2%	0	-1	-2	-2	-15,100	6
Green Line Extension to Mystic Ave	500	$ 212,000,000	$ 2,500,000	0%	0%	-1	0	0	0	-1,200	3
Green Line Extension to Mystic Ave with TDM Policies[3]	2,000	$ 212,000,000	$ 2,500,000	-1%	1%	-1	0	0	0	-4,800	5
New Sullivan Sq Station on the Rock/Newb. Commuter Rail	100	$ 26,400,000	$ 29,500	0%	0%	0	1	0	0	-200	4
New Sullivan Sq Station on the Rock/Newb. Commuter Rail with TDM Policies[3]	200	$ 26,400,000	$ 29,500	0%	0%	0	1	0	0	-500	5
Major Bike/Ped. (incl. ped bridge Assembly-Everett and Everett-Rivers Edge)	300	$ 80,000,000	$ 50,000	0%	0%	0	0	0	0	-700	3
New Orange Line Station at Rivers Edge	500	$ 90,000,000	$ 29,500	0%	0%	0	0	0	0	-1,200	5
Orange Line Headway Improvement (4.5 min. to 3 min.)	8,000	$ 400,000,000	$ 35,903,000	-2%	2%	-3	-1	-1	-1	-19,100	6
Orange Line Spur to Route 16 (2-Stations)	26,800	$ 1,250,000,000	$ 35,775,000	-4%	4%	-1	-2	-2	-2	-67,900	8
Orange Line Spur to Everett (3-Stations)	28,500	$ 3,500,000,000	$ 39,700,000	-4%	4%	-1	-2	-2	-2	-62,300	6
Orange Line Spur to Rte 1 (5-Stations)	38,500	$ 5,000,000,000	$ 49,980,000	-5%	5%	-1	-3	-3	-3	-91,700	10
Commuter rail station at Encore Boston on Rockport/Newburyport line	80	$ 18,480,000	$ 29,500	0%	0%	0	0	0	0	-200	4

[1] Multiple intersections were examined as part of the this Study. This metric examines the total delay experienced at specific intersections that comprise these four locations. The range in delay reduced was broken into seven groupings, ranging from reductions to increases (-3 to +3).

[2] Some project ideas could be constructed more easily and sooner than others. This qualitative metric gauges the ease by which a component could be implemented. The range is from 0, indicating easiest to implement, to 10, indicating the most difficult (note that these numbers do not imply years to construct).

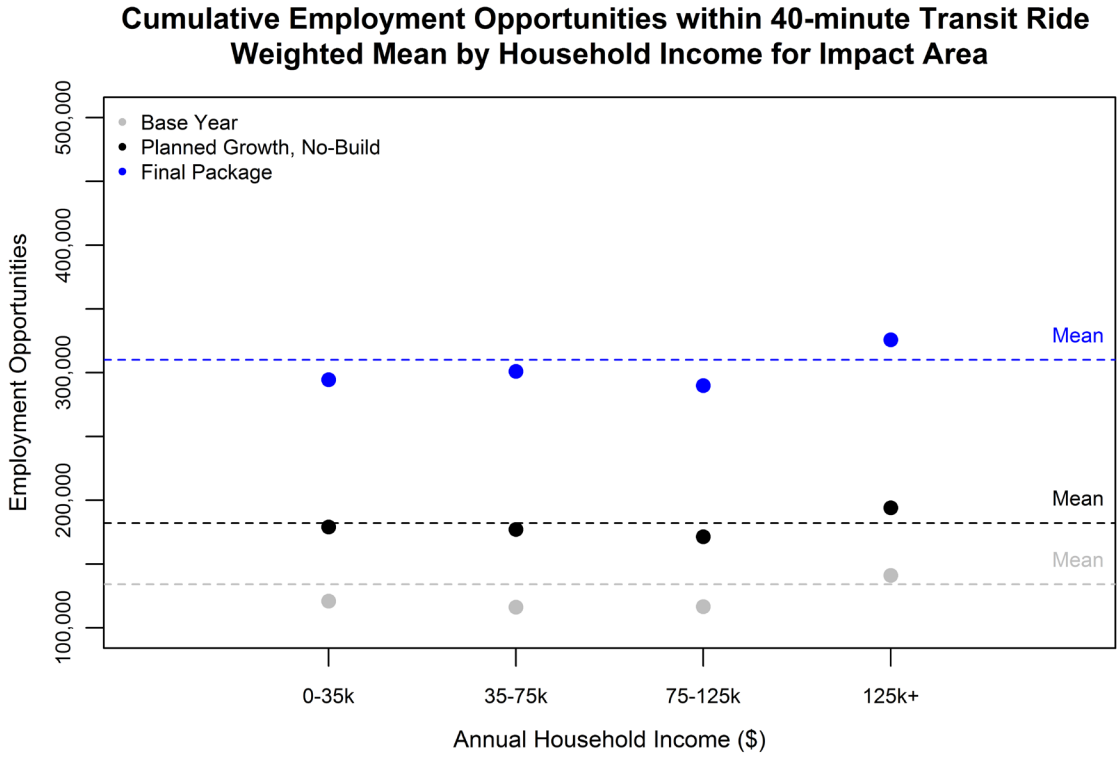
[3] This measure is intended to illustrate the effects of incorporating Transportation Demand Management policies with transportation infrastructure improvements. Please see the TDM Policies station for more information.

ACCESS TO OPPORTUNITY MEASURES

The Working Group recognized early on that the effectiveness of a transportation system cannot be measured only by the speed of traffic and the frequency of buses, but by the extent to which the system connects residents to the places they need to go: jobs, schools, friends, health care, and more. Similarly, a high-functioning transportation system stimulates economic activity by ensuring that employers have access to a large labor pool of workers who can get to their place of work easily. To support the Working Group's efforts to use these criteria, MAPC evaluated access to jobs and labor for workers and employees within the Impact Analysis Area under current conditions, the Planned Growth No-Build scenario, and the final Package Scenario. This analysis was conducted to assess the extent to which the set of recommendations advanced by the Working Group would improve economic opportunity.

