

Core Capacity Constraints: Appendices

Accommodating Growth on Greater Boston's Congested Roads and Crowded Transit System

Project Manager

Bruce Kaplan

Project Principal

Scott Peterson

Report Author

William Kuttner

Data Analysts

Brynn Leopold

Drashti Joshi

Ian Harrington

Tom Humphrey

Graphics

Ken Dumas

Jane Gillis

Cover Design

Kate Parker-O'Toole

The preparation of this document was supported by the Federal Highway Administration through MHD 3C PL contracts #32075 and #33101.

Central Transportation Planning Staff
Directed by the Boston Region Metropolitan Planning Organization. The MPO is composed of state and regional agencies and authorities, and local governments.

August 2016

Table of Contents

Appendix A Land Use and Development

Appendix B Travel Demand Forecasting

Appendix C Roadway Congestion

Appendix D Rapid Transit Service Frequencies

Appendix E Base-Year Passengers

Appendix F Passengers per Vehicle: Base Year

Appendix G Passengers per Vehicle: Year 2040 No-Build Scenario

Appendix H Passengers per Vehicle: Year 2040 Build Scenario

Appendix I Transportation Mitigation Practices

Appendix A

Land Use and Development

Support data related to demographic and development trends presented in Chapter 2 have been grouped together in Appendix A. These include:

- Municipal and regional land areas used to calculate densities and density trends (Table A-1)
- Locations of the 20 sample TAZs shown graphically (Figure A-1)
- Brief descriptions of the 72 large-impact projects in the 20 sample TAZs (Table A-2). The TAZs are listed in the same order as in Table 5 of the report: from north-most to south-most.
- Brief descriptions of nine projected large developments which are not located in the 20 sample TAZs (Table A-3). The TAZ numbers of these projects are noted and the TAZs are also shown in Figure A-1.

Table A-1
Study Area and Boston MPO Region Land Areas
Square Miles

Boston	48.7
Cambridge	6.5
Somerville	4.1
Brookline	6.8
Medford	8.0
Revere	5.8
Arlington	5.2
Everett	3.4
Chelsea	2.2
Study Area	90.7
Rest of MPO	1,313.7
Entire MPO	1,404.4

Source: Central Transportation Planning Staff

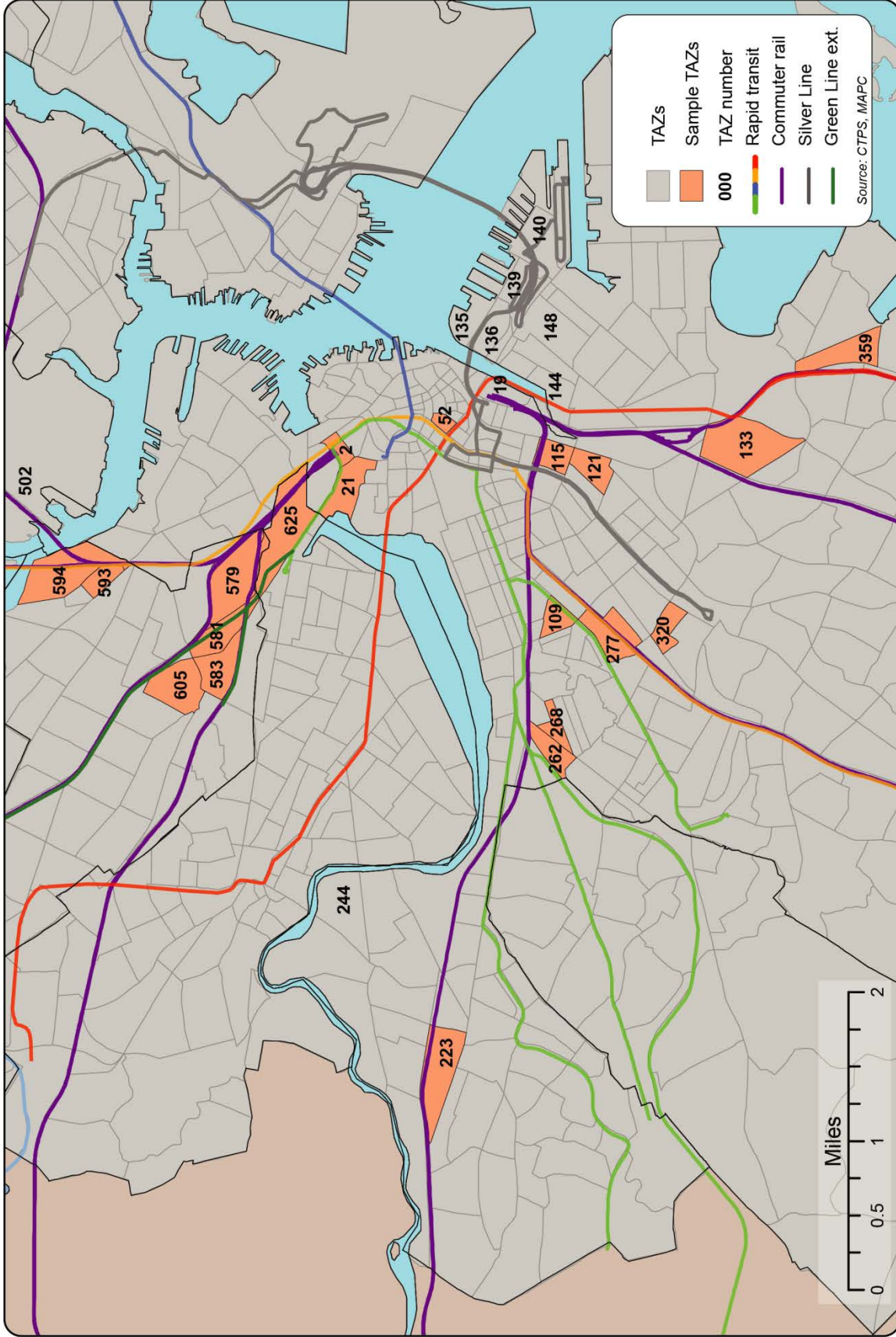


FIGURE A-1
Traffic Analysis Zones (TAZs)
with Large-Impact Developments



Table A-2
Large Impact Projects in the Sample TAZs
Somerville and Cambridge

TAZ	City	Development	Completion Year	Total Housing Units	Expected Residents	Commercial Square Feet	Expected Jobs
594	Somerville	Assembly Row: Block 11 (Phase 2)	2027	0	0	330,000	1,184
	Somerville	Assembly Row: Block 5	2018	285	658	125,560	314
	Somerville	Assembly Row: Block 6	2027	447	1,033	40,000	100
	Somerville	Assembly Row: Block 7	2027	233	538	649,393	2,471
	Somerville	Assembly Row: Block 8	2027	0	0	680,971	2,632
	Somerville	Assembly Row: Block 3 (Future)	2027	547	1,264	11,654	29
	Somerville	Assembly Row: Block 11 (Phase 1)	2015	0	0	874,297	3,340
	Somerville	Assembly Row: Block 9	2027	0	0	490,179	1,961
	Somerville	Assembly Row: Rest of Permitted Development	2027	215	497	389,928	1,413
593	Somerville	Assembly Square - 2nd Urban Renewal District	2037	2,000	4,620	3,000,000	9,636
605	Somerville	25 Hamlet	2015	2	5	0	0
	Somerville	Union Square Revitalization: D-5	2027	208	480	573,581	2,010
	Somerville	Union Square Revitalization: D-7	2027	18	42	49,570	174
583	Somerville	Union Square Revitalization: D-2	2027	176	407	484,460	1,698
	Somerville	Union Square Revitalization: D-1	2027	105	243	290,243	1,017
	Somerville	Union Square Revitalization: Rest of Development*	2027	96	222	2,219,749	7,780
581	Somerville	Brickbottom Redevelopment	2027	750	1,733	1,600,000	4,711
579	Somerville	Inner Belt Redevelopment	2035	1,000	2,310	2,800,000	8,245
625	Cambridge	20 Child St. / North Point Bldg N	2015	341	788	2,400	6
	Cambridge	Water St., #22 (Mac-Grey)	2015	392	906	0	0
	Cambridge	East Street Phase 2, #1-25 (Smith)	2017	341	788	2,400	6
	Cambridge	219 Monsignor O'Brien Highway	2015	0	0	0	107
	Cambridge	EF Proposed Building	2025	0	0	381,000	1,182
	Cambridge	North Point Master Plan - Remainder (Guilford/S&S)	2032	1,796	4,149	1,771,030	6,606

**Table A-2 (cont.)
Large Impact Projects in the Sample TAZs
Boston**

TAZ	City	Development	Completion Year	Total Housing Units	Expected Residents	Commercial Square Feet	Expected Jobs
21	Boston	Garden Garage Site Redevelopment	2015	500	1,155	500,000	1,250
2	Boston	Nashua St Residences at the Fleet Center	2020	503	1,162	0	0
	Boston	The Boston Garden	2018	497	1,148	900,000	3,394
223	Boston	Brighton Landing South Parking project	2027	0	0	0	0
	Boston	Boston Landing	2027	0	0	1,315,000	4,684
	Boston	37 North Beacon Street	2027	180	416	0	0
	Boston	Lowe's Brighton	2025	0	0	146,000	365
	Boston	217 Market Street (Market Street Crossing)	2025	116	268	26,525	66
	Boston	District 9 at 61 North Beacon Street	2020	76	176	0	0
	Boston	New Brighton Landing	2015	0	0	1,210,136	4,811
52	Boston	One Franklin/Filene's Redevelopment	2020	140	323	756,700	2,974
	Boston	Millennium Tower and Burnham Building	2016	0	0	370,000	1,203
262	Boston	Parcel 7 Air Rights	2027	330	762	0	0
	Boston	Landmark Center North Addition	2027	550	1,271	0	0
	Boston	Turnpike Air Rights Parcels 7 & 8	2020	282	651	447,000	1,636
	Boston	121 Brookline Avenue	2020	0	0	117,000	459
	Boston	Landmark Center Redevelopment	2018	550	1,271	200,000	523
268	Boston	1271 Boylston Street	2027	184	425	4,000	184
	Boston	Fenway Point	2027	320	739	0	0
	Boston	1282 Boylston	2015	350	809	10,000	1
	Boston	Fenway Triangle Mixed Use Project	2015	300	693	450,000	1,530
109	Boston	Belvidere Street	2030	80	185	10,000	25
	Boston	Belvidere/Dalton West	2027	225	520	0	0
	Boston	Belvidere-Dalton Project	2027	500	1,155	0	0
	Boston	Christian Science Plaza Revitalization Project	2020	0	0	952,000	2,356

