MVMPO

Congestion Management Process

Amended January 2025

Merrimack Valley Metropolitan Planning Organization Congestion Management Process As Amended January 22, 2025

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I. Front Matter

Funding Disclaimer

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Merrimack Valley Planning Commission
160 Main Street
Haverhill, MA 01830
Email: transportation@mvpc.org

Complaints may also be filed directly with the United State Department of Transportation at:

U.S. Department of Transportation
Office of Civil Rights
1200 New Jersey Avenue, SE
Washington, DC 20590
Website: civilrights.justice.gov

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Chinese Simple
如果需要使用其它语言了解信息，请联系Merrimack Valley大都会规划组织（MVMPO）《民权法案》第六章协调员，电话978-374-0519，转15。

Chinese Traditional
如果需要使用其他語言瞭解資訊，請聯繫Merrimack Valley大都會規劃組織（MVMPO）《民權法案》第六章協調員，電話978-374-0519，轉15。

Vietnamese
Nếu quý vị cần thông tin này bằng tiếng khác, vui lòng liên hệ Điều phối viên Luật VI/Chống phân biệt đối xử của MVMPO theo số điện thoại 978-374-0519, số máy nhánh 15.

French Creole
Si yon moun vle genyen enfòmasyon sa yo nan yon lòt lang, tanpri kontakte Kowòdinatè kont Diskriminasyon/MVMPO Title VI la nan nimewo 978-374-0519, ekstansyon 15.

Russian
Если Вам необходима данная информация на любом другом языке, пожалуйста, свяжитесь с Координатором Титула VI/Защита от дескриминации в MVMPO по тел: 978-374-0519, добавочный 15.

French
Si vous avez besoin d'obtenir une copie de la présente dans une autre langue, veuillez contacter le coordinateur du Titre VI/anti-discrimination de MVMPO en composant le 978-374-0519, poste 15.

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Se ha bisogno di ricevere queste informazioni in un'altra lingua si prega di contattare il coordinatore del MVMPO del Titolo VI e dell'ufficio contro la discriminazione al 978-374-0519 interno 15.

Mon-Khmer, Cambodian
ប្រសិនបើលោក-អ្នកត្រូវការបកប្រែព័ត៌មាននេះ
សូមទាក់ទងអ្នកសម្របសម្រួលជំពូកទី6/គ្មានការរើសអើងរបស់ MVMPO តាមរយៈលេខទូរស័ព្ទ 978-374-0519 រួចភ្ជាប់ទៅលេខ 15។

Arabic
إذا كنت بحاجة إلى هذه المعلومات بلغة أخرى، يُرجى الاتصال بمنسق الفقرة السادسة لمنع التمييز التابع لمنظمة التخطيط الحضري في
ميريماك فالي على الهاتف: 978-374-0519 ثم اضغط الأرقام 15

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II. Context

Urbanized areas with a population over 200,000 are considered Transportation Management Areas (TMAs). Based on federal statutes that define Metropolitan Planning Organization (MPO) processes, MPOs serving TMAs are required to establish a Congestion Management Process (CMP). Much of the Merrimack Valley Region is within the Boston MA-NH-RI Urbanized Area, and therefore the Merrimack Valley MPO (MVMPO) is required to establish a CMP.

Code of Federal Regulations CMP Elements

Per 23 CFR 450.322(d), the CMP shall be developed, established, and implemented as part of the metropolitan planning process and shall include:

1. Methods to monitor and evaluate the performance of the multimodal transportation system, including the identification of the underlying causes of recurring and non-recurring congestion and the evaluation of alternative strategies. The CMP should provide information supporting the implementation of actions and should ideally evaluate the effectiveness of implemented actions;

2. A definition of congestion management objectives and appropriate performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods. Since levels of acceptable system performance may vary among local communities, performance measures should be tailored to the specific needs of the area and established cooperatively by the State(s), affected MPO(s), and local officials in consultation with the operators of major modes of transportation in the coverage area, including providers of public transportation;

3. The establishment of a coordinated program for data collection and system performance monitoring to define the extent and duration of congestion to help identify causes of congestion and evaluate the efficiency and effectiveness of implemented actions. To the extent possible, the data collection program should be coordinated with existing data sources (including archived operational/ITS data) and coordinated with operations managers in the metropolitan area;

4. The identification and evaluation of the anticipated performance and expected benefits of appropriate congestion management strategies that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures. The following categories of strategies, or combinations of strategies, are some examples of what should be appropriately considered for each area:

    a. Demand management measures, including growth management, and congestion pricing;
    b. Traffic operational improvements;
    c. Public transportation improvements;
    d. ITS technologies as related to the regional ITS architecture; and
    e. Where necessary, additional system capacity.