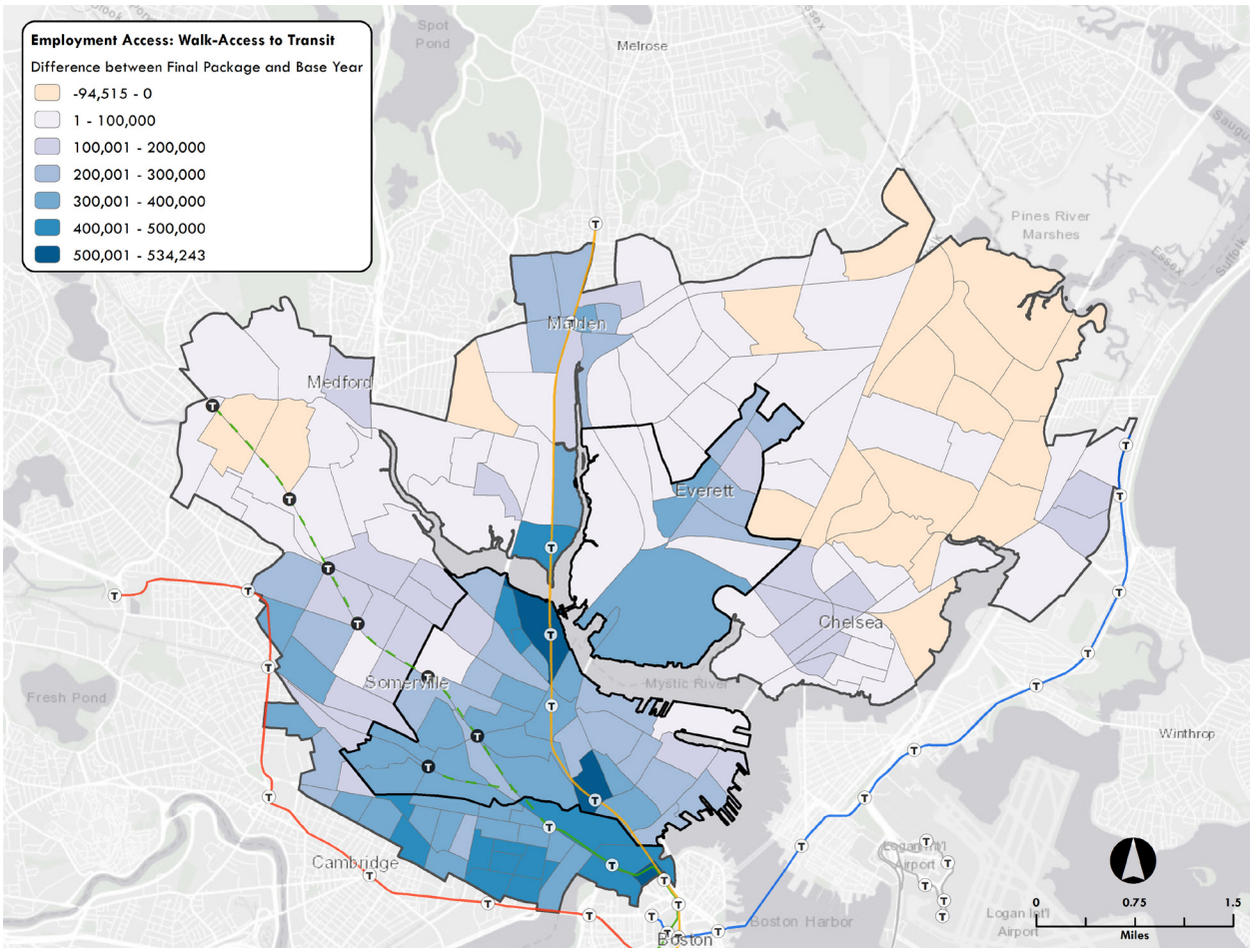
Specifically, MAPC estimated how many jobs (anywhere in the region) could be reached from each TAZ in the Analysis Area by two modes/thresholds: a 20-minute drive or a 40-minute transit commute (including walking and wait times). MAPC also evaluated how many workers (living anywhere in the region) could reach Analysis Area TAZs by the same mode/thresholds. This analysis was conducted for existing conditions and two of the 2040 scenarios, Scenario 2: the Planned Growth No-Build and Scenario 9: the Final Package. MAPC also evaluated the equity impacts of any accessibility changes by examining the changes for the four quartiles of income groups, using a weighted average of each TAZ.

Figure 19. Cumulative Employment Opportunities within 40-minute Transit Ride Weighted Mean by Household Income for Impact Area



The results show that the "Final Package scenario" would provide a substantial improvement to job and labor accessibility for workers and employers in the study area. Currently, the average worker in the Impact Analysis Area can reach approximately 800,000 job opportunities within a 20-minute drive, and 140,000 jobs within a 40-minute transit commute. For both automobile and transit commutes, households with incomes over $125,000 per year have greater job access than do lower-income households. By 2040, the number of jobs in the Analysis Area would increase significantly, but under the "No-Build" conditions traffic congestion would actually result in a decline in job access via automobile, to only 785,000 jobs within a 20-minute drive. Access to jobs via transit within 40 minutes will increase somewhat to 180,000 jobs.

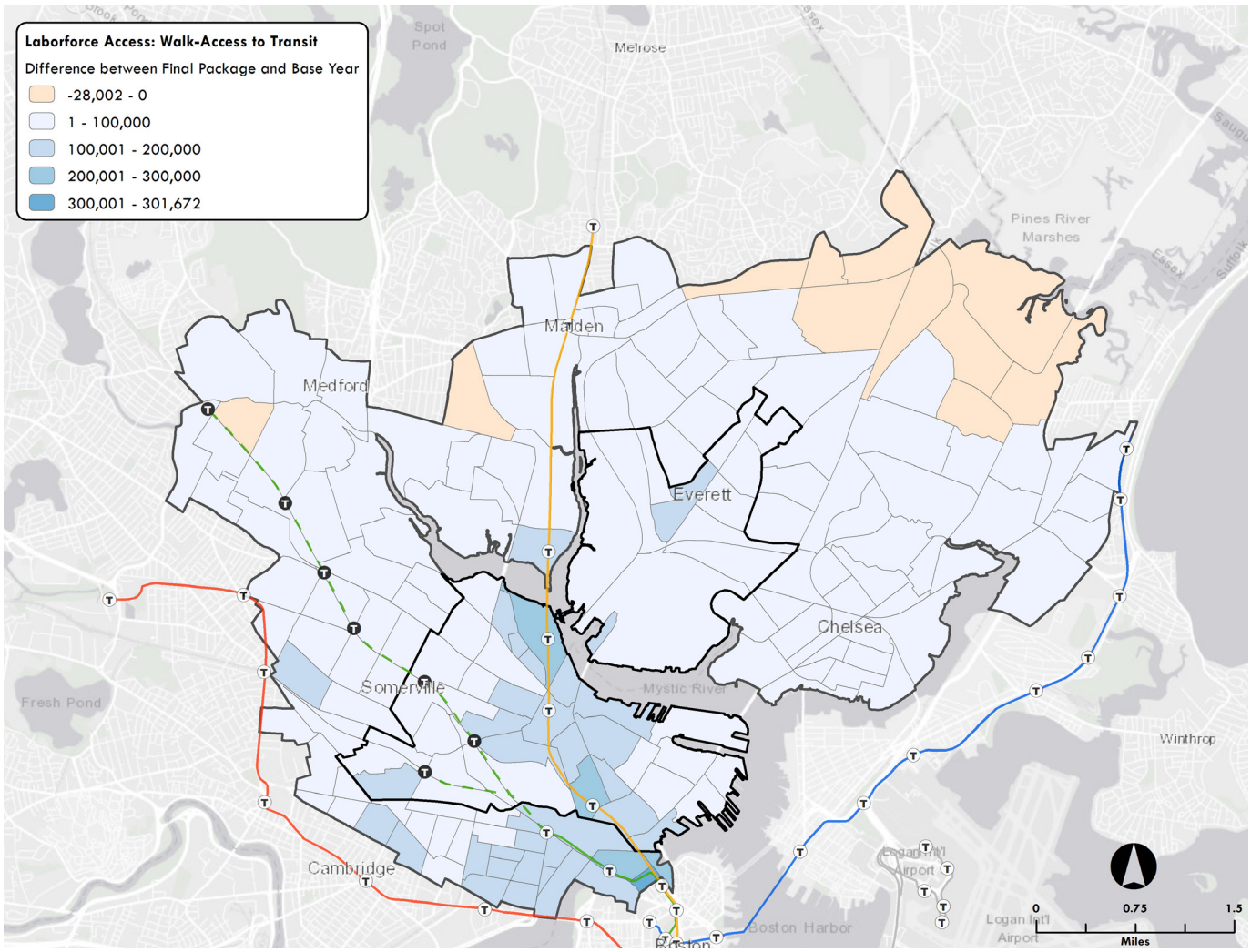
Figure 20. Employment Access: Walk-Access to Transit Map



MAPC analysis indicates that the Final Package scenario would provide substantial improvements to job accessibility. The average worker in the Analysis Area would be able to access 855,000 jobs via a 20-minute automobile commute and 310,000 via a 40-minute transit commute. While disparities in access across income categories would not be eliminated, they would not be made worse by the modeled improvements.