**Table A-2 (cont.)
Large Impact Projects in the Sample TAZs
Boston (cont.)**

TAZ	City	Development	Completion Year	Total Housing Units	Expected Residents	Commercial Square Feet	Expected Jobs
115	Boston	Harrison/Albany Master Plan - NY Streets - East	2035	467	1,079	590,367	2,610
	Boston	Harrison/Albany Master Plan - NY Streets - Central	2035	358	827	420,391	1,588
	Boston	Hamilton Towne Gate	2030	97	224	11,106	28
	Boston	345 Harrison Street	2027	560	1,294	0	0
	Boston	1000 Washington Street	2015	0	0	100,000	400
	Boston	Ink Block- 300 Harrison Avenue	2015	471	1,088	65,000	163
121	Boston	Harrison/Albany Master Plan - Back Streets	2035	0	0	2,427,338	9,709
	Boston	Harrison/Albany Master Plan - SOWA	2035	627	1,448	1,332,911	5,214
	Boston	600 Harrison Avenue	2027	160	370	0	0
277	Boston	316-320 Huntington Avenue	2030	450	1,040	0	0
	Boston	GrandMarc Residence Hall at Northeastern University- 316 Huntington Ave	2027	700	1,617	0	0
	Boston	New England Conservatory Residence Hall- 0 St. Botolph and Gainsborough	2027	252	582	0	0
	Boston	Northeastern University - Interdisciplinary Science & Engineering Ctr	2018	0	0	197,000	276
	Boston	New England Conservatory- 286 Huntington Avenue	2017	0	0	65,000	91
320	Boston	Cescent Parcel Roxbury	2030	0	0	220,000	820
	Boston	Tremont Crossing	2027	300	693	1,000,000	2,700
133	Boston	South Bay Planning Study (MTA Parcels)	2035	1,500	3,465	2,500,000	9,250
	Boston	Target South Bay Expansion	2020	0	0	21,700	54
359	Boston	Columbia Point Master Plan - Synergy Site	2035	500	1,155	438,200	1,621
	Boston	Columbia Point Master Plan - MBTA Site	2035	0	0	257,500	1,019
	Boston	Columbia Point Master Plan - BG Site	2035	430	993	0	0
	Boston	25 Morrissey Boulevard	2027	278	642	0	0
	Boston	Herb Chambers at 75 Morrissey Blvd	2027	0	0	27,706	69

TAZ = transportation analysis zone.

SoWa = South of Washington Street.

Source: MAPC regional development database.

Table A-3
Other Large Projects in the Study Area not Within a Sample TAZ

TAZ	Development	Expected Residents	Commercial Square Feet	Expected Jobs	Current Study
19	South Station	5,590	4,190,000	14,304	South Station Expansion
135	Seaport Square	5,405	2,715,728	11,326	South Boston Waterfront Transportation Plan
136	Seaport Square	6,535	1,901,330	6,071	South Boston Waterfront Transportation Plan
139	Parcel A-2, Summer St., Seaport Square	0	1,325,850	4,535	South Boston Waterfront Transportation Plan
140	Waterfront Development/Parcel K	702	1,749,678	6,558	South Boston Waterfront Transportation Plan
144	HQ hotels and housing	5,022	2,773,340	11,468	South Boston Waterfront Transportation Plan
148	Boston Convention and Exhibition Center	0	3,026,984	8,068	South Boston Waterfront Transportation Plan
244	Harvard/Allston	1,513	3,256,000	5,882	Allston Interchange Traffic Study
502	Wynn Casino	492	2,901,673	7,012	Everett Transit Needs

TAZ = transportation analysis zone

Source: MAPC regional development database.

Appendix B

Travel Demand Forecasting

A goal of this study is to identify the transportation impacts of a defined set of development projects and business expansions and relate these impacts to specific parts of the transportation system. This requires developing detailed base-year travel data and projecting these data to year 2040 with sufficient detail that the impacts of individual projects can be identified.

To develop base-year and projected travel data at the required level of detail, staff has utilized a variety of data sources to build base-year data, and a combination of model and off-model techniques to make projections to 2040. The availability of useful base-year data and forecasting techniques vary by mode, submode, or type of projection. Some of the simpler data development and forecasting procedures are described in the main text. This appendix discusses some of the data development and projection approaches that were not described in the report.

Transit Forecasting

Detailed operational data of the four rapid transit lines were collected by the MBTA in 2012. Passenger entrances through turnstiles at rapid transit stations were obtained for the same period as the operational data. Using these two data sources it was possible to calculate the passenger loads and crowding levels between adjacent pairs of rapid transit stations by direction for each 15-minute interval during the AM and PM peak periods. These were the most detailed data developed for this study and became the basis of the rapid transit crowding analyses. Green Line and Mattapan Line stations not accessed through turnstiles could not be analyzed in this manner, and the Silver Line services were analyzed using calculations specifically developed for bus-vehicle services.

The No-Build Scenario assumed significant broad-based growth in regional travel demand. For the rapid transit system, it was assumed that the ridership growth that had been observed at individual rapid stations between 1997 and 2013 would continue at the same rate through year 2040. Projected increases varied between stations, and ridership increases between adjacent stations were estimated by averaging the growth in boardings at the two individual stations. The projected added ridership was allocated to directions, peak periods, and 15-minute intervals based on travel patterns observed in the 2012 Base Year.

Growth in the Build Scenario was based on detailed analyses of new trips that the 72 selected large-impact projects would be expected to generate. New trips were estimated for each project individually based on the population and types of jobs that are expected to be added at each location. The increased trips from the 72 projects were then grouped into the 20 sample TAZs.

The shares of new Build-Scenario trips in the 20 Sample TAZs that would use transit were assumed to be the same mode shares as in the Base Year. Estimates of transit mode shares by trip type and TAZ were derived from the Boston MPO regional travel demand model. The projected new transit riders were then added to the No-Build Scenario ridership, and peak-period boardings were increased accordingly at the rapid transit stations that would best serve the Build Scenario developments. Use of the rapid transit system by the new riders was assumed to reflect Base Year travel patterns.

Highway Modeling

Unlike the transit forecasts, which could assume an increase in boardings at specific stations on a well-defined system, traffic forecasts rely on the regional travel demand model to allocate new traffic to the myriad of paths available to motorists going to or leaving a new development. The network of major highways and arterial roads used in the model is extensive, including roads stretching from New Hampshire to Rhode Island and Cape Cod. As a general rule, extensive traffic models used to study a smaller area undergo a process known as calibration, in which trips generated by certain TAZs are adjusted so that traffic volumes estimated in the traffic assignment model step reasonably match traffic counts on study area roadways. This study was able utilize a version of the regional model which had undergone extensive calibration as part of Allston I-90 Interchange Study.

The calibrated Base Year trips were increased by a set of factors by vehicle type to provide an estimate of 2040 traffic. These factors were calculated from another region-wide modeling effort, the Route 3 South Project Mobility Study. The factors derived from this study were:

12.5 percent	Single-occupancy vehicles (SOVs)
11.5 percent	High-occupancy vehicles (HOVs)
11.8 percent	Large trucks (6+ wheels)
9.0 percent	Commercial vans and pickup trucks
19.1 percent	Hazardous cargoes

The trips by vehicle type obtained after multiplying by these factors were used to estimate the Build Scenario traffic volumes. This is because substantially all the projects envisioned for 2040 in the 20 sample TAZs were assumed in Year 2040 for the Route 3 study.

Vehicle trips in the 2040 No-Build Scenario were developed by subtracting the auto trips from the SOV and HOV trip tables that were estimated in the mode share calculations for the 72 large-impact projects described above in the Transit Forecasting section. For both the No-Build and Build scenarios, the geographic distribution of trip trips between home, work, and other destinations reflected the trip distribution patterns assumed for the Boston Region MPO's Long Range Transportation Plan (LRTP).

Appendix C

Roadway Congestion

This appendix summarizes traffic assignment results with tables and graphics for the Base Year, No-Build, and Build scenarios. The assignment step of the regional travel demand model allocates vehicle traffic to the roads included in the regional model network. The assigned volumes are compared with estimates of the capacities of network roadways, which indicate the presence and severity of roadway congestion.

The accompanying six figures show parts of the modeled roadway network where traffic volumes are estimated or predicted to exceed 85 percent of the roadway's capacity. Figures C-1, C-2, and C-3 show congested roadways during the AM peak period for the three modeled scenarios, and Figures C-4, C-5, and C-6 illustrate PM peak period congestion.

Each graphic is accompanied by a table listing the names of roadways that have congested sections in the Base Year, or gain additional congested sections in the future scenarios. The graphics have been prepared for readability and do not show all modeled roadways. The lists include all roads having or gaining congested sections, even if these congested roadway links are very short, or in some cases, not shown in the graphic.