5. The identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation; and

6. The implementation of a process for periodic assessment of the effectiveness of implemented strategies based on of the area's established performance measures. The results of this evaluation shall be provided to decision makers and the public to provide guidance on selection of effective strategies for future implementation.

Congestion Management Process Purpose

The CMP is used to guide other MPO planning studies, measures, and programing decisions. Federal guidance for the CMP consists of eight actions:

- Develop Regional Objectives
- Define the CMP Network
- Develop Multimodal Performance Measures
- Collect Data/Monitor System Performance
- Analyze Congestion Problems and Needs
- Identify and Assess Strategies
- Program and Implement Strategies
- Evaluate Strategy Effectiveness

Alignment with MV Vision 2050

As a component of the metropolitan planning process, the CMP supports the goals outlined in MVMPO's Metropolitan Transportation Plan (MTP). These goals are:

Goal 1. Provide equitable access to the transportation network

- Improve multimodal access in Regional Environmental Justice Plus (REJ+) Neighborhoods.

Goal 2. Improve transportation mode share balance

- Prioritize projects that include the addition or improvement of sidewalks, bicycle lanes, sidepaths and trails.
- Make connections to regional and inter-regional destinations through separated-protected bicycle facilities.
- Improve capacity for buses and rail service and the ability to achieve multimodal connections along transit corridors.

Goal 3. Ensure environmental sustainability

- Reduce vehicle miles traveled (VMT) across all communities.
- Improve regional air quality.

Goal 4. Promote economic vitality

- Improve multimodal access to jobs, tourist destinations, and commercial cores.
- Improve the walkability and bikeability of regional downtowns and tourist destinations.

Goal 5. Advance resilient networks

- Ensure or create network redundancy.
- Enhance effective evacuation routes.

Goal 6. Support a state of good repair

- Maintain 80% of all federal aid roadways at good or greater pavement condition.
- Maintain and modernize transit capital assets.
- Maintain 80% of all pedestrian and bicycle infrastructure at good or greater condition.

Goal 7. Support compact land use and attainable housing

- Improve multimodal access in designated Massachusetts Bay Transit Authority (MBTA) communities' planned housing neighborhoods.
- Create multimodal access in areas with a greater housing density and mixed-use districts.

Goal 8. Significantly reduce serious injuries and fatalities

- Improve safety for roadways' most vulnerable users.
- Reduce the design speed of vehicular traffic in high demand pedestrian and bicycle areas.
- Adopt a safe systems approach to addressing rising rates of serious injuries and fatalities.