The improvements modeled in the Final Package scenario would broaden the labor pool from which employers in the Impact Analysis Area could draw workers. As a result of transit improvements and TDM measures, an additional 200,000 workers could reach job sites near Assembly Row and Community College in less than a 40-minute transit commute (as compared to Scenario 1). Employers near Sullivan Square would have access

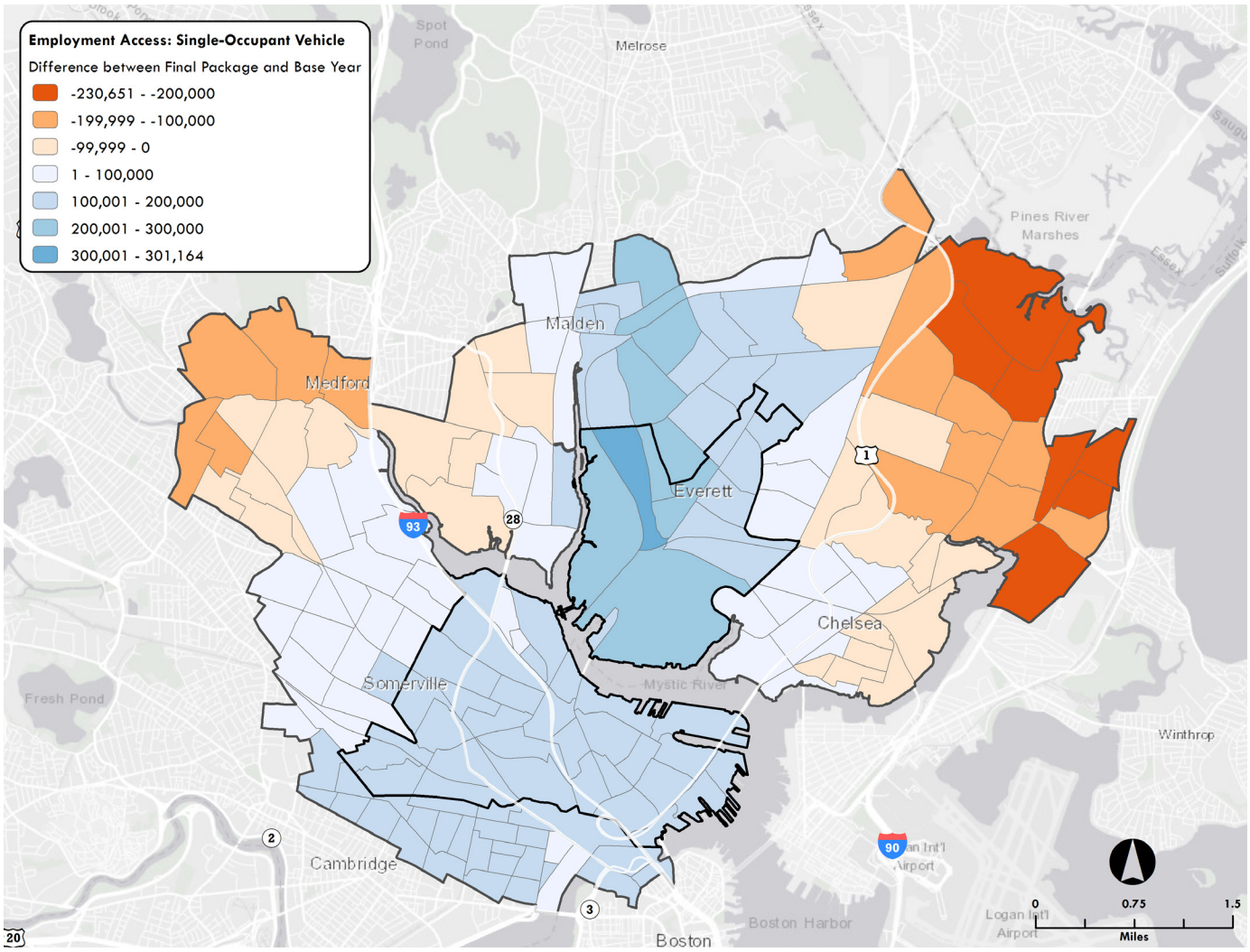
Figure 21. Labor force Access: Walk-Access to Transit Map



to an additional 50,000 workers within a 40-minute transit commute, as compared to Scenario 1. Job sites near Lechmere, Kendall, and North Station would see similar increase in the number of workers living within a 40 minute transit commute. As a result of this increased accessibility to labor via transit, this area would become an even more attractive area for economic development, as employers seek to locate in areas where they have maximum access to the region's skilled labor force.

These results demonstrate that the transportation improvements examined, especially the transit and TDM measures, would substantially improve access to opportunity and labor for workers and employers in the study area, and would not have a disproportionate negative impact on low-income residents.

Figure 22. Employment Access: Single Occupant Vehicle Map



FUNDING OPTIONS

Implementing the recommendations will require a variety of funding mechanisms, both traditional and innovative, and include state, municipal, and private sector resources. The following provides a brief overview of the various potential funding mechanisms decision makers could use to fund transportation infrastructure. Not all of the following funding options are appropriate for all infrastructure improvements, and several new ideas at the end of this chapter would require changes to Massachusetts laws or regulations. See Appendix 4 for additional information.

FEDERAL **SOURCES**

Two primary means of federal funding:

1. Formula Funding from the Federal Highway Administration (FHWA
2. Federal Transit Administration (FTA) that is programmed by the Boston Metropolitan Planning Organization

Federal funding comes to the Boston region by two primary means: formula funding from the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) that is programmed by the Boston Metropolitan Planning Organization, and occasional funding through various competitive federal discretionary funding programs. The primary pathway through which federal funding is allocated is through the Boston MPO, which is responsible for conducting the federally required metropolitan transportation planning process for the Boston area. For example, the MPO has invested $158 million in federal funds to help finance the MBTA Green Line Extension in Cambridge, Somerville and Medford.

The federal government also provides grants through a number of discretionary programs. For example, the Better Utilizing Investments to Leverage Development program (formerly called Transportation Investment Generating Economic Recovery [TIGER]) grant program has provided approximately $500 million per year across the country to support a variety of innovative transportation projects, including multi-modal and multi-jurisdictional projects that can be difficult to fund through traditional federal programs. MassDOT has applied for two TIGER grants in the study area in the past, neither of which were awarded funding. In 2015, MassDOT applied for TIGER funding to construct the Silver Line Gateway bus project from Logan Airport to Chelsea. In 2009, the City of Somerville applied for TIGER funding to help construct the Somerville Community Path extension.

STATE FUNDING **SOURCES**

State transportation capital funds are typically allocated by the Legislature and Governor via bonds that authorize how the funding can be used. MassDOT oversees most of this funding.
MassDOT's Capital Investment Program (CIP) outlines a process for prioritizing capital spending from multiple state and federal sources. The CIP organizes projects into three priorities: Reliability, Modernization, and Expansion. Investments focus first on fixing and modernizing existing transportation assets. Expansion projects, which include many of the Working Group's recommendations, comprise a smaller portion of available funds.
Operating funds for the MBTA are derived from several sources, including municipal assessments determined by formula. For fiscal year 2019, the City of Boston provides $88 million annually to the MBTA, while Somerville provides roughly $5.3 million and Everett provides $3 million.

In addition to MassDOT, several state agencies administer grants that could be used to fund transportation infrastructure. The most significant is the MassWorks Infrastructure Program, administered through the Executive Office of Housing and Economic Development (EOHED).

MUNICIPAL **SOURCES OF FUNDING**

Municipalities have several options to fund certain transportation infrastructure. The state-administered Chapter 90 formula funding program for street and sidewalk repair is the most commonly used. For Fiscal Year 2019, the City of Boston received $14.7 million in annual Chapter 90 allocations, while Somerville received $1.1 million annually and Everett received nearly $646,000.

Municipalities also commonly utilize federal Community Development Block Grant (CDBG) funds to help pay for certain transportation improvements. Again, street and sidewalk repairs are the most common application of CDBG funds.

Municipalities can also leverage their own tax resources by making direct payments from their general funds or issuing bonds to finance local infrastructure improvements. State law does not typically allow municipal governments to issue debt for capital investment on state property or for state projects. The City of Somerville has secured permission from the Massachusetts Legislature via Home Rule Petition to borrow for investment in certain state assets and projects, including a $50 million contribution to project costs for the Green Line Extension.

Massachusetts law allows municipalities to pursue "tax increment financing," under which debt is issued against future projected tax revenues.

Tax increment financing tools are designed to capture incremental growth in tax revenues in order to pay for infrastructure improvements. District Increment Financing (DIF) is the locally driven public financing alternative available to all cities and towns in the Commonwealth. The City of Somerville has utilized DIF borrowings with great success in Assembly Square, where future incremental tax revenues were used as collateral to underwrite $25 million in utility and street improvements.