Base-Year Congested Links: AM Peak Period

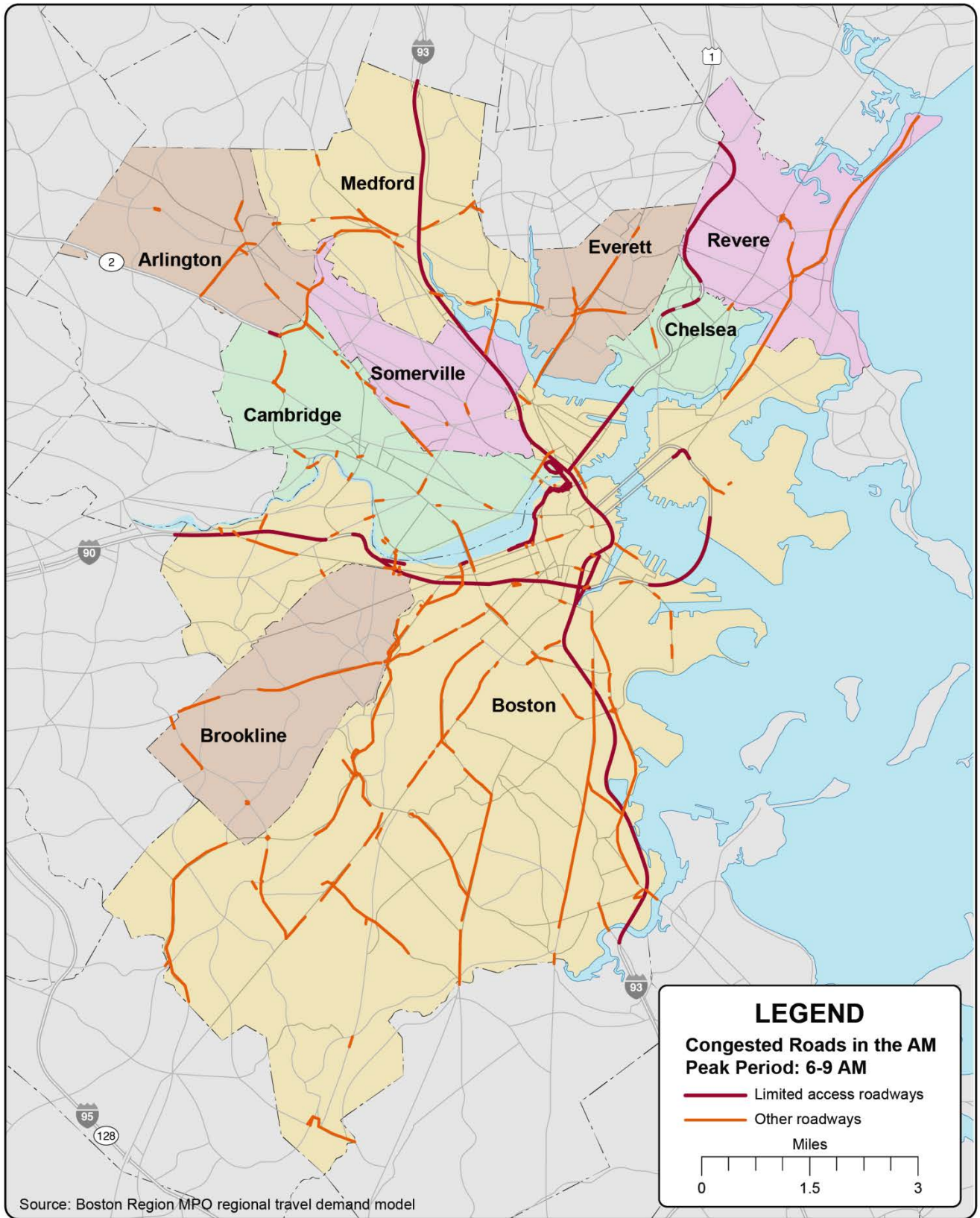
Limited-Access Roadways

Interstate 90	<i>Boston (cont.)</i>	<i>Arlington</i>	<i>Chelsea</i>
Interstate 93	Massachusetts Ave	Broadway	Broadway
US Route 1	May St	Chestnut St	Everett Ave
Tobin Bridge	Melnea Cass Blvd	Massachusetts Ave	
Ted Williams Tunnel	Milton St	Medford St	<i>Everett</i>
Storrow Drive	Morrissey Blvd	Mystic St	Broadway
Soldiers Field Road	Morton St	Mystic Valley Pkwy	Main St
Route 2	N Beacon St	Pleasant St	Revere Beach Pkwy

Other Roadways

Boston

Arborway	Neponset Ave	<i>Brookline</i>	<i>Medford</i>
Austin St	Neponset Valley Pkwy	Essex St	Fellsway
Beacon St	Old Colony Ave	Hammond Pond Pkwy	Fellsway West
Beacon St	Parsons St	Route 9	High St
Belgrade Ave	Purchase St	W Roxbury Pkwy	Mystic Valley Pkwy
Birmingham Pkwy	Riverway		Revere Beach Pkwy
Blue Hill Ave	Route 1A	<i>Cambridge</i>	Roosevelt Circle
Boylston St	Seaport Blvd	Alewife Brook Pkwy	Salem St
Brookline Ave	South St	Brattle St	Winthrop St
BU Bridge	Southampton St	Broadway	
Cambridge St	Spring St	Eliot Bridge	<i>Revere</i>
Centre St	State St	Fresh Pond Pkwy	American Legion Hwy
Charlesgate Overpass	Summer St	Gerry's Landing Rd	Broadway
Columbia Rd	Tremont St	JFK St	Lee Burbank Hwy
Columbus Ave	University Rd	Land Blvd	North Shore Rd
Commonwealth Ave	VFW Pkwy	Main St	
Cummins Hwy	W Roxbury Pkwy	Massachusetts Ave	<i>Somerville</i>
Dorchester Ave	Washington St	Memorial Dr	Alewife Brook Pkwy
Eliot Bridge		Prospect St	Beacon St
Embankment Rd		Reid Rotary	Fellsway
Freeport St		Western Ave	McGrath Hwy
Frontage Rd (I-93)			Mystic Valley Pkwy
Gallivan Blvd			Somerville Ave
Granite Ave			
Harvard Ave			
Huntington Ave			
Hyde Park Ave			
Jamaica Way			
L Street			
Logan Airport Rd			
Maffa Way			
Mass Ave Connector			



**BOSTON
 REGION
 MPO**



FIGURE C-1
Location of Base-Year Scenario
AM Congested Roadway Links

*Core
 Capacity
 Constraints*

Year 2040 No-Build Scenario Congested Links: AM Peak Period

Limited-access roadways adding congested links

Interstate 90
Interstate 93
US Route 1
Tobin Bridge
Ted Williams Tunnel
Storrow Drive
Soldiers Field Road
Route 2

Limited-access roadways first showing congestion in this scenario

Leverett Connector
Sumner Tunnel
Callahan Tunnel

Other roadways already with congested sections adding congested links

Boston
Austin St
Beacon St
Boylston St
Brookline Ave
BU Bridge
Cambridge St
Charlesgate Overpass
Commonwealth Ave
Embankment Rd
Frontage Road (I-93)
Harvard Ave
Huntington Ave
Logan Airport Rd
Massachusetts Ave
N Beacon St
Stuart St
University Rd

Arlington
Massachusetts Ave
Mystic St
Pleasant St

Brookline
Route 9
West Roxbury Pkwy

Cambridge
Alewife Brook Pkwy
Fresh Pond Pkwy
Gerry's Landing Rd
Massachusetts Ave
Prospect St
Reid Rotary

Medford
Fellsway
High St
Revere Beach Pkwy
Salem St
Winthrop St

Revere
Broadway

Somerville
McGrath Hwy
Somerville Ave

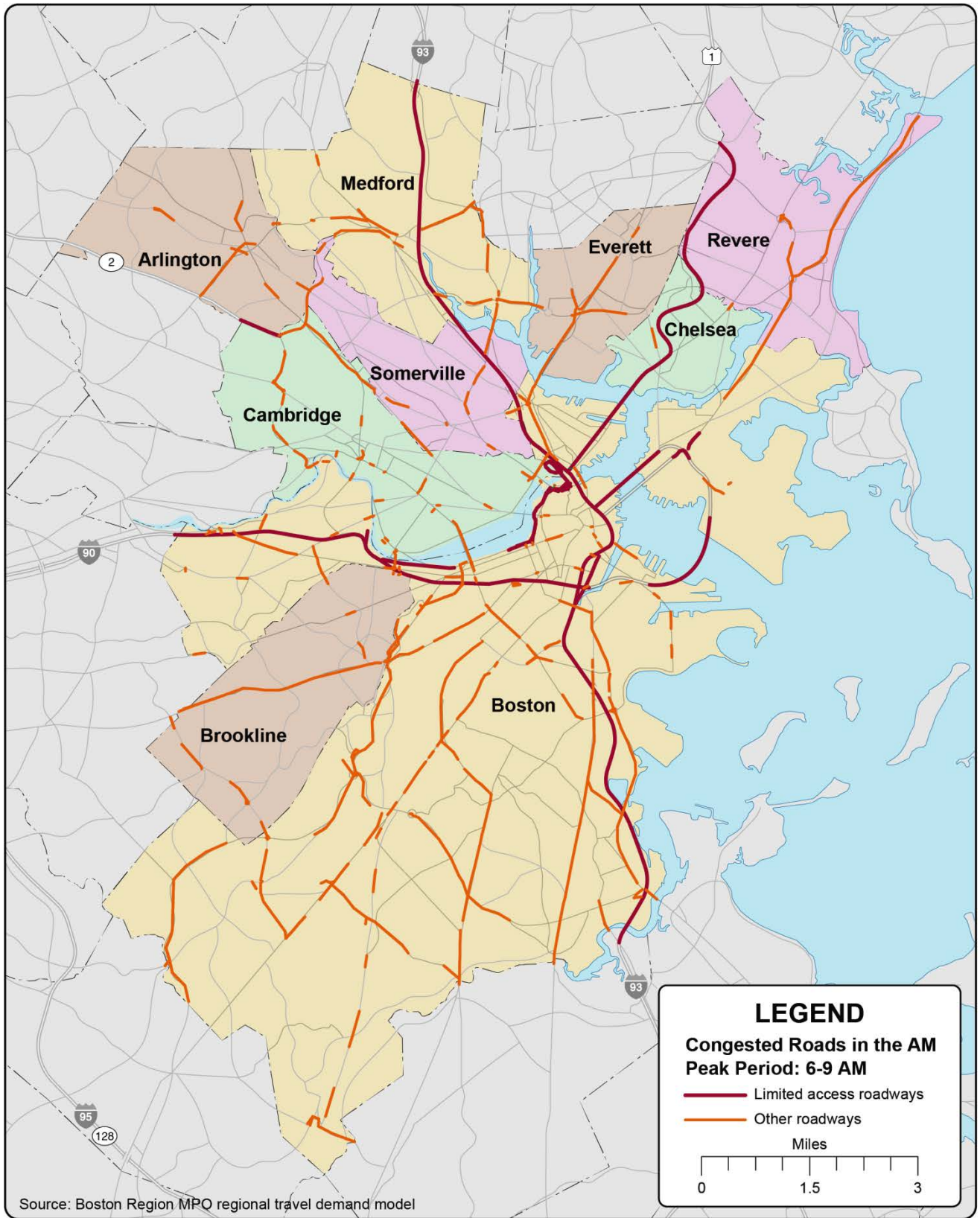
Other roadways first showing congestion in this scenario