III. Existing Conditions

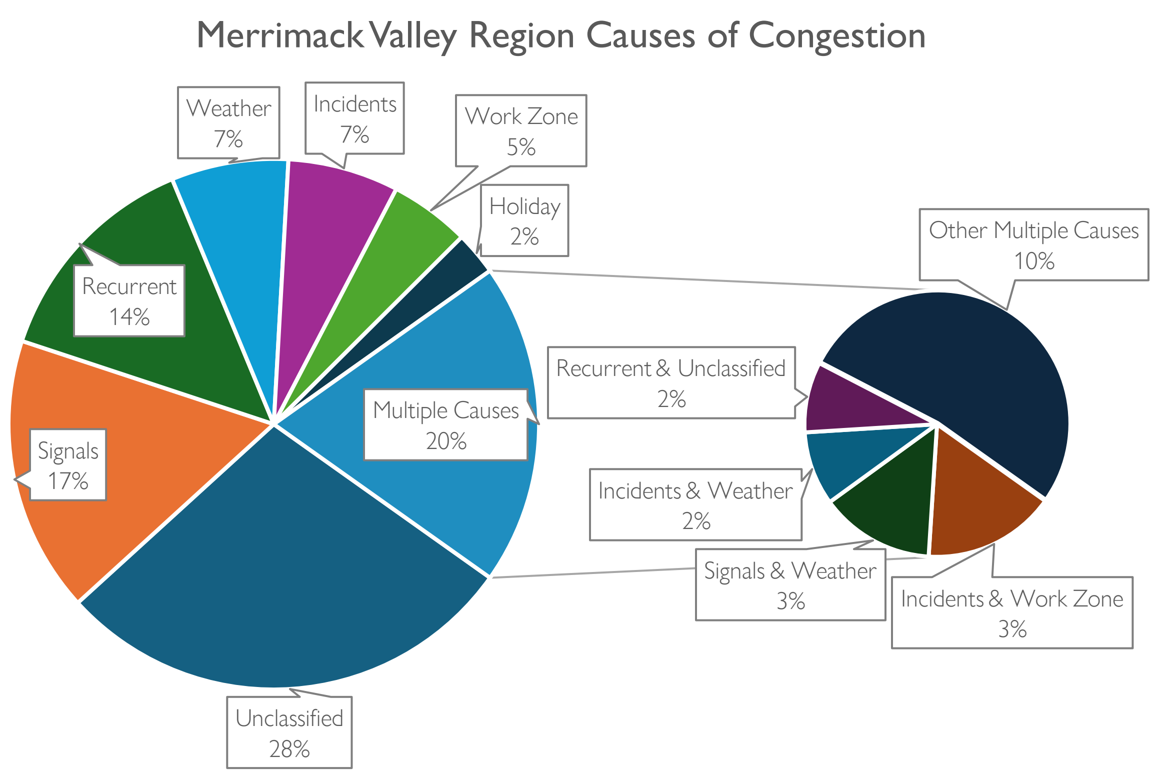
Congestion Definition and Causes

Congestion refers to delay or an increase in travel time that exceeds what occurs under free-flow or stable conditions. There are two main types of congestion, *recurring congestion* and *non-recurring congestion.*

- *Recurring congestion* is generally concentrated in short time periods during peak periods of travel and is caused by excessive traffic volumes resulting in reduced speed and traffic flow.
- *Non-recurring congestion* is caused by unforeseen incidents such as crashes, weather events, holiday travel, and work zones.

The chart below shows the breakdown of congestion causes in the Merrimack Valley region during FFY24 based on INRIX data available through Regional Integrated Transportation Information System (RITIS). While it is common in the transportation industry to evaluate point-based congestion—the location of where congestion is initiated, often an intersection, roadway bend, or exit location—consistent with *MV Vision 2050*, the MVMMPO board's main concern relates to the overall travel time of a trip. Often, roadway improvements focused on reducing point-based congestion result in only nominal benefits, particularly in a coordinated corridor. This document uses available data to explore both point based delays and travel time.

Figure 1 MVMPO Region Causes of Congestion



Congestion can be costly in terms of the opportunity cost associated with delays in travel time. Congestion occurrences led to an estimated total of 2,919,712 vehicle hours of delay in the Merrimack Valley region in FFY24.