DEVELOPER **FUNDING**

Contributions from the private sector for transportation infrastructure typically come in the form of mitigation for the impacts from new development. To date in Massachusetts, these contributions have been secured on a project-by-project scale by municipalities and state agencies. Municipalities do not have great flexibility under Massachusetts law to levy formula-based impact fees, and generally rely on discretionary land use permits and voluntary development agreements to secure private mitigation payments for infrastructure. The project-by-project approach does not facilitate the aggregation of contributions towards regional solutions.

STATE LEVEL MITIGATION (MEPA).

The Massachusetts Environmental Policy Act (MEPA) ensures that the environmental and transportation impacts of development projects and other activities that exceed MEPA review thresholds are appropriately mitigated by the developer. Common transportation-related thresholds which trigger MassDOT's Public/Private Development Unit's involvement of a development proposal include generation of 2,000 or more new daily trips; construction of 300 or more new parking spaces; the combination of 1,000 or more new daily trips and 150 or more new parking spaces; and the creation of five or more acres of impervious surface area.

In coordinating and consulting with developers and other project stakeholders, MassDOT works to ensure multimodal transportation goals are being advanced through the project. This includes the incorporation of transportation demand management measures and other strategies, such as the construction or reconstruction of bicycle and pedestrian facilities. Projects with larger anticipated impacts on nearby transportation systems—i.e. on roadways, bus, and rail transit routes—are often required to provide mitigation in the form of roadway reconstruction, intersection signalization and signal optimization, incorporation of transit facilities such as bus stops within or adjacent to the development site, and direct funding to transit agencies to improve services.

LOCAL MITIGATION.

Municipalities have their own development review processes and usually require that large developments conduct impact studies and mitigate impacts as a requirement to receive a building permit or other local approval. In Boston, for example, the city requires a development to have a Transportation Access Plan Agreement (TAPA) which consists of various agreed upon mitigation measures negotiated between the city and developer. In Cambridge, a development agreement with a large landowner in Kendall Square in 2016 was utilized to create a revenue stream to help fund $6 million worth of service reliability improvements to the MBTA.

NEGOTIATED CONTRIBUTIONS (PUBLIC-PRIVATE PARTNERSHIP).

Although formalized processes, such as MEPA, are avenues for developers to contribute to the funding of transportation infrastructure, they can also negotiate directly with state and local governments to fund infrastructure. The Local Infrastructure Development Program is a tool available under current state law by which a landowner or group of landowners can endorse a voluntary tax surcharge on their property to help pay for infrastructure improvements benefiting the property.

MASSACHUSETTS GAMING COMMISSION & **ENCORE BOSTON HARBOR**

As part of both Encore Boston Harbor's gaming license and MEPA requirements, the resort is contributing a significant amount of transportation-related mitigation. Additionally, the Gaming Commission oversees a Community Mitigation Fund that is funded by all gaming operations in the Commonwealth.

ENCORE BOSTON HARBOR MITIGATION.

Encore is providing payments for a variety of infrastructure and TDM services as part of the commitments necessary to secure permissions to build. Over fifteen years, this includes $57.5 million for road infrastructure, $58.1 million for water transportation and shuttle buses, and $7.3 million for Orange Line service improvements, and other improvements that total $265 million.

COMMUNITY MITIGATION FUND.

As part of the effort to help offset impacts that may result from the development and operation of gaming facilities, in addition to project-specific mitigation, the Massachusetts Legislature created the Community Mitigation Fund as part of the Expanded Gaming Act. The Community Mitigation Fund is designed to help communities offset a wide range of such costs including local and regional education, transportation, infrastructure, housing, environmental issues and public safety. In 2017 the City of Everett received $150,000 to support a bike sharing system and an additional $150,000 to design exclusive bus lanes in the city. The City of Boston received $250,000 to supports its planning for the Rutherford Avenue corridor. The City of Somerville received two grants totaling $250,000 to study and plan for improvements to Route 28 and Route 38.

COMMUNITY CASINO MITIGATION PAYMENTS.

Encore Boston Harbor has also entered into Host Community (with Everett) and Surrounding Community agreements to provide annual mitigation payments of $5.25 million to Everett, $2 million to Boston, and $650,000 to Somerville. Such amounts are in addition to the value of annual real estate taxes received by Everett, pre-opening payments received by the communities, any payments related to the planned Rutherford Avenue and Sullivan Square long-term improvement project, and other mitigation such as vouchers to area businesses.

GAMING LICENSE MITIGATION "REOPENER."

In addition to the above commitments, Encore Boston Harbor is also required to use its best efforts to work with the MBTA, MassDOT, and DCR on any future plans to create mass transit opportunities that serve the Gaming Establishment and to consider making a reasonable contribution to the cost of implementation of such mass transit opportunities. The Gaming Commission has also reserved the right to modify or amend Encore Boston Harbor's mitigation requirements to avoid or minimize impacts to the environment.

INNOVATIVE IDEAS **FOR FUNDING AND IMPLEMENTATION**

One of the goals of the Lower Mystic Regional Working Group is to foster cross municipal coordination in addressing the impacts of new development in the Sullivan Square area on the transportation system and to seek out additional sources of funding. This section explores new ideas to support this type of coordinated funding and implementation at the local level. These ideas are either non-traditional in Massachusetts or would require changes in state laws or regulations.

REGIONAL MITIGATION FUND.

Recently, Assembly Station on the Orange Line in Somerville and the Boston Landing Commuter Rail station in Brighton have exemplified the use of developer contributions to help fund one-time transit improvements such as infill stations. However, the ability for state or local mitigation processes to require multiple developers to pool funding for transportation investments with significant capital costs (beyond what is reasonable for one developer to fund) is limited.

A Regional Mitigation Fund, or some other type of developer contribution program, would enable developers to deposit mitigation funding into a pool for future transportation investments. This would allow large-scale capital construction projects to proceed when the travel demand for such an investment is reached and/or a certain funding contribution threshold is realized. Contributions to the fund could be limited to a pre-defined geographic area, such as a municipality or within a threshold distance of a roadway or transit station.

An agreement between the MBTA, the City of Cambridge, the Cambridge Redevelopment Authority, and developer Boston Properties to facilitate the approval for one million square feet of development in Kendall Square may serve as a model for this type of approach. See Appendix 7 for this agreement.

MITIGATION PAYMENTS DIRECTED TO MBTA FOR OPERATIONS.

Short of a pooled mitigation fund or negotiated agreement like the Kendall Square example above, opportunities exist to improve the process for new developments to provide funding to the MBTA to both mitigate service impacts and to increase MBTA service (or make it more reliable) to meet the mode share goal of the development. Encore Boston Harbor's payments for improved Orange Line service provide a strong example for this mechanism. See Appendix 8 for this agreement. Cities and towns, working with the MBTA, could identify a standard practice for how new developments will quantify their impact on MBTA service and contribute accordingly to mitigate that impact.

SPECIAL ASSESSMENT DISTRICT.

While the agreement in Kendall Square mentioned above is a good start in formalizing private commitments to future identified MBTA improvements, it could be challenging to structure such an agreement involving multiple property owners or multiple municipalities. It also only captures value from new development, not already existing land uses that would also benefit from new infrastructure. Some states allow local governments to create Special Assessment Districts, whereby the government entity (city, town, county) identifies the geographic boundaries of the district based upon the benefit of the infrastructure improvement. A special tax is levied on properties that would benefit from the public investment. Assessments typically require a majority vote of affected property owners in order to be implemented.

REGIONAL BALLOT INITIATIVE.

Municipalities in Massachusetts have limited ability to raise revenue through anything other than property taxes. In many parts of the country, transportation improvements are funded via ballot initiatives that link the new or increased tax to the improvement.

Allowing municipalities a broader range of opportunities to raise revenue through additional local taxes could provide funding for transportation improvements, but new legislation would be required to enable this.

SUPPLEMENTAL INFRASTRUCTURE FINANCING FOR TRANSPORTATION.

In the 2015-2016 legislative session, the Massachusetts State Legislature considered (but did not approve) a bill to create a new value capture mechanism called the Supplemental Infrastructure Financing for Transportation (SIFT) program (proposed Chapter 40X of the General Laws). Like DIF, SIFT would capture incremental growth in property tax revenues from the existing municipal levy. However, SIFT revenues would be dedicated to state or regional transportation projects. In order to facilitate the use of property tax increment for transportation projects, the proposed legislation would create a process for collaboration between municipalities and the project sponsor, such as the MBTA, a Regional Transit Authority (RTA), or MassDOT.