Boston
Atlantic Ave
Bedford St
Bigelow St
Broadway
Herald St
New Chardon St
Nonantum Rd
Pearl St
Rutherford Ave

Brookline
Beacon St
Harvard St
South St

Cambridge
Mount Auburn St
Msgr O'Brien Hwy
Sidney St

Revere
Copeland Circle



**BOSTON
 REGION
 MPO**

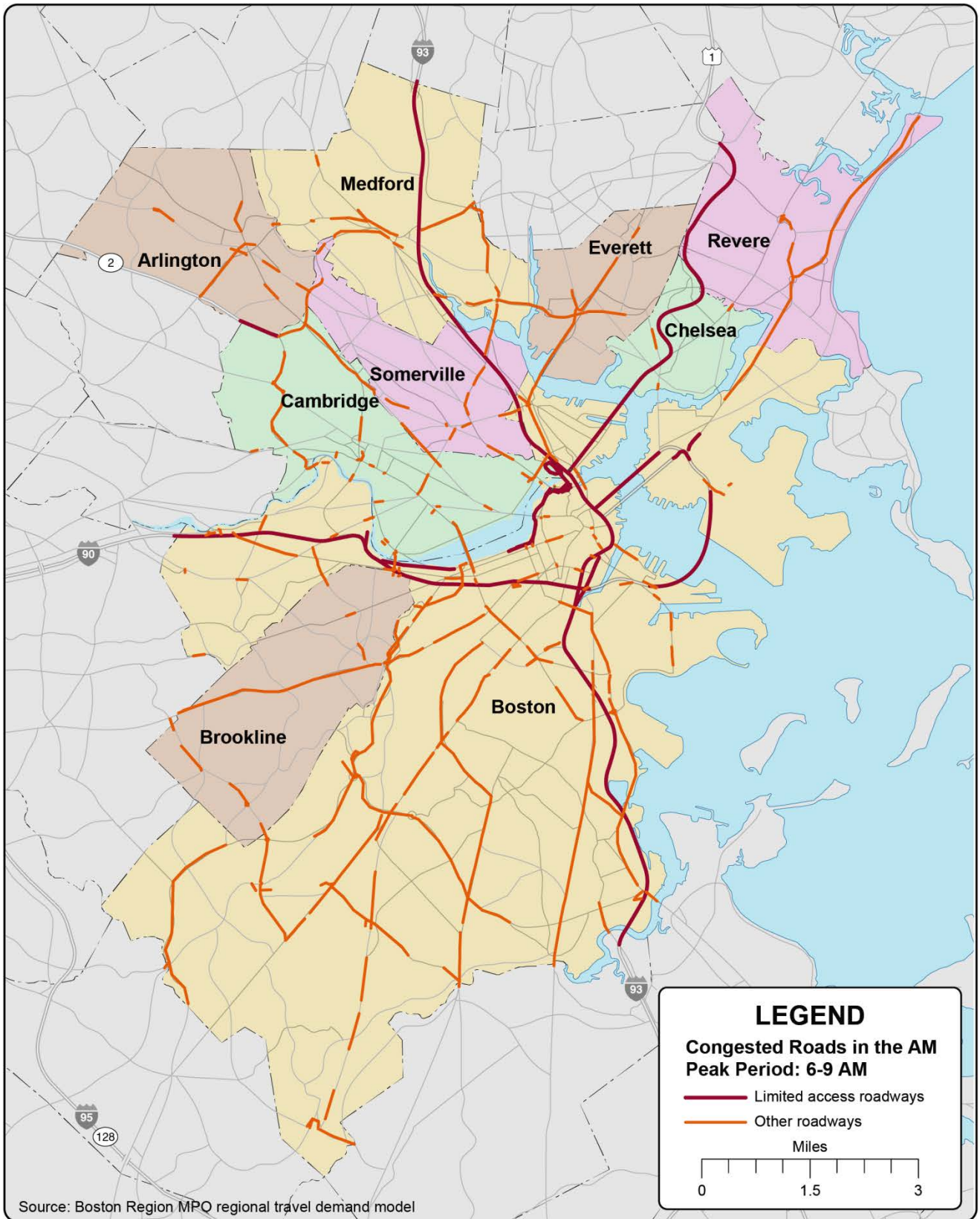


FIGURE C-2
Location of Future Year No-Build Scenario
AM Congested Roadway Links

*Core
 Capacity
 Constraints*

Year 2040 Build Scenario Congested Links: AM Peak Period

<u>Limited-access roadways adding congested links</u>	<u>Other roadways already with congested sections adding congested links</u>	<u>Other roadways first showing congestion in this scenario</u>
Interstate 90	<i>Boston</i>	<i>Boston</i>
Interstate 93	Arborway	Charles River Dam
Tobin Bridge	Beacon St	Charles Street South
	Boylston St	Day Blvd
	Cambridge St	Harborside Drive
	Columbus Ave	Preble St
	Dorchester Ave	West Fourth Street
	Embankment Road	West Roxbury Pkwy
	Freeport St	
	Frontage Road (I-93)	<i>Cambridge</i>
	Hyde Park Ave	Hampshire St
	Mass Ave Connector	
	Massachusetts Ave	<i>Chelsea</i>
	N Beacon St	Pearl St
	Riverway	
	Stuart St	<i>Somerville</i>
	Tremont St	Prospect St
	VFW Pkwy	Washington St
	Washington St	
	<i>Arlington</i>	
	Broadway	
	Medford St	
	Mystic Valley Pkwy	
	<i>Brookline</i>	
	Route 9	
	<i>Cambridge</i>	
	Fresh Pond Pkwy	
	Gerry's Landing Rd	
	Massachusetts Ave	
	Mount Auburn St	
	Msgr O'Brien Hwy	
	<i>Everett</i>	
	Broadway	
	Revere Beach Pkwy	
	<i>Medford</i>	
	Fellsway	
	Revere Beach Pkwy	
	<i>Somerville</i>	
	Beacon St	
	McGrath Hwy	



**BOSTON
 REGION
 MPO**



FIGURE C-3
Location of Future Year Build Scenario
AM Congested Roadway Links

*Core
 Capacity
 Constraints*

Base-Year Congested Links: PM Peak Period

Limited-Access Roadways

Interstate 90
Interstate 93
US Route 1
Tobin Bridge
Leverett Connector
Sumner Tunnel
Callahan Tunnel
Ted Williams Tunnel
Storrow Drive
Soldiers Field Road
Route 2

Other Roadways

Boston

Adams St
Alford St
Arborway
Austin St
Beacon St
Belgrade Ave
Berkeley St
Blue Hill Ave
Boylston St
Brookline Ave
BU Bridge
Cambridge St
Casey Hwy
Centre St
Charles River Dam
Charles St South
Charlesgate Overpass
Columbia Rd
Commonwealth Ave
Congress St
Court St
Cross St
Cummins Hwy
D St
Dorchester Ave
E Berkeley St
Eliot Bridge
Embankment Rd
Endicott St
Essex St
Faneuil St

Boston (cont.)

Freeport St
Gallivan Blvd
Granite Ave
Haul Rd
Herald St
Huntington Ave
Hyde Park Ave
Jamaicaway
Kneeland St
L St
Logan Airport Rd
Main St
Market St
Mass Ave Connector
Massachusetts Ave
Melnea Cass Blvd
Meridian St
Milton St
Morrissey Blvd
Morton St
Mystic Ave
N Beacon St
N Harvard St
N Washington St
Neponset Ave
Neponset Valley Pkwy
New Chardon St
Nonantum Rd
Old Colony Ave
Porter St
Purchase St
Riverway
Rte 1A
Rutherford Ave
Seaport Blvd
Spring St
St. James Ave
State St
Stuart St
Sudbury St
Sullivan Sq
Summer St
Tremont St
VFW Pkwy
W Roxbury Pkwy
Washington St

Arlington

Broadway
Massachusetts Ave
Medford St
Mystic St
Pleasant St

Brookline

Beacon St
Brookline Ave
Grove St
Hammond Pond Pkwy
Harvard St
Route 9
W Roxbury Pkwy

Cambridge

Alewife Brook Pkwy
Brattle St
Broadway
Cambridge St
Charlestown Ave
Concord Ave
Fresh Pond Pkwy
Gerry's Landing Rd
Hampshire St
Land Blvd
Main St
Massachusetts Ave
Memorial Dr
Mount Auburn St
Msgr O'Brien Hwy
Peabody St
Prospect St
Sidney St
Somerville Ave
Waterhouse St
Western Ave