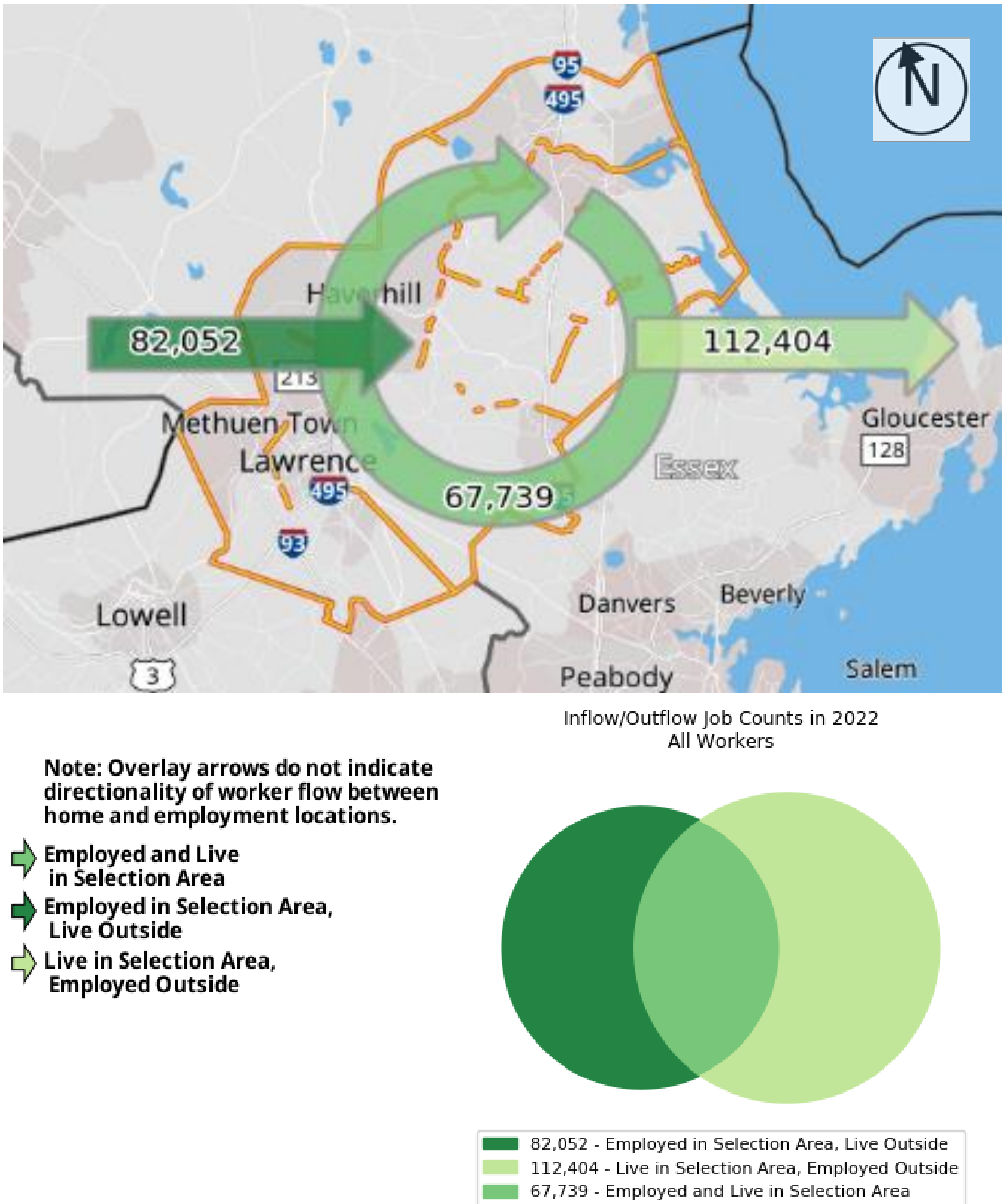
Merrimack Valley Congestion Factors

The Merrimack Valley region has several factors contributing to congestion. The Merrimack Valley is located within commuting distance of Boston and other major job centers in the Boston metropolitan area, and there are significant employment centers within the Merrimack Valley region as well. This results in substantial commuting into, out of, and through the region. Per 2022 LODES data, 82,052 workers live outside of the region and work in the region, 112,404 workers live in the region and work elsewhere, and 67,739 workers are employed in and live in the region.

There are three interstate highways running through the region, I-93, I-95, and I-495, bringing people to destinations in Massachusetts and New Hampshire. The region is also home to numerous recreational destinations such as beaches contributing to seasonal travel into and within the region.

Figure 3 shows the top job destinations for workers living in the Merrimack Valley region and Figure 4 shows the top locations where people employed in the Merrimack Valley region live per 2022 LODES data. The data in Figure 3 and Figure 4 is based on cities and Census Designated Places (CDPs). In cases where CDPs are not coterminous with municipal boundaries, the number of people employed in a CDP represented on the map may be lower than the total number of people employed in the municipality. Appendix E includes maps showing the top job destinations for people living in each Merrimack Valley region municipality.