KEY FINDINGS

The Lower Mystic area is one of Massachusetts' biggest growth centers.

Substantial areas of underutilized industrial land and growing market demand for housing and commercial space near the core of the region suggest that development pressures here are likely to rise. Meanwhile, Boston, Somerville and Everett are developing plans to take advantage of this market interest to create more homes and jobs for local residents. If these plans are fully realized in the coming decades, the Scenario Focus Area could gain up to 27,000 new households and 55,000 new jobs, with the Encore Boston Harbor project representing just a fraction of the total. This future growth could meet 5% of the state's housing needs and accommodate 20% of projected statewide employment from 2010 -2040, but not without challenges. That much growth could add almost 500,000 daily trips to and from the study area (a 34% increase from 2010), straining the transportation system in the future.

Roadway and highway improvements alone produce few benefits for the study area.

The study assessed various ideas for relieving roadway congestion in the Lower Mystic area, including multiple on- and off-ramp configurations and conversion of the HOV lane on I-93 to a general purpose lane. Unfortunately, none of the roadway capacity improvements had an unequivocally positive effect on congestion relief. In some cases, the traffic bottleneck simply moved to a different part of the study area, pushing the problem from one neighborhood to another. New roadway connections may also attract drivers away from other congested areas, resulting in some benefit to the overall roadway network, but little relief for local drivers.

For example, a northbound off-ramp from I-93 to Alford Street improved traffic delay slightly at Sullivan Square but worsened congestion on Broadway in Everett. Converting the I-93 HOV lane to a general purpose lane improved highway speeds for commuters driving from northern suburbs, but worsened traffic delays in Sullivan Square. A new I-93 North on-ramp near City Square could slightly reduce traffic delays in Sullivan Square, but the impacts on Rutherford Ave and I-93 require further study to better understand.

Model results did show that with lower automobile ownership and more convenient transit options, many residents and workers would avoid driving for certain trips. The corresponding reduction in cars coming and going would result in a noticeable and widespread reduction in neighborhood traffic.

The MBTA Orange Line is the backbone of mobility in this area, and improved frequency of service will make or break the Lower Mystic study area.

The Orange Line is already crowded during peak periods. With substantially improved feeder bus service and major new development immediately adjacent to MBTA stations, there will be many more people riding the Orange Line. Morning rush-hour boardings north of Community College could increase by as much as 43%.

While the MBTA already plans to increase train frequency to four and a half minutes, it may not be enough. To accommodate the projected level of demand, according to the model using the Planned Growth projections, it could be necessary to run Orange Line trains as frequently as every three minutes during rush hour. In addition to meeting new local demand for transit trips, riders all along the Orange Line would benefit from more frequent, more reliable, and less crowded trains. These improvements could be enough to entice 24,000 new riders to take transit, system-wide, and the increased capacity would be sufficient to accommodate those new trips.

Improved local bus service offers a large return on investment and a short implementation timeline.
Most of the study area is beyond walking distance from the Orange Line or commuter rail stops. Buses are the principal transit option for most residents in the Impact Analysis Area, and the only option available to Everett residents. Some bus routes are currently over capacity. The bus improvements that were modeled—improved frequency, speed, coverage, connectivity, and reliability—provided substantial benefits, including faster travel times, less overcrowding, and improved access to jobs and opportunities. By attracting more residents and workers to take transit, a network of new and substantially improved bus services could serve 100,000 new daily transit trips, reducing automobile mode share by 4%.

While expanded local bus service does not require securing new rights-of-way or building rail lines and stations, it is not without capital expense. More frequent bus service requires a larger bus fleet, and corresponding storage and maintenance facilities. However, the MBTA's existing bus facilities are already at capacity, so a substantial expansion of the bus fleet would also require investments in new garages and maintenance facilities.

Bus rapid transit in a dedicated right-of-way offers tremendous mobility and equity benefits at an intermediate cost and implementation timeline.
For most transit riders in the study area—including all riders in Everett—a trip to Cambridge or downtown Boston requires at least one transfer, adding time and uncertainty to the trip. One of the most promising options studied was a bus rapid transit line from Everett with two branches connecting directly to Kendall Square and North Station. Using a mix of exclusive and priority lanes, this service could attract 36,400 riders daily, generate 5,200 new daily transit trips, and reduce auto mode share in the study area by 1 percent. By providing a direct trip to downtown, this service would also reduce Orange Line crowding.

Land use policies are essential components of a sustainable transportation system.
The study tested various land use policies and transportation demand management strategies to see what effect they have on travel patterns, transit use, and congestion. It found that the right land use policies substantially amplify the benefits of new transit investments. By attracting households and employers more inclined to use the new transit services, incentivizing alternative modes, and discouraging single occupancy automobile use when other options are available, these policies have a synergistic relationship with infrastructure and service investments.

The most significant benefits occur when new or substantially improved transit service is paired with transit-oriented parking policies such as market-rate commuter parking or reduction of residential parking requirements. By providing additional incentives to avoid driving and take transit instead, these two strategies together would reduce by 45,000 the number of single-occupant vehicle trips to and from the area, while allowing the same amount of housing and job growth. This reduction in automobile travel was found to be enough to measurably reduce traffic delay at Sullivan Square and the other major intersections that were studied, resulting in a 5 percent reduction in auto mode share in the study area.

While not explicitly modeled here, evidence from elsewhere also demonstrates other land use and TDM policies can reduce demand for automobile trips: a mix of uses so that employees and residents can walk to local destinations; higher densities so that there are abundant destinations nearby; higher levels of affordable housing for transit-reliant populations more likely to use the new services; discounted transit passes; alternative work schedules; and a compact, pedestrian friendly street grid so that residents and employees find it convenient and safe to walk to nearby destinations. These important principles can be advanced in a variety of ways: through local zoning and permitting, the MEPA process, and disposition policies for public land.

A complete walking and biking network requires new connections both large and small.
Improved pedestrian and bicycle facilities received a significant amount of support through the study's public engagement process. The area lacks a connected network of dedicated bike and pedestrian paths, and only a few local roads are fully "complete." These features are essential parts of a sustainable transportation system. Easy and safe connections to transit stops are needed to achieve maximum ridership, and regional connections can provide an alternative to transit or driving.

The study evaluated some potential improvements, including shared-use paths, Complete Streets improvements, and pedestrian bridges over the Malden and Mystic rivers. To be successful, these regional connections should be complemented by a pedestrian- and bike-friendly local street network, which can only be developed block-by-block.

RECOMMENDATIONS

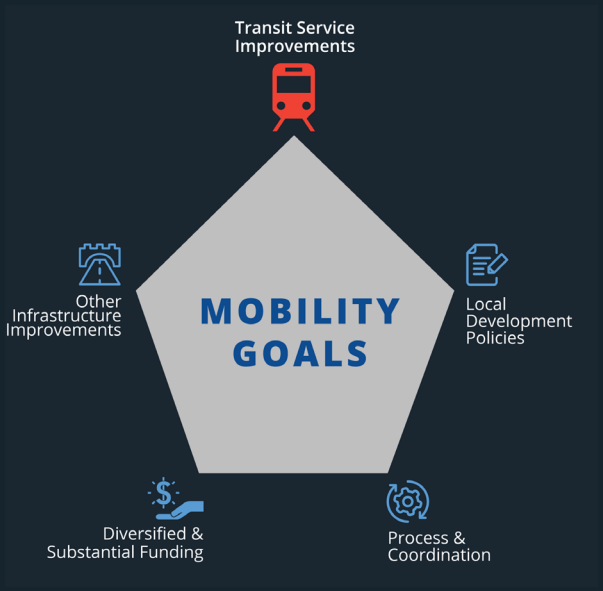
The Lower Mystic Regional Working Group recommends that the Commonwealth, regional entities, and local jurisdictions implement plans and policies to support walkable, mixed-use, mixed-income growth in the Study Area, and continue to pursue strategies to align infrastructure improvements to support these growth policies.