Chelsea

Broadway
Everett Ave
Pearl St
Revere Beach Pkwy

Everett

Alford St
Broadway
Main St
Revere Beach Pkwy

Medford

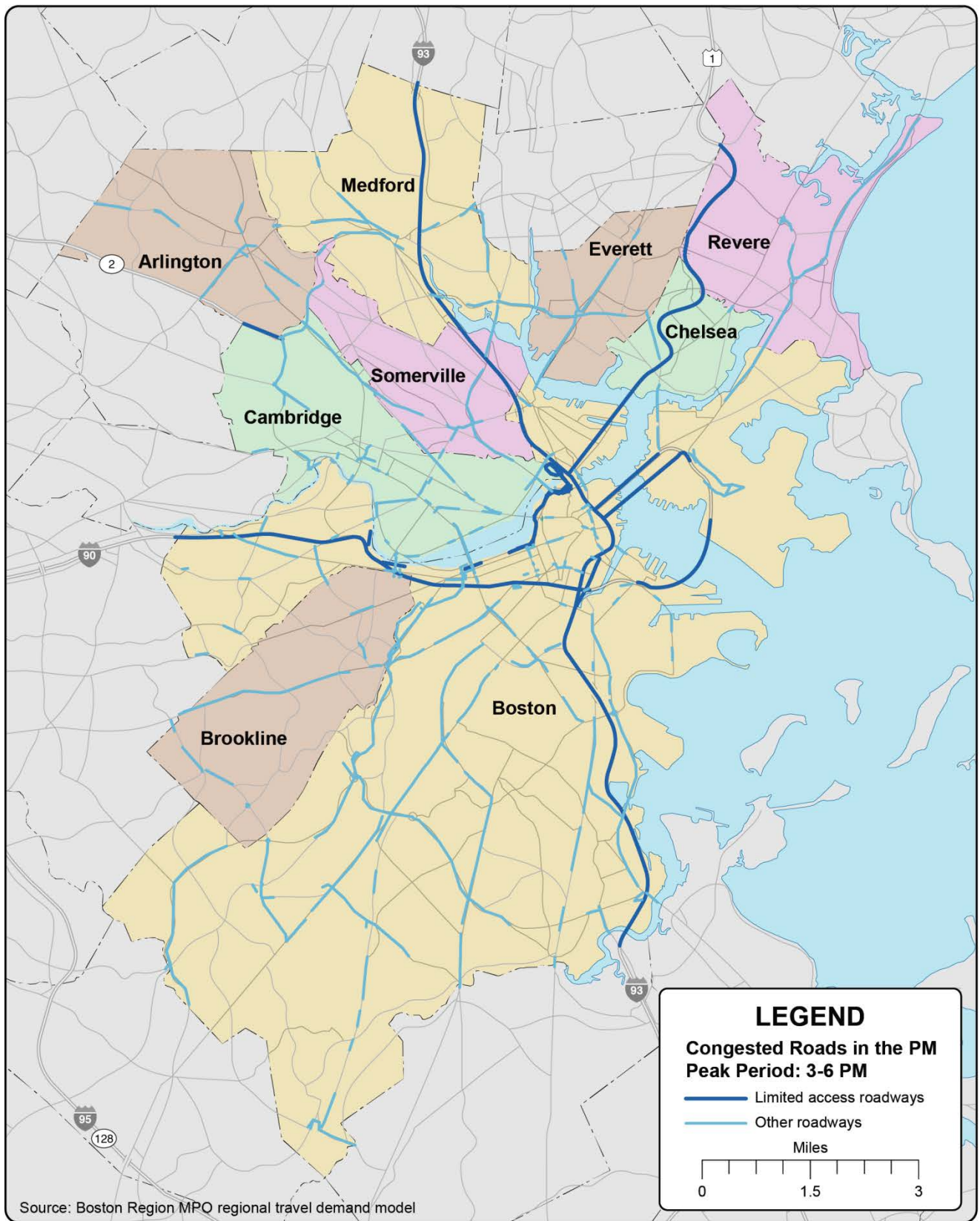
Fellsway
Fellsway West
High St
Mystic Valley Pkwy
Salem St
Winthrop St

Revere

American Legion Hwy
Cutler Hwy
Lee Burbank Hwy
North Shore Rd
VFW Pkwy

Somerville

Alewife Brook Pkwy
Beacon St
Fellsway
McGrath Hwy
Mystic Ave
Mystic Valley Pkwy
Prospect St
Somerville Ave
Washington St



**BOSTON
 REGION
 MPO**

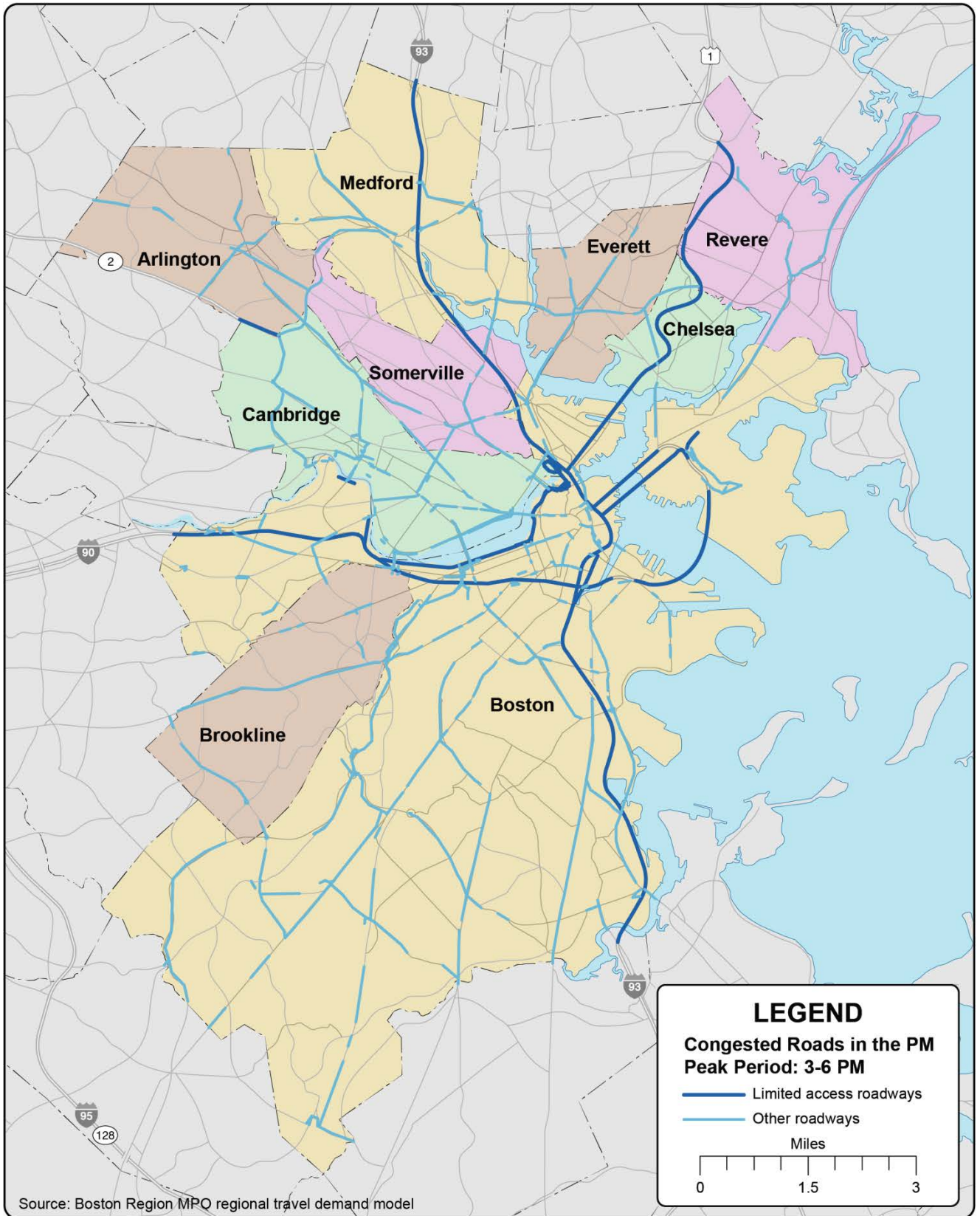


FIGURE C-4
Location of Base-Year Scenario
PM Congested Roadway Links

*Core
 Capacity
 Constraints*

Year 2040 No-Build Scenario Congested Links: PM Peak Period

Limited-access roadways adding congested links	Other roadways already with congested sections adding congested links (cont.)	Other roadways first showing congestion in this scenario
Interstate 90	<i>Arlington</i>	<i>Boston</i>
Interstate 93	Broadway	Atlantic Ave
US Route 1	Massachusetts Ave	Broadway
Storrow Drive	Medford St	Columbus Ave
Other roadways already with congested sections adding congested links	Mystic St	Frontage Rd
<i>Boston</i>	<i>Brookline</i>	Harvard Ave
Alford St	Beacon St	High St
Beacon St	Harvard St	Park Dr
Belgrade Ave	Route 9	Park St
Blue Hill Ave	<i>Cambridge</i>	Pearl St
BU Bridge	Concord Ave	Preble St
Cambridge St	Fresh Pond Pkwy	Seaver St
Centre St	Main St	University Rd
Charles St South	Massachusetts Ave	<i>Arlington</i>
Commonwealth Ave	Memorial Dr	Mystic Valley Pkwy
Congress St	Mount Auburn St	<i>Brookline</i>
Cross St	Prospect St	South St
Dorchester Ave	<i>Chelsea</i>	<i>Cambridge</i>
Eliot Bridge	Everett Ave	Cambridge Pkwy Connector
Embankment Rd	Revere Beach Pkwy	JFK St
Essex St	<i>Everett</i>	<i>Revere</i>
Freeport St	Broadway	Squire Rd
Granite Ave	Revere Beach Pkwy	<i>Somerville</i>
Herald St	<i>Medford</i>	Lombardi Way
Huntington Ave	Fellsway	
Hyde Park Ave	Fellsway West	
Jamaicaway	High St	
L St	Mystic Valley Pkwy	
Logan Airport Rd	Salem St	
Massachusetts Ave	Winthrop St	
Melnea Cass Blvd	<i>Revere</i>	
Meridian St	American Legion Hwy	
Morrissey Blvd	Lee Burbank Hwy	
Morton St	<i>Somerville</i>	
N Beacon St	Beacon St	
Nonantum Rd	Fellsway	
Old Colony Ave	McGrath Hwy	
Riverway	Prospect St	
Rutherford Ave	Somerville Ave	
Seaport Blvd	Washington St	
St James Ave		
State St		
Summer St		
Tremont St		
Washington St		