Figure 2 MVMPO Region Inflow/Outflow of Workers



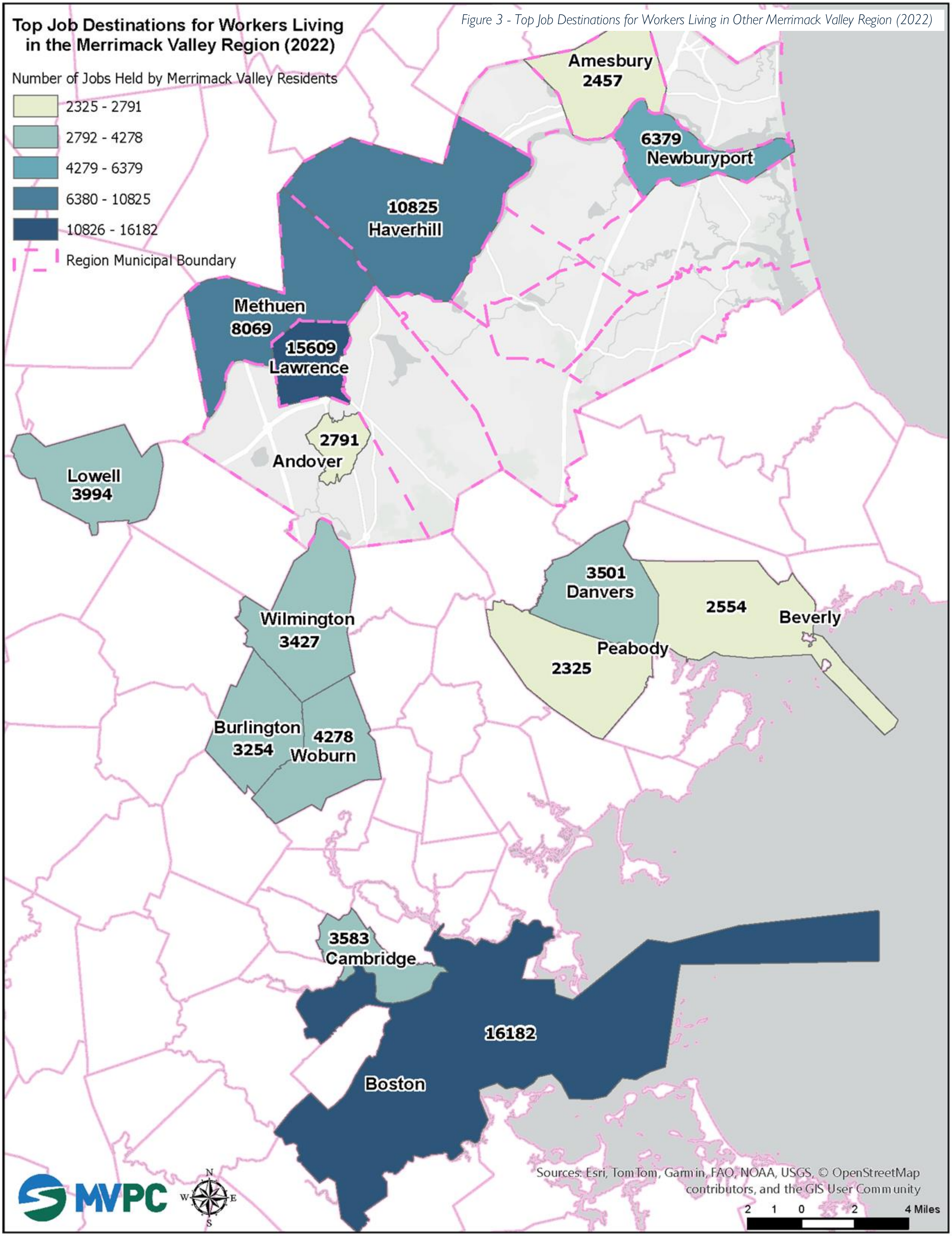


Figure 3 - Top Job Destinations for Workers Living in Other Merrimack Valley Region (2022)