The Working Group examined a range of infrastructure and policy alternatives to improve transportation, mobility and connectivity in and around Sullivan Square, including in the communities of Charlestown, Everett, and Somerville. As the Key Findings indicate, there is no singular solution to solving this area's transportation challenges. However, the Working Group concluded that a systematic and holistic approach to transportation for this area is essential to ensure a more desirable transportation future for the study area. No one action will address the numerous issues facing the study area. However, multiple actions sequenced deliberately and when considered together can improve the transit experience, reduce travel times, decrease traffic

Figure 29. Study Area Improvements

STUDY AREA IMPROVEMENTS

To improve the transit experience, reduce travel times, decrease traffic congestion, improve access to jobs, and enhance the area's quality of life in the Study Area, the Lower Mystic Regional Working Group concluded:



Transit is Key

- Invest in the Orange Line to ensure capacity is sufficient to meet future demand
- Improve local bus services through additional routes, dedicated lanes, and priority signals
- Extend Bus Rapid Transit from Chelsea Station through Everett and Sullivan Square to Kendall Square and North Station.

Transit needs transit-oriented local development policies to flourish

- Substantially reduce the amount of parking in new residential developments within walking distance to transit
- Enact innovative transportation demand management policies to limit single-occupant vehicle commuter trips to and from major new job centers in the Lower Mystic area
- Ensure the Lower Mystic area remains accessible to people across the socio-economic spectrum, while minimizing displacement of current residents
- Create a regional Transportation Management Association (TMA)

Transit improvements can be complemented by additional road and path improvements

- Continue to develop the regional active transportation network with bicycle lanes and pedestrian paths and bridges
- Ensure all local roadways incorporate Complete Streets elements

Substantial but diversified investment is needed

- Seek comprehensive funding sources to implement this study's recommendations, including innovative means of financing
- Align developer transportation mitigation with this study's recommendations

Regional coordination is critical

- Continue Working Group coordination to ensure continued progress on implementation
- Jointly consider further study of Orange Line spur to Everett, I-93 northbound on-ramp at City Square, and modifications to the I-93 southbound HOV lane

congestion, improve access to jobs, and enhance the quality of life for area residents. These actions include transit improvements; infrastructure improvements for roads, paths, and trails; exploration of increased funding from traditional and innovative sources; local policies to encourage density and mobility beyond vehicles; and processes to ensure on-going collaboration and coordination.

TRANSIT SERVICE **IMPROVEMENTS**

The three recommended transit actions are highly interactive with one another. For instance, increased bus and BRT ridership will place increased demand on the Orange Line. Some BRT service terminating in Kendall Square may take some pressure off of bus service and ridership to Sullivan Square as well as on the Orange Line itself. The extent and amount of bus service will need to be coordinated with the development of BRT services so one does not cannibalize ridership from the other. The Working Group determined it will be important to look further at these three actions in concert and consider their interactions, synergies, and trade-offs.

EXTEND THE BUS RAPID TRANSIT THROUGH EVERETT TO KENDALL SQUARE AND TO NORTH STATION

Bus rapid transit service on dedicated right-of-way could provide high quality transit service from Everett, Chelsea, East Boston, and Charlestown to North Station and Kendall Square. The Working Group identified the potential for service from the Chelsea Station (Silver Line) to Kendall Square via Sullivan Station, and another route extending from Glendale Square in Everett to North Station via Sullivan Station.

Implementation: The mobility benefits of BRT with dedicated right-of-way were demonstrated via modeling results and are a priority recommendation; however, the services were defined only at a conceptual level. Detailed analysis would be needed to determine the feasibility, utility, and cost of various alignment and service frequency options. Further study would be needed to advance this concept to a state where it can be designed and funded. The benefits of this type of service are best realized with sections of dedicated right-of-way for a bus lane. Sections of dedicated right-of-way could include the MBTA Newburyport commuter rail corridor and repurposing parking or travel lanes along Second Street and Broadway in Everett, Rutherford Avenue in Boston, and Washington Street and Inner Belt Road in Somerville. Further study could also determine if phased expansion of BRT service would be feasible, and if so, on what routes and stops.

Next step: MassDOT and the cities should work together to commission a feasibility study to assess routing alternatives, barriers, and capital and operational costs. The Working Group should be invited and empowered to serve as forum for execution of this feasibility study.

Key stakeholder(s): MassDOT, MBTA, Boston, Cambridge, and Somerville

Estimated Cost: Capital $312 million and annual operating $32 million

Funding Sources from Similar Projects: The Silver Line Chelsea extension was funded, at a cost of $56.7 million, by the MBTA (approximately $49.1 million) and MassDOT ($7.6 million).

IMPROVE LOCAL BUS SERVICES

The Working Group evaluated a number of improvements to existing bus lines, including new routes, dedicated lanes, increased frequencies, and route alterations. As with the new bus rapid transit concepts, these changes were modeled conceptually.

Implementation: Bus improvements could proceed incrementally, particularly with respect to the timing of improved service frequencies along the Orange Line or future bus rapid transit in the study area. Therefore, a strategic roadmap would be needed to plan for phasing of the recommended bus improvements. This roadmap could have its start, in part, through the MBTA Bus Service Delivery Plan, which is beginning in spring 2018.

To maximize the effectiveness of bus services, bus-only travel lanes must be provided on local roads. Boston, Everett, and Somerville have served as regional leaders on this type of collaboration, and successful pilot projects and partnerships with the MBTA should be celebrated and expanded in the Lower Mystic study area. Partnership strategies for implementing Transit Signal Priority (TSP) technologies at key locally-controlled intersections should be scaled up quickly to maximize the benefit of any bus prioritization lanes like those on Broadway in Everett or Prospect Street in Somerville.

As with increased bus service in other communities, capacity constraints at MBTA bus garages may represent an impediment to certain types of service expansions. In these cases, the MBTA would need to explore opportunities for expansion of garages or new garage construction. The cities of Boston, Everett, and Somerville all host major MBTA garage facilities for bus and rail fleets. Working through the Metropolitan Mayors Coalition, the three cities should collaborate with the MBTA in seeking solutions to any new needs associated with solving regional congestion in and around Sullivan Square.

Next step: The bus improvements identified through this project should be evaluated, and, to the extent feasible, they should be incorporated into the MBTA's ongoing Service Delivery Plan.

Key stakeholder(s): MBTA, Boston, Cambridge, Everett, Somerville, and neighboring municipalities as appropriate

Estimated Cost: Capital $205 million and annual operating $23.5 million

Funding Sources from Similar Projects: City of Boston announced in 2018 that it intends to increase parking fines and will use some of the additional $5 million in revenue to fund dedicated bus lanes, among other transportation improvements.

ENSURE ADEQUATE FREQUENCY AND CAPACITY OF ORANGE LINE SERVICE

The modeling suggests that improving the frequency on the Orange Line beyond the currently planned four and a half minutes (to be completed by 2022) could be necessary to accommodate increased demand associated with new development and feeder bus services. While the MBTA is currently in the process of procuring new trains, the agency's attention to Orange Line capacity should be maintained after that equipment is delivered, so that if development and ridership trends are on track to exceed the new capacity, efforts can be made well in advance to make the purchases and improvements necessary to increase capacity even more.

Implementation: The modeling of Orange Line headway improvements suggested that three-minute headways during peak periods would optimize the benefits of increased frequency, including supporting the increased demands from the proposed expansion of feeder bus service. Even incremental improvements toward that frequency would reduce crowding and improve travel times. However, substantial capital improvements are needed to make this happen. As a first step, MassDOT and the MBTA would be required to perform a complete feasibility analysis and assessment of the number of new cars, signal improvements, operational changes, and facility improvements needed to achieve increased frequencies. Additional transportation modeling would be needed to assess the incremental increases in demand likely to be caused by new development and feeder bus services, and a final headway improvement figure needed to meet that demand and/or allow improvements to be phased in over time. Once the necessary investments and phasing have been further assessed, MassDOT would be able to consider the frequency improvements alongside other priorities for inclusion into its capital planning process.