**BOSTON
REGION
MPO**

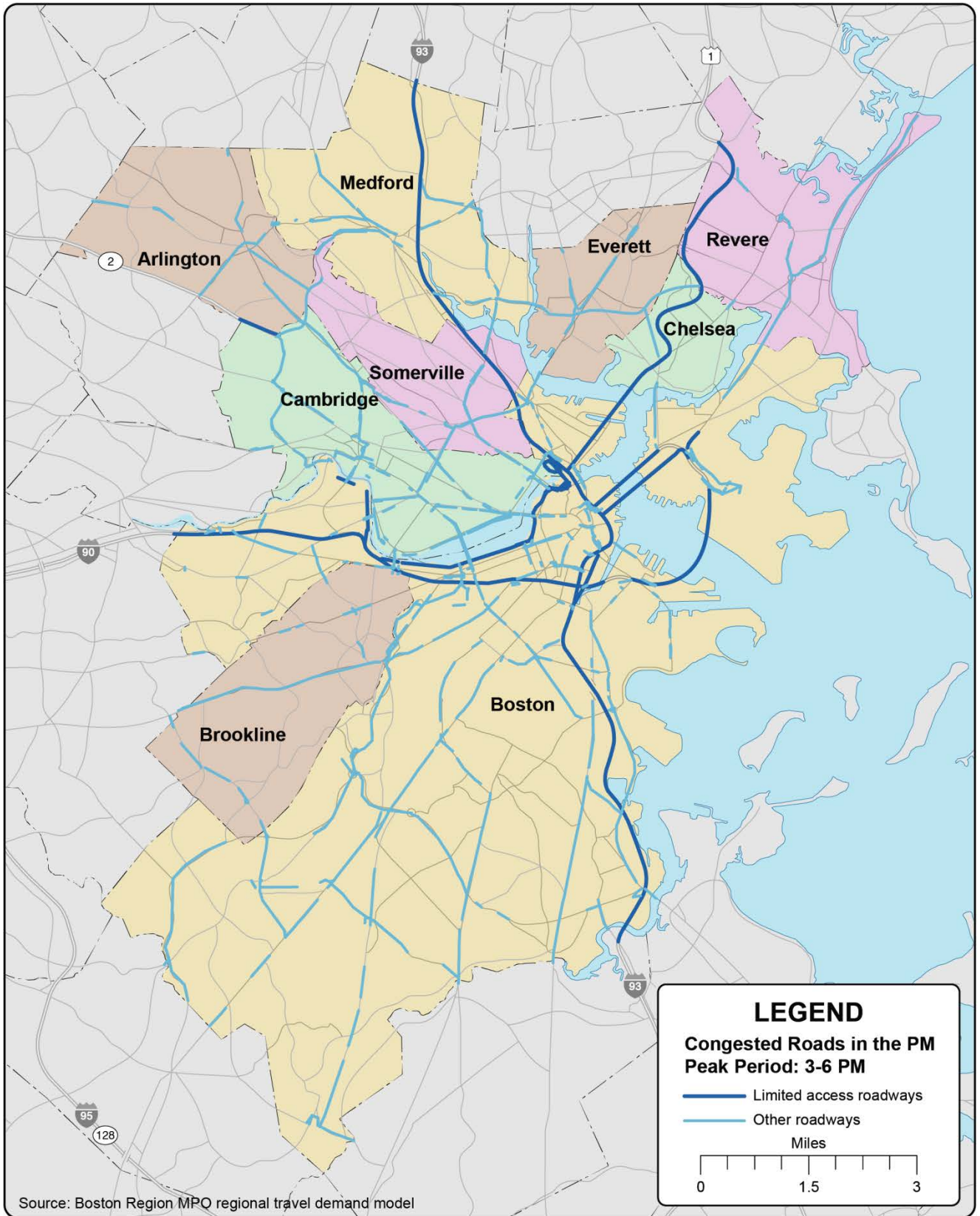


FIGURE C-5
Location of Future Year No-Build Scenario
PM Congested Roadway Links

*Core
Capacity
Constraints*

Year 2040 Build Scenario Congested Links: PM Peak Period

<u>Limited-access roadways adding congested links</u>	<u>Other roadways already with congested sections adding congested links (cont.)</u>	<u>Other roadways first showing congestion in this scenario</u>
US Route 1	<i>Brookline</i>	<i>Boston</i>
Storrow Dr	Route 9	Agassiz Rd
Soldiers Field Rd		Arlington St
	<i>Cambridge</i>	Charles St Circle
	Concord Ave	Charlesgate East
	Hampshire St	Kosciuszko Circle
	Land Blvd	Mugar Way
	Main St	North St
	Massachusetts Ave	West 4th Street (SE Xway)
	Msgr O'Brien Hwy	
	Prospect St	<i>Brookline</i>
		River Rd
	<i>Everett</i>	<i>Cambridge</i>
	Broadway	Magazine St
	Revere Beach Pkwy	River St
	<i>Medford</i>	
	Fellsway	
	<i>Revere</i>	
	American Legion Hwy	
	Lee Burbank Hwy	
	Squire Rd	
	<i>Somerville</i>	
	McGrath Hwy	
	Somerville Ave	
	Washington St	



**BOSTON
REGION
MPO**



FIGURE C-6
Location of Future Year Build Scenario
PM Congested Roadway Links

*Core
Capacity
Constraints*

Reverse of Figure C-6

Appendices D, E, F, G, H

74 pages

Core Capacity Constraints

Intentionally blank

Appendix I

Transportation Mitigation Practices in Study Area Municipalities

Arlington

The town of Arlington has no formal mechanism that requires developers to implement transportation mitigation measures connected to their project's traffic or transit impacts (beyond providing at least two and no more than 20 bicycle parking spaces, with one for every fifteen parking spaces above eight spaces¹), nor a threshold that requires a study of the impacts. Despite not having a site plan review ordinance to describe a standard process, developers' proposals must be approved by the town's Board of Selectmen, which receives support and recommendations from other departments and committees in the town government, before construction is permitted. The most important of these support entities is the Transportation Advisory Committee (TAC).

The TAC, made up of local and knowledgeable transportation professionals, has been the force behind the town's mitigation efforts. The TAC was voted into existence in 2001 to assist the Board of Selectmen in dealing with parking, traffic, and transportation issues in the town. The TAC works with the Department of Planning and Community Development, the Department of Public Works, and the Director of Police Services for town transportation studies, as well as with the Board of Selectmen when requested to study developer's traffic studies or citizen complaints. In effect, the committee functions as on-call consultants for the Board of Selectmen. According to a memo produced in 2004, TAC's decision criteria for evaluating transportation impacts of development projects includes:

- Safety
- Mobility
- Equity
- Environmental and Public Health
- Priority

The TAC screens the need for traffic calming by investigating traffic volume, vehicle classification, speed, cut-through traffic, crashes, existing geometry, and nearby trip generators. It then reviews the applicability, suitability, feasibility, user considerations, and impact of the requested measure.

¹ Arlington, Massachusetts, Zoning Bylaws § 8.8.3

Based on TAC reviews and recommendations, several transportation mitigation measures have been implemented and paid for by developers as conditions of obtaining a building permit. Where the Minuteman Bikeway crosses Mill Street, developers installed a warning system that flashes lights and sounds when a person walking or biking is about to approach the popular crossing. An Opticom device for the intersection of Massachusetts Avenue and Route 60 was purchased to allow for emergency vehicles to control nearby traffic signals and preempt changes to increase response times. Intersection geometry adjustments and signal retiming were done at the intersection of Massachusetts Avenue and Route 16 to allow for different turning coordination.

Boston

The Boston Redevelopment Authority (BRA) adopted Article 80 of the zoning code in 1996 to provide guidelines for review processes for development projects of different scales:

- Large projects (Article 80B): adding more than 50,000 square feet
- Planned Development Areas (Article 80C): new overlay zoning districts for projects greater than one acre
- Institutional Master Plans (Article 80D): projects relating to academic or medical campuses
- Small projects (Article 80E): adding more than 20,000 square feet

The Article 80 process often includes a review of transportation impacts, and it is a required component for approval of large projects. After a Letter of Intent is filed with the BRA, the Project Notification Form (PNF) includes transportation analysis and should identify mitigation efforts expected to be included in the final constructed project. A Draft Project Impact Report provides preliminary traffic impact modeling results further refined into the Final Project Impact Report, after determining adequacy in conjunction with the Boston Transportation Department (BTD) review process. This transportation review, undertaken in coordination with the BTD, focuses on traffic generation, parking, and curb-cut impacts, as well as requirements of the Boston Air Pollution Control Commission.

Prior to the issuance of a building permit, all projects must sign a Construction Management Plan (CMP) with the BTD that specifies what measures will be in place to manage transportation impacts during construction, and large projects must sign a Transportation Access Plan Agreement (TAPA). The extent and detail of the analyses and modeling required depends on the size, location, and complexity of the projects under review, and the TAPA may include findings and discussion related to all of the following components:

- Parking
- Loading
- Access
- Vehicular traffic
- Public transportation
- Pedestrian circulation
- Access plan
- Continued monitoring

The BTD employs a district-based approach to reviewing the parking component of proposed development projects, wherein proposals are evaluated based on the character of the neighborhood, the existing capacity of the roadways and transit infrastructure, the cumulative impact on all proposed projects in the vicinity, constraints by other parking regulations in the area, and programs offered by local Transportation Management Associations (TMAs). New TAPA guidelines put in place through Access Boston 2000-2010 require developers to include bicycle facilities and programs to encourage car sharing.

As a result of the new guidelines established by Access Boston 2000-2010, bicycle parking and car-sharing programs, as well as orientation packets with transit information for residents and employees, on-site transportation coordinators, and project websites containing transit information are the most frequent mitigation measures identified in PNFs submitted to the BRA. Electric vehicle charging stations, transit pass subsidies, and participation in TMAs are also popular measures.

Brookline

Brookline starts considering mitigation at the beginning of the town's plan review process. A traffic impact study is required of Major Impact Projects (identified as 16-plus units of housing or at least 25,000 square feet of nonresidential space) or asked for specifically by the Planning Board for projects that do not fit into clear land-use categories and therefore have uncertain impacts. Based on the results of the study, the Planning and Community Development Department and the Transportation Division of the Department of Public Works negotiate case-by-case mitigation with developers.

Frequent TDM measures required of developers include sidewalk improvements, bicycle parking and showers, and geometric layout changes. Several recent projects, including 2 Brookline Place, agreed to a capped target percentage for single-occupancy vehicle mode share for employees, which must be annually monitored and achieved, or additional mitigation measures would be required. Additionally, the developer of 10 Brookline Place and the town of Brookline

agreed to spend one percent of hard construction costs on transportation mitigation measures at the Brookline Village Green Line station.

In the future, Brookline planners hope to adopt a town-wide policy applicable to all projects similar to the City of Cambridge's Parking and Transportation Demand Management ordinance to provide clear expectations for developers. With more standardized guidelines, obtaining permits would entail less uncertainty and timeline risk and regulations would be more development-friendly.

This new ordinance is being advanced for a number of other reasons. There is ongoing growth pressure in the Longwood Medical Area, near Boston University and Boston College, in the Fenway, and along Route 9 in Newton that is projected to bring additional traffic through the town of Brookline. Additionally, many of the housing units developed in the past 15 years did not meet the Major Impact Project threshold and did not have their traffic impacts studied. Finally, there continues to be a moderate pace of commercial development near transit stations.

Although the ordinance is still under development, it is likely to include the following two components: 1) TDM points above a certain threshold, based on project square footage, will be required before a project is approved, and 2) projects further from a transit station will get more credits for implementing measures than those closer to a transit station.