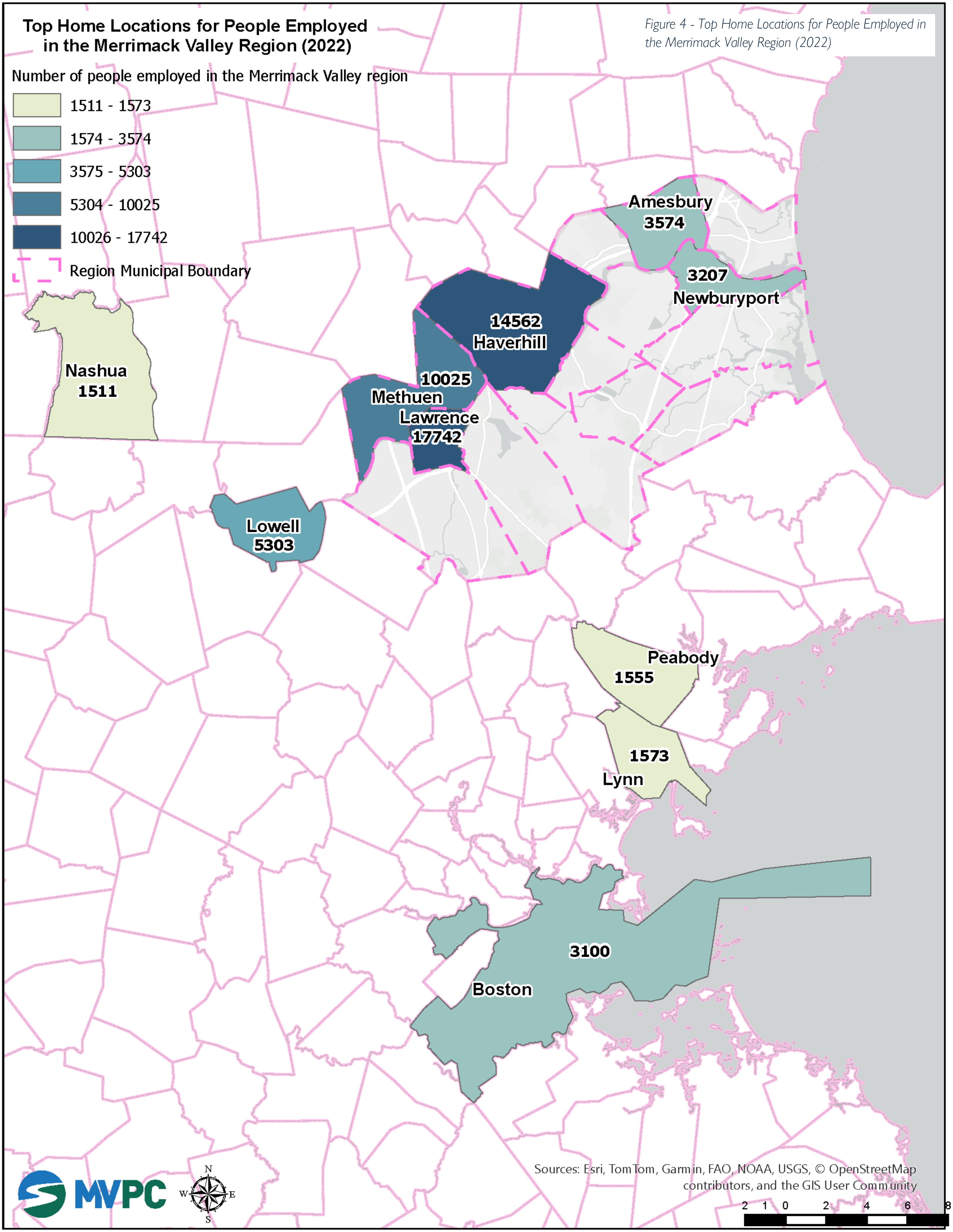


Figure 4 - Top Home Locations for People Employed in the Merrimack Valley Region (2022)

Existing Merrimack Valley Travel Assets

The Merrimack Valley has several strengths pertaining to travel and congestion mitigation.

- The region is served by two MBTA commuter rail lines with seven stops within the region. These rail lines allow for non-automobile travel into Boston and other destinations in the Boston Metropolitan area.
- The Merrimack Valley is served by MeVa Transit, which provides fare-free fixed-route and paratransit services throughout the region.
- The region is served by Amtrak with a stop in Haverhill on the Downeaster line between Boston and Maine.
- The Merrimack Valley is also home to a network of off-road shared use path, providing safe and comfortable locations for people to travel by bike and on foot.