Next step: Develop scope and budget for feasibility analysis and identify funding sources to conduct that analysis

Key stakeholder(s): MassDOT/MBTA

Estimated Cost: Capital $400 million and annual operating $36 million

Funding Sources from Similar Projects: MBTA purchased 152 new Orange Line cars in 2014 at a cost of $370 million, which will be fully operational by 2023. This project was completely state-funded to allow for vehicle assembly in Massachusetts.

LOCAL DEVELOPMENT **POLICIES**

The Working Group found that transit improvements and local land use policies can either mutually support one other or work against one another. While highlighting the importance of land use policy action by the three cities, the Working Group emphasized that the enactment of land use policies would work best if timed with the increase in transit availability to ensure that infrastructure investment and policy change work together. The Working Group recognizes that further detailing of and understanding about how TDM measures could be phased over time is essential for ensuring success of the overall approach.

SUBSTANTIALLY REDUCE THE AMOUNT OF PARKING IN NEW RESIDENTIAL DEVELOPMENTS WITHIN WALKING DISTANCE TO TRANSIT

Reducing the amount of residential off-street parking was shown in the model to have a tremendous impact on the number of trips made by single-occupant vehicles. For new residential development, parking requirements should be set at levels that attract car-free households and strongly discourage multiple-vehicle ownership. An emphasis on affordable units will also attract residents who are likely to own fewer vehicles and utilize transit more frequently, while also helping to reduce displacement.

Implementation: Each city should initiate a public process to reduce the residential parking requirements established in zoning and other regulations. The establishment of parking maximums should also be considered. This process would likely involve more analysis of current parking utilization (both on- and off-street) and the likely demand associated with new housing development. MAPC's "Perfect Fit Parking Program" is available to assist communities in conducting this research and analyzing the results. Since residential parking is often a divisive topic within communities, sufficient public engagement utilizing existing data would be necessary.

Next steps: Collect parking utilization data and begin a public process for modifying requirements. Scrutinize current development proposals and strongly encourage developers to reduce on-site parking. Promote the neighborhood benefits of lower parking ratios to the surrounding community.

Key stakeholder(s): Boston, Everett, Somerville, MAPC

DEVELOP AND ENACT EVIDENCE-BASED TRANSPORTATION DEMAND MANAGEMENT POLICIES TO LIMIT SINGLE-OCCUPANCY VEHICLE TRIPS TO JOBS.

Cities should employ a variety of policies that encourage alternative modes of travel to work, especially in future high-growth areas. The modeling indicated that the most impactful way to achieve this objective is to limit commercial parking and eliminate employer-subsidized free parking. Other strategies, such as subsidized transit passes, can complement commercial parking reduction strategies.

Implementation. The modeling utilized a method of applying anticipated future market-rate prices to commercial parking in high growth areas. Requiring employers to create a parking and transportation demand management plan, similar to Cambridge's ordinance, would provide a menu of options to achieve a reduction in single-occupant vehicle trips to work. The most prominent strategy is a combination of limitations on the amount of new parking created as part of new development sites and a requirement that parking be priced at market rates for employees. Another way of accomplishing this reduction in parking is for employers to pass along the cost saving of not building or leasing parking spaces to their staff by providing a financial incentive for employees to not drive and park. This type of commuter benefit program is sometimes referred to as "parking cash-out" and is currently offered by large employers in Kendall Square such at the Massachusetts Institute of Technology. Less effective, but still worthwhile, options include discounted transit passes, emergency ride home services, bicycle commuter amenities, telecommute options, and other incentives. See Appendix 9 for City of Cambridge's Parking and Transportation Demand ordinance.

Next step: The cities should begin the process of adopting new city policies to limit commercial parking. The cities may wish to have further, in-depth discussions with the City of Cambridge to apply lessons learned from their program.

Key stakeholder(s): Boston, Everett, Somerville

STRIVE TO ENSURE THE LOWER MYSTIC AREA REMAINS ACCESSIBLE TO PEOPLE ACROSS THE SOCIO-ECONOMIC SPECTRUM.

Policies should be enacted that limit displacement and ensure inclusive neighborhoods so that vulnerable population groups have access to transit, jobs, and housing. In addition to ensuring equitable access to transportation choices, these policies will also allow the area to attract and retain car-free households which will have less impact on local roadway congestion.

Implementation: The cities should continue to utilize land use policies that promote local accessibility, sufficient density, a mix of uses, and affordable and workforce housing. These policies should involve the preservation of existing subsidized housing, as well as the production of new housing that is affordable to a wide range of income groups.

Next step: Assess existing land use and housing policies, especially affordable housing requirements and incentives, and adjust as necessary. The municipalities can work together through the Metropolitan Mayors Coalition Housing Task Force and utilize the assistance of Governor Baker's Housing Choice Program, with the engagement of the Department of Housing & Community Development, MassHousing, and other agencies.

Key stakeholder(s): Boston, Everett, Somerville, MAPC

OTHER **INFRASTRUCTURE IMPROVEMENTS**

The Working Group concluded that continued development of an active transportation network and Complete Streets would be a significant driver of improved mobility in the study area. These improvements would increase bicycle and pedestrian mode share for standalone trips; accommodate more frequent, shorter non-motorized trips for shopping and other activities as vehicle use decreases; and work in synergy with transit development by improving first- and last-mile pedestrian and bicycle access.

CONTINUE TO DEVELOP A REGIONAL "ACTIVE TRANSPORTATION" NETWORK

The Working Group recommends continuing to fill in the gaps to create a high-quality, shared-use path system throughout the Lower Mystic area and surrounding communities. Foremost among these improvements is a pedestrian/bicycle bridge over the Mystic River, connecting Assembly Row to the Encore resort. A recent study of this bridge estimated the cost at $22.6 million and identified the need for the expansion of the head house at the Assembly Orange Line station to create an entrance on the Draw 7 Park side of the station. Other connections which could be developed over time include a pedestrian/bicycle bridge across the Malden River between Everett and Medford, the Somerville Community Path Extension from Washington Street to Cambridge Crossing, and a connection of the Northern Strand Path across Route 16 to Chelsea. While all of these projects will have only limited impact on congestion, they will enhance mobility options in the study area and advance other goals, such as encouraging more biking and walking and expanding recreational connections, all of which can improve public health.

Implementation: Responsibilities for developing these regional networks belong to a variety of public agencies, including the Department of Conservation and Recreation, MassDOT, and individual cities and towns. These parties should advance the planning, design, and construction of critical missing links through the Boston MPO's project development process.

Next step: Continue with the study and design process for the Mystic River pedestrian bridge and continue with the planning, design, and construction as needed for other identified links.

Key stakeholder(s): Encore Boston Harbor, Massachusetts Gaming Commission (administrator of the Community Mitigation Fund), Everett, Somerville, Department of Conservation and Recreation, MassDOT, Boston MPO, MAPC

Estimated Cost: Capital $80 million and annual operating $50,000

ENSURE ALL LOCAL ROADWAYS ARE COMPLETE STREETS

Complementing an off-road shared-use path network should be safe and comfortable on-road pedestrian and bicycle facilities. Facilities should be context-specific and may include sidewalks, bicycle lanes, buffered bicycle lanes, separated bicycle lanes, traffic-calming strategies, and intersection safety improvements.

Implementation: Using local and state resources, each municipality should continue to construct high quality, safe, comfortable, and accessible facilities on municipally-owned roads.

Next step: Implement municipal complete streets policies and prioritization plans

Key stakeholder(s): Boston, Everett, Somerville

Estimated Cost: Capital $10 million

DIVERSIFIED **AND SUBSTANTIAL FUNDING**

The Working Group recognizes that few of these actions can take place without funding, while at the same acknowledging transportation dollars are in high demand, especially for new initiatives. Thus, the Working Group recommends pursuing both existing and innovative sources of funding to expedite action in the Study Area.

ALIGN DEVELOPER TRANSPORTATION MITIGATION WITH THIS STUDY'S RECOMMENDATIONS

In order to accomplish all of the objectives in these recommendations, and to ensure a sustainable future for Sullivan Square and the surrounding areas of Boston, Somerville, and Everett, it would be necessary for all funders to contribute to the effort. Increased use of developer mitigation investments, not only from MEPA-eligible projects, but from locally permitted projects as well, can help ensure adequate funding is available for improvements above and beyond existing state and federal sources.