Cambridge

The city of Cambridge has a history of transportation mitigation policies dating to 1992. Three regulatory avenues exist through which development proposals must identify the transportation mitigation measures to be included: the Parking and Transportation Demand Management Ordinance (PTDM); a city-wide Vehicle Trip Reduction Ordinance; and the Cambridge Redevelopment Authority's (CRA's) Land Development Agreements.

The PTDM ordinance, adopted in 1998 and made permanent in 2006, is managed by the City's Community Development Department (CDD) and its Traffic, Parking, and Transportation Department (TPTD). When an owner of nonresidential property proposes to add parking spaces above the number already registered with the city, a PTDM plan must be approved before a city permit is granted. Small project PTDM plans, applicable if total parking equals 5 to 19 spaces, require the implementation of three of nine TDM measures. Large project PTDM plans apply if total parking is 20 or more spaces. Large projects require a single-occupancy vehicle mode-share commitment, a comprehensive

set of TDM measures, and annual monitoring and reporting that includes an employee/patron survey of trip origin and mode.

Article 19 on Project Review of the Cambridge zoning regulations requires a traffic impact study that looks at existing transportation conditions, intersection crash history, projected trips in the build condition with added growth rate, and other area projects' trips in order to anticipate future transportation conditions. The PTDM plan process begins when a developer submits a draft to the CDD. A PTDM officer issues a draft decision with recommendations for revisions. The developer can then submit a final plan that is then approved, approved with additional conditions, or denied. PTDM officers look at five criteria of exceedances, identified in Article 19.25.11, that point out which impacts need to be mitigated:

- Project trip generation for a 24-hour period and at AM and PM peaks
- Changes in level of service at identified signalized intersections
- Increased traffic volume on residential streets
- Increased vehicle queues at identified signalized intersections
- Lack of sufficient pedestrian and bicycle facilities

Although PTDM officers negotiate PTDM plans with developers on a case-by-case basis, they employ a somewhat standard set of measures in order to increase consistency and make the development process more predictable. This can be seen in the Small Project Form's nine options. Sample TDM measures used in PTDM plans include:

- Transit subsidy for employees/tenants
- Free shuttle bus
- Bus shelter
- Market-rate parking fee charged directly to employees or patrons
- Electric vehicle charging stations
- Daily parking charge available for occasional drivers instead of only a monthly parking pass
- Bicycle parking above minimum zoning requirement
- Shower/locker room for bicyclists
- Financial incentive for walking or biking
- Emergency ride home program
- Car/vanpool matching aid
- Priority/discounted high-occupancy vehicle parking
- Hubway membership and station construction

- Transportation information—website and orientation packet and real-time screens
- Hiring of Cambridge residents
- On-site TDM coordinator
- TMA membership
- EZRide Shuttles
- Flexible work hours

Other measures of transportation mitigation that have been used in developer's PTDM plans include:

- Signal equipment and fiber optic cables
- Studying new turning lanes

The second mitigation avenue dates from 1992 when the City of Cambridge adopted a Vehicle Trip Reduction Ordinance (Chapter 10.17 of the Code of Ordinances) in response to the Clean Air Act amendments in 1990 and the Intermodal Surface Transportation Efficiency Act of 1991. The same year, the city's Bicycle Program was created and is administered within the Division of Environmental and Transportation Planning of the CDD. Recognizing that, "Increasing the use of commuting alternatives and reducing the number of trips by single-occupancy vehicles is beneficial for the City and the Commonwealth in reducing vehicle miles travelled, traffic and associated air pollution, fuel use, noise, and congestion . . ." ²

Cambridge created a city-wide program to encourage alternatives to vehicle trips and incentivize city departments, employers, institutions, owners of multiple-tenant buildings and complexes, and other organizations to use mass transit, bicycles, or walking. The effort included an expanded commuter mobility program, a bicycle and pedestrian mobility program, restrictions on visitor vehicle passes, fees for residential parking stickers, study of zoning revisions, improved coordination with the MBTA, regulations concerning idling vehicles, and taxicab improvements.

The last avenue by which transportation mitigation measures from developments are identified comes through the CRA, which operates separately from the CDD and works in the Kendall Square Urban Renewal Area (KSURA). Boston Properties, the developer with exclusive rights to the KSURA, owns the land, but the CRA still maintains the air rights over renovated MBTA property around Kendall station. The CRA can negotiate with Boston Properties before granting permission for construction; the terms of these transactions include development

² Cambridge, Massachusetts, Code of Ordinances §10.17.020.H

rights, infrastructure obligations, and financial considerations. Despite negotiating directly with the CRA, Boston Properties must still comply with all underlying CDD regulations and obtain city permits.

As part of the agreement to build 3 and 5 Cambridge Center, Boston Properties funded improvements to the Kendall Square station including lengthened and widened station platforms, upgraded interiors, and relocated station entrances. With the completion of the Cambridge Center buildings, Boston Properties is also obliged to operate, maintain, and repair Nowiszewki Plaza in front of the Kendall Red Line station entrance on Main Street.³

Boston Properties recently came to the CRA following Cambridge's release of the K2C2 plan in 2013 calling for one million additional square feet in the area. Negotiating with the CDD and CRA to develop one million additional square feet in the KSURA as suggested in the K2C2 plan, Boston Properties proposed that their transportation mitigation funding go almost exclusively to improving transit service on the MBTA Red Line. Tenants of the area already shirk vehicle commuting in large numbers, and private companies, including BioGen, are offering coach bus shuttles for employees from the suburbs.⁴ Boston Properties has argued that more benefits can be realized by devoting mitigation efforts to public transportation physical improvements instead of the typical TDM measures that are designed to siphon driving commuters to public transportation. The details of this arrangement and whether it may be implemented are not yet complete.

Additionally an amendment to the Kendall Square Urban Renewal Plan put forth by the CRA, a MEPA Notice of Project Change (comparable in scope to an Environmental Impact Report), was submitted to the MEPA Office to be approved in October 2015. The amendment includes elements to allow for the additional square footage and to create a transit investment tool. This amendment contains a chapter detailing the consideration of transit impacts in the MEPA process.

Chelsea

When development proposals are submitted in the city of Chelsea, a development impact statement can be requested at the discretion of the special permit granting authority. In Chelsea, most developments of a large size that would be expected to have traffic and transit impacts are done as "planned developments." These are projects that are more than two contiguous acres of

³ <http://cambridgecivic.com/?p=3491>.

⁴ <http://www.bostonglobe.com/business/2014/12/24/biogen-idec-provides-coach-commuting-for-suburban-worker/f3s5JrhADCmdD0Mae0iLoM/story.html#>.

nonresidential area or four contiguous acres of residential area, generally above 25 units, and need special permits because of their size to start construction. The required development impact statement must project the number of vehicles expected to enter and depart the site daily and at peak hours. The impact report must also show the daily volume and at peak hours on adjacent streets.

Mitigation has not traditionally been on the forefront of Chelsea's priorities for new development, but when it is done, roadway repaving, sidewalk construction, and signal improvements are the most popular measures. In the future, with the introduction of Silver Line Gateway service and interest in development growing throughout the city, city officials have more ability to ask for funding tied to local transportation improvements. New and improved pedestrian connections in the Highland Street and Central Avenue neighborhoods are likely to be addressed in the near term. Transit mitigation is unlikely at this time because the new Silver Line service will likely have sufficient capacity, and improvements to the existing bus services could well be beyond the scope of a typical mitigation agreement.

Much of the transportation mitigation done thus far with completed projects was paid for by MassWorks Infrastructure Program grants and not the developers themselves because of tightened financial markets in recent years. Chelsea has been awarded \$11.5 million in four phases since 2011 for its Gateway Center improvement in the Everett Avenue Urban Renewal District to support the development of two hotels, 250,000 square feet of office space, and 230 units of housing. Market Basket donated some land for sidewalk widening for a greenway project, and a hotel developer paid for engineering studies to redesign the Everett Avenue and Spruce Street intersection, but did not cover construction costs to implement the design changes.

Everett

Everett has not set up a redevelopment authority with appropriate powers defined by state legislation. As a consequence, Everett historically has not been able to demand transportation mitigation. Nevertheless, the city has successfully arranged for voluntary transportation improvements by developers, which largely fall under the label of limited-scale cosmetic enhancements. The Batch Yard housing developers repaved the public street in front of their complex as a means to improve its appearance and attract the luxury tenants it is targeting.

Site plan review is required for projects consisting of more than 5,000 square feet of nonresidential space or four or more residential dwelling units and should include, if requested by the planning board, a narrative addressing concerns about traffic flow and circulation. The Planning Board may also request additional studies on the adequacy of parking and loading facilities, traffic and pedestrian

circulation, and access to the site. These studies have the potential to lead to mitigation requests from the Planning Board.

In response to the potential casino siting, Everett adopted new zoning amendments that require traffic impact analyses with development proposals in particular areas of the city. A traffic impact study is required for developments in the Lower Broadway Economic Development District zone that are expected to generate more than 100 peak hour trips or more than 750 average daily trips.

This type study also must identify proposed methods as necessary to mitigate the impacts. The Planning Board, the approving authority of site plans, is allowed to accept contributions of funds to pay for the design and/or construction of off-site improvements if they are proportional to the impacts resulting from the project. The code also has performance standards for site plans that require buildings in the zone to incorporate access to water-based transportation and reduction in on-site parking if a fixed public transportation stop is within 600 linear feet of a pedestrian entrance to a project.

Much of the transportation mitigation done in Everett to date has been a result of the MEPA process. The most prominent example is the Wynn casino development, which also occasioned the proposed zoning amendments. Besides typical measures such as traffic signal improvement, sidewalk construction, and roadway redesigns to accommodate a larger vehicle volume, the Wynn casino developers proposed mitigation measures not yet employed in the Boston Core Area. The as-yet undefined, ongoing operating cost contribution to the MBTA Orange Line service to increase frequency, especially during peak hours and late-night service, and to make improvements for better handling of additional peak-hour passengers would be a first in the region. The casino operator will also run shuttle buses to connect with Malden Center and Wellington MBTA stations, and may construct a pedestrian bridge over the Mystic River to Assembly Square station. Wynn also proposes funding long-term Sullivan Square mitigation projects for 10 years after the project opens and to pay the city of Boston for every vehicle above Friday PM peak period projections.⁵

A study underway by MassDOT, the Everett Transit Action Plan, envisions a set of smaller-scale recommendations. These could either be implemented through future mitigation agreements or possibly implemented by the city itself.