CMP Network

Figure 5 below shows the overall roadway network, transit network, shared use paths, and park and ride facilities in the Merrimack Valley region. Figure 6 shows the CMP network, which includes all roadways in the Merrimack Valley region with a functional classification of:

- Interstates
- Principal Arterials
- Minor Arterials
- Collector Streets
- Local Roads of Regional Significance

Vehicle traffic volume performance measures will be calculated for links in this network, where volume data is available.

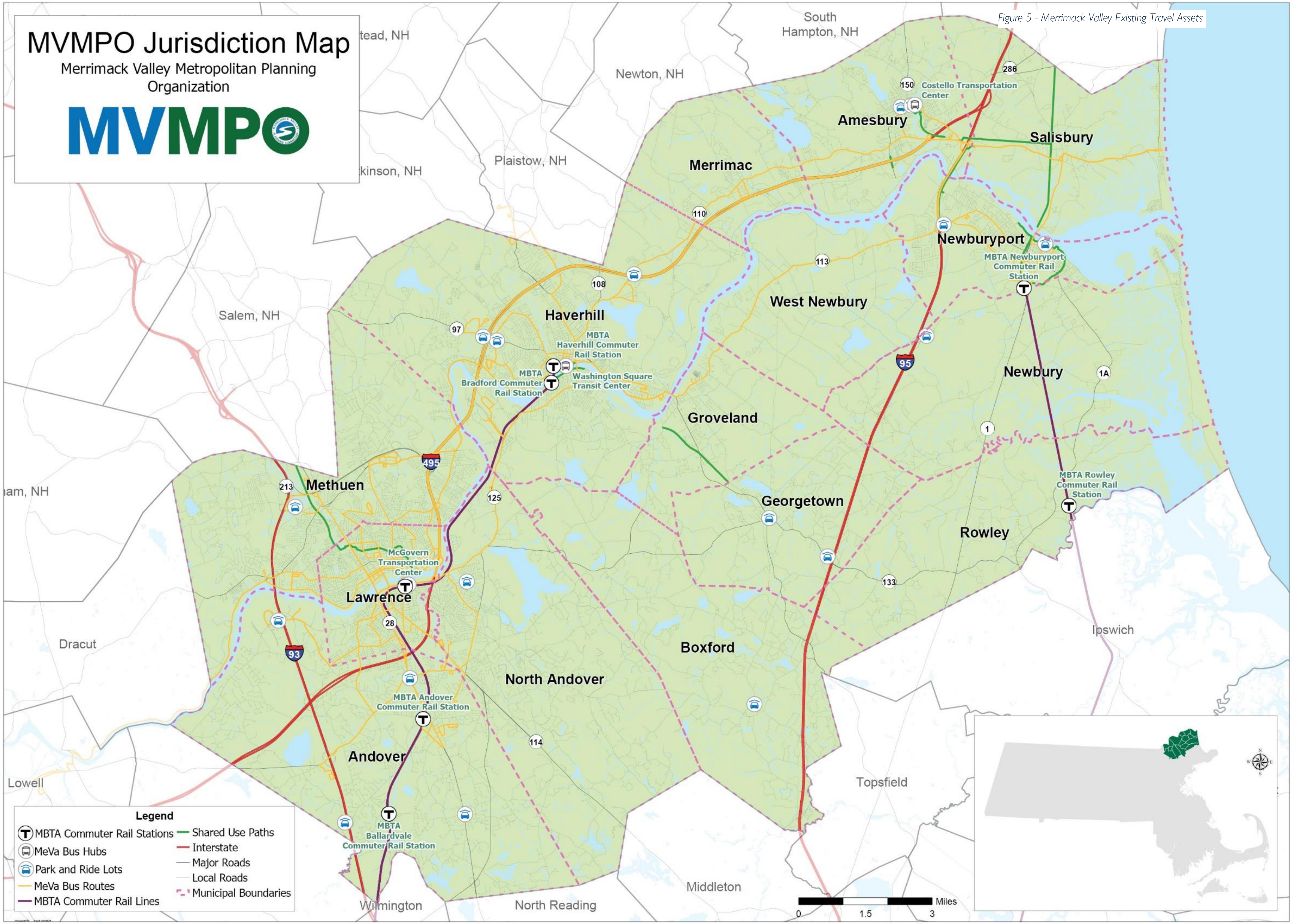