Implementation: Mechanisms to regionally coordinate or pool development mitigation funds to support the infrastructure recommendations should be pursued.

Next step: Everett, Somerville, Boston, MassDOT, MBTA, and MAPC would coordinate and discuss timing and appropriate mechanisms to carry out implementation steps.

Key stakeholder(s): Boston, Everett, Somerville, MassDOT, MBTA, MAPC

SEEK COMPREHENSIVE FUNDING SOURCES TO IMPLEMENT THIS STUDY'S RECOMMENDATIONS

As noted above, existing federal and state funding sources can only provide a partial solution to implementing the recommendations. Additional funding mechanisms should be explored and developed, especially as other regional and statewide needs will affect availability of federal and state funds and the pace of investment. These additional mechanisms could include utilizing value capture techniques (while recognizing the importance of funding regular municipal services), as well as creating new funding sources through local or regional ballot initiatives.

Implementation: Establish priorities and begin the process of seeking state and federal funds. Hold conversations with local, regional, and state leaders about additional funding tools.

Next step: Everett, Boston, Somerville, MassDOT, and MBTA would coordinate and discuss timing and appropriate mechanisms to carry out implementation steps.

Key stakeholder(s): Boston, Everett, Somerville, MAPC, MassDOT, MBTA, Gaming Commission

PROCESS **AND COORDINATION**

Lastly, the Working Group recognizes that continued coordination is essential for moving these recommendations forward in a holistic way, taking into account timing, sequencing, funding sources, technical feasibility, and other factors. Thus, the Working Group recommends these two process measures.

CREATE A REGIONAL TRANSPORTATION MANAGEMENT ASSOCIATION (TMA)

A TMA, whether a newly-created entity or an expansion of an existing one, can play a critical role in ensuring that employer-funded transportation services provide maximum benefit for employees and the broader community. A regional TMA or consortium of more localized TMAs in this area could work with the participating municipalities and proponents of major developments in all three cities to conduct service planning, joint procurement and service delivery, and other coordinated efforts. A focus of employer-funded shuttles and mobility services should be on filling gaps that the MBTA is unable to fill after an evaluation of potential new service.

Implementation: The cities would work together and develop a coordinated strategy that ensures future development and large employers participate in the TMA. Encore Boston Harbor is obligated under its state permits to establish a TMA. Another nascent TMA in Assembly Square has been recently formed and may serve as an instructive case for study and documentation. The potential exists for these two entities to form a nucleus of coordinated, demand-side mobility management efforts in the Lower Mystic.

Next Step: Initiate a process to explore the structure and function of a multi-municipal TMA focused on the study area, involving a wide variety of stakeholders including development proponents and existing TMAs nearby.

Key stakeholder(s): Boston, Everett, Somerville, and other communities, as applicable; major existing employers and proponents of new developments.

CONTINUE WORKING GROUP COORDINATION TO ENSURE CONTINUED PROGRESS ON IMPLEMENTATION

The Working Group should meet periodically to discuss immediate and longer-term next steps, progress, and coordination for the various initiatives identified in these recommendations.

Implementation: MAPC should coordinate convening the Working Group and any other relevant stakeholders on a periodic basis.

Next step: MAPC to convene Working Group once or twice per year.

PROJECTS FOR **FUTURE CONSIDERATION**

As the Working Group modeled and analyzed the different alternatives, several infrastructure elements were deemed to be worthy of study as part of future planning efforts but were not included in the recommendations section below because of cost, feasibility, or inconclusive modeling results.

ORANGE LINE SPUR ORIGINATING AT SULLIVAN SQUARE

The Working Group analyzed several versions of an Orange Line spur extending from the existing Sullivan Square station. All three iterations (an extension to Route 1, an extension just to Glendale Square, an extension just to Route 16) that were tested showed robust ridership and reductions in auto mode share from 4 to 5 percent. However, the large cost of the spur alternatives, ranging from $1.25 billion to $5 billion in capital cost with annual operating costs between $35 million and $50 million, made the Working Group believe that this level of investment was much longer term in nature and needed further conceptual study. Additionally, a spur line off the Orange Line would reduce the overall frequency of service for stations north of Sullivan Square, as a percentage of trains are diverted to service the new spur line. The overall cost, feasibility, and impact on the entire Orange Line need additional study to advance this concept. In the meantime, the City of Everett requests that actions are not taken to preclude an Orange Line spur in the future. Specifically, the city requests that the MBTA reserve space at Sullivan Square station to accommodate a conjoining spur line as improvements are made to the station, that space for an expanded train bridge over the Mystic River be maintained, and that the commuter rail corridor west of the casino maintain space for additional rail tracks in the future.

I-93 ON-RAMP AT CITY SQUARE

The Working Group analyzed several highway improvements, and the most promising at relieving congestion to Rutherford Avenue and Sullivan Square was a new I-93 on-ramp in the City Square area at the intersection of Rutherford Avenue and the ramp to Route 1, potentially with a connecting ramp that starts at the I-93 south on ramp close to the North Washington Street and Chelsea Street intersection. The modeling results showed this type of on-ramp could improve some intersections but worsen conditions for others along Rutherford Avenue. It may also attract motorists from other corridors who perceive the new on-ramp as a faster route to access I-93 north. Additionally, the weaving impacts of a new on-ramp merging onto I-93 need additional analysis. While conceptually an attractive idea to move traffic off of Rutherford Avenue that is traversing the corridor to access I-93 north at exit 29 in Somerville, it needs additional study to better quantify the benefits to Rutherford Avenue and potential impacts to I-93.

I-93 SOUTHBOUND HOV LANE CONVERSION

The Working Group also explored converting the I-93 southbound high-occupancy vehicle (HOV) lane to a general traffic lane because currently the HOV lane is not utilized to its full capacity. While the Working Group remains strongly committed to encouraging multiple occupancy vehicle use, the HOV lane could be studied across a range of options, including but not limited to a dedicated bus lane, a general traffic lane, a pilot general traffic lane during the Washington Bridge Construction, and/or a pilot for various demand management mechanisms.

IMMEDIATE NEXT STEPS

With new development occurring, it's an exciting time to live and work in the Lower Mystic Area. Future projects must be cognizant of the relationship between the improvement of transit options and transportation demand management measures to decrease single-occupancy vehicle use. Advancement should be commensurate between these areas to maximize the synergies between them. Given that not all recommendations can be advanced simultaneously, the Working Group recommends the following immediate next steps for 2018 and 2019.

- Conduct a planning process to assess the feasibility and prepare conceptual designs for transit improvements recommended in this report and how they link and are sequenced with enactment of local parking and other transportation demand management policies. This report should further detail bus and BRT routes, model and refine interactions among local bus routes, bus rapid transit, and the Orange Line. Attention should also be given to the Orange Line capacity necessary to accommodate growth in development and transit ridership in the area and along the line as a whole.

- Coordinate these recommendations with other current and near-term future planning processes such as Focus 40, the MBTA Bus Service Delivery Plan, Rail Vision, and municipal planning efforts.

- Develop municipal plans to implement appropriate parking policies for both residential and commercial uses.

- Identify ways to coordinate individual development project mitigation funds for regional investment, including transit, and/or designing a regional transportation mitigation process.

- Work to incorporate these recommendations, where appropriate, into future MEPA certificates for development in this area.

- Continue to meet on a periodic basis to discuss and track implementation of these recommendations.


Oak Grove 4 min
Oak Grove 15 min
OUTBOUND/OAKGROVE

LIST OF APPENDICES

Appendix 1: Technical memorandum summarizing each modeling scenario.

Appendix 2: Matrix summarizing modeling results

Appendix 3: Encore Resort Section 61 Findings

Appendix 4: Funding options research memorandum

Appendix 5: Telecommuting research memorandum

Appendix 6: List of current Long Range Transportation Plans

Appendix 7: Developer agreement example: Kendall Square Transit Enhancement Program Memorandum of Understanding

Appendix 8: Developer agreement example: Encore-Orange Line Operations

Appendix 9: TDM ordinance example: Cambridge Parking and Transportation Demand Ordinance

Appendix 10: Lower Mystic Regional Working Group Community Engagement Survey