⁵ <https://www.bostonglobe.com/business/2015/07/30/wynn-aims-first-company-subsidize-mbta-operations-with-orange-line-plans/bzI3fNIPbSBzBsogXDYpsI/story.html>.

Medford

In Medford, transportation mitigation measures are identified regularly during site plan review for all residential projects of six or more units, all commercial projects over 10,000 square feet, all medical office space of 5,000 or more square feet, or all restaurant projects over 2,500 square feet. Traffic analyses included in the written statement of site plan applications must estimate peak-hour traffic volumes generated by the proposed use in relation to exiting volumes and projected future conditions.

Based on their expected impact, each project's mitigation requirements are negotiated on a case-by-case basis, but where multiple projects are proposed for the same area, it is often the first project to be approved that is responsible for the desired roadway improvements in the project area. The mitigation measure most often required for approval is retiming traffic signals, but sidewalk improvements, roadway widening, curb-cut access, and pedestrian connections are also frequent.

Additionally, a linkage fee based on the size of a project is assessed across the entire town regardless of development site and contributes to a fund responsible for local roadway and traffic facility capital improvement projects with linkage grants to the parks and recreation facilities trust.⁶

Revere

Because much of the residential and commercial development occurring in the city of Revere falls along state-owned roadways near the shoreline, the city relies largely on MassDOT to develop transportation mitigation policies on a case-by-case basis through its State Highway Access Permits procedures. The requirements and process of MassDOT review are described later in this section.

Despite MassDOT's extensive involvement in transportation mitigation in Revere, site plan review regulations allow Revere to request traffic impact studies from multifamily, commercial, and industrial projects. These studies must detail:

- Existing traffic volume, composition, peak hour levels, and existing street capacities
- Estimated average daily traffic generation, composition peak hour levels, and directional flows resulting from the proposed development
- Proposed methods to mitigate the estimated traffic impact
- Methodology and sources used to derive existing data and estimations.⁷

⁶ Ord. No. 548 §17 c-1, 4-3-1990

⁷ Revere, Massachusetts, Code of Ordinances, 90-237 § 1 (part)

The site plan review committee considers the convenience and safety of vehicular and pedestrian movement as well as access configuration in relation to adjacent streets when making recommendations about approval.

Funding for many mitigation projects, including roadway reconfiguration, Blue Line station platform extensions, signalization improvement, and bus-stop consolidations, has come from the federal government, the state government, or the MBTA. Individual developers do not routinely contribute. Revere maintains a mechanism for this to become a more common practice, however. The Community Improvement Trust Fund is a separate fund through which funds can be directed to specific projects by the mayor with approval of the City Council.

Payments to the fund come from projects that have been granted special permits or variances above the intensity of use written into the zoning code, where the amount is proportional to the portion of the project that exceeds the code regulations. Payments to the trust are to be made in two equal installments up to a maximum of three percent of total construction costs, the first payment made at the issuance of a building permit and the second made at the issuance of an occupancy permit. The funds may be expended on more than just transportation facilities, but must be appropriated to facilities directly impacted by the project. The possible infrastructure and community facilities eligible for funding include:

- Roadway and sidewalk reconstruction
- Signalization improvements
- Sewer, water, and drainage improvements
- Recreation and open space areas and the support of athletic programs
- Fire protection facilities and equipment
- Crime prevention facilities and equipment
- School buildings and educational programs
- Library improvements⁸

Somerville

Somerville, like many other communities in the Study Area, determines its required transportation mitigation measures by negotiating with developers on a case-by-case basis. Nonetheless, the plan review process almost always includes some form of impact evaluation, even if mitigation is not required thereafter. For projects necessitating special permits, Planned Unit Developments (PUD), and Preliminary Master Plans, detailed explanations of any changes to the vehicular, bicycle, and pedestrian circulation patterns is required as an application supplementary form for the Planning Board before approval can be granted.

⁸ Revere, Massachusetts, Code of Ordinances, 91-23 § 8 (part)

The Special Districts proposed in the draft 2015 Zoning Ordinance update have additional traffic impact reviews. Any already approved PUD is to be considered a Neighborhood Development Plan and remain in effect, but future special approval processes are shown in Table 27. When applicable, the Planning Board may also request a Transportation Study, a Traffic Access and Impact Study, and/or a Transportation Demand Management Plan in the Assembly Square special zoning district, which will be reviewed by the Director of Traffic and Parking.

There are some design elements included in the draft 2015 Zoning Ordinance update currently under review that incorporate public realm requirements to promote pedestrian activity, such as required sidewalk widths in some residential mixed-use districts. In Somerville, all nonresidential uses with more than 5,000 square feet of gross leasable space are required to provide bicycle parking in amounts specified in the zoning code for each principal use category.

Table 27
Somerville Neighborhood Requirements for Plan Approval Process

Special District	Large Development Plan Approval	Neighborhood Development Plan Approval
Assembly Square	5+ acres	40+ acres
Brickbottom	2+ acres	20+ acres
Grand Junction		10+ acres
Inner Belt	8+ acres	20+ acres

Source: Somerville Zoning Ordinance, January 22, 2015 BOA Submittal

MassDOT

MassDOT gets involved with a development’s transportation mitigation measures in two ways: 1) MEPA regulations and 2) Approvals of Access to State Highways with Section 61 Findings. Preparation of a Transportation Impact Assessment (TIA) is triggered by MEPA thresholds—generally more than 3,000 new average daily trips to a single location or the addition of 1,000 or more parking spaces at a single location—and/or by the MassDOT state highway access regulations. Projects that are on state highways, or whose trip generation will impact nearby state highways or intersections controlled by MassDOT, are subject to access approval procedures.⁹

⁹ http://www.massdot.state.ma.us/Portals/8/docs/access_permits/HMD_60_02_3_000.pdf.

For TIA scoping purposes, MassDOT requires the preparation of a Transportation Scoping Letter (TSL) that agrees on the analytical approach, technical assumptions, and key issues to be addressed. TSLs must be submitted early in the development process, no later than the Environmental Notification Form, and are considered preliminary and likely to evolve throughout the process. The TSL, nevertheless, must include the following elements:

- Projected trip generation
- Mode split
- Transportation demand management measures adopted
- Study area and transportation network
- Trip distribution pattern
- Analysis periods
- Site plans
- Access spacing and circulation assessment
- Safety
- Parking

Guidelines for the TIA provide for a multimodal transportation development review to enhance transit, bicycle, and pedestrian facilities and to emphasize transportation-efficient development. They also foster implementation of TDM programs. In particular, calculations for transit ridership by direction and by route, dwell times, crowding, speeds, and multimodal level-of-service changes from pre- and post-development scenarios must be included. TIA information ensures that mitigation measures are fully funded with descriptions of responsible parties, timelines to completion, and duration of responsibility. The TIA also provides the basis for ongoing monitoring programs to evaluate the effectiveness of mitigation measures.¹⁰

The finished TIA, completed through consultation and negotiation between all stakeholders, provides the developer, affected municipalities, MassDOT, MassRIDES, local TMA, and the general public with information needed to assess the adequacy of existing and planned transportation infrastructure, the project's impacts, and proposed mitigation measures. MassDOT has the prerogative to accept financial payment in lieu of direct investment in mitigation facilities and/or service improvements, at its discretion, which would be deposited in a mitigation bank to fund future improvements.

State Highway Access Permits are issued by the MassDOT Highway Division. Section 61 Findings, if applicable based on the Final EIR, identify multimodal mitigation measures to balance the needs of all users of the transportation

¹⁰ <http://www.mass.gov/eea/docs/mepa/transportation-impact-assessment-guidelines-3-13-14.pdf>

network. TDM programs are frequently a component of access permits. Physical actions must be settled by the time of approval, whereas nonphysical actions must be available upon site opening. On-site physical mitigation examples include configuration of driveway design, building arrangement, parking management, internal circulation, and pedestrian, bicycle, and transit accommodations. Off-site mitigation measures can include traffic signal coordination and/or optimization, intersection reconstruction, roadway widening, transit service improvements, bus priority signal systems, and access management.

MBTA

The MBTA has very little history of engaging in mitigation negotiations with developers, in part because of limited legal authority and jurisdiction. As a result, there is also no standard protocol for involving private developers with transit mitigation. When offering bids for transit-oriented development on MBTA property, the statute requires disposing of land or entering into a ground lease with the “highest responsive bidder” that offers the most financial value to the MBTA and that also meets certain nonfinancial requirements such as a history of and references for competent project management as well as a record of successful projects. Projects near MBTA stations but not on MBTA land have no obligation to involve the MBTA in transportation mitigation negotiations.

The Wynn casino project in Everett is the largest project to date that the MBTA has actively engaged in discussions about transit impacts based on new trips generated. The mitigation measures to be implemented are not yet finalized, but potentially include operational subsidies as well as a number of physical construction projects designed to improve circulation and efficiency at nearby rapid transit and commuter rail stations related to both train and bus service.

The proposed Boston Landing/New Balance commuter rail station is another example in which a private developer contributes significant funds to the MBTA. In contrast to the Wynn Casino’s use of existing stations and improvement of circulation and transit service, the new infill commuter rail station will be financed privately by New Balance. New Balance will also commit to covering station maintenance costs for several years in exchange for two guaranteed peak period trains stopping in each direction on weekdays.

The Assembly Square Orange Line station was partially financed by Federal Realty Investment Trust, the developer that also developed the adjacent transit-oriented Assembly Row complex. The MBTA is in the process of beginning a conversation about transportation mitigation with another private developer desiring to construct more square footage in the area.

Much greater participation in the development process, and therefore the ability to negotiate mitigation, may be possible for transit-oriented projects constructed on MBTA land. The MBTA Real Estate Department oversees the agency's real estate holdings and manages its office and warehouse facilities. Massachusetts Realty Group, the MBTA's asset manager, manages the leasing, licensing, inventory, easements, sale of MBTA property, and air rights holdings. One such project is the air rights development over the Hynes Convention Center station, which will involve an MBTA Station Improvements Agreement to renovate the Green Line station to be accessible to people with disabilities and to refurbish a second station entrance. This, as is typical of other joint development projects the MBTA has done, will involve the developer funding design and construction costs of station improvements, but the MBTA actually administering the work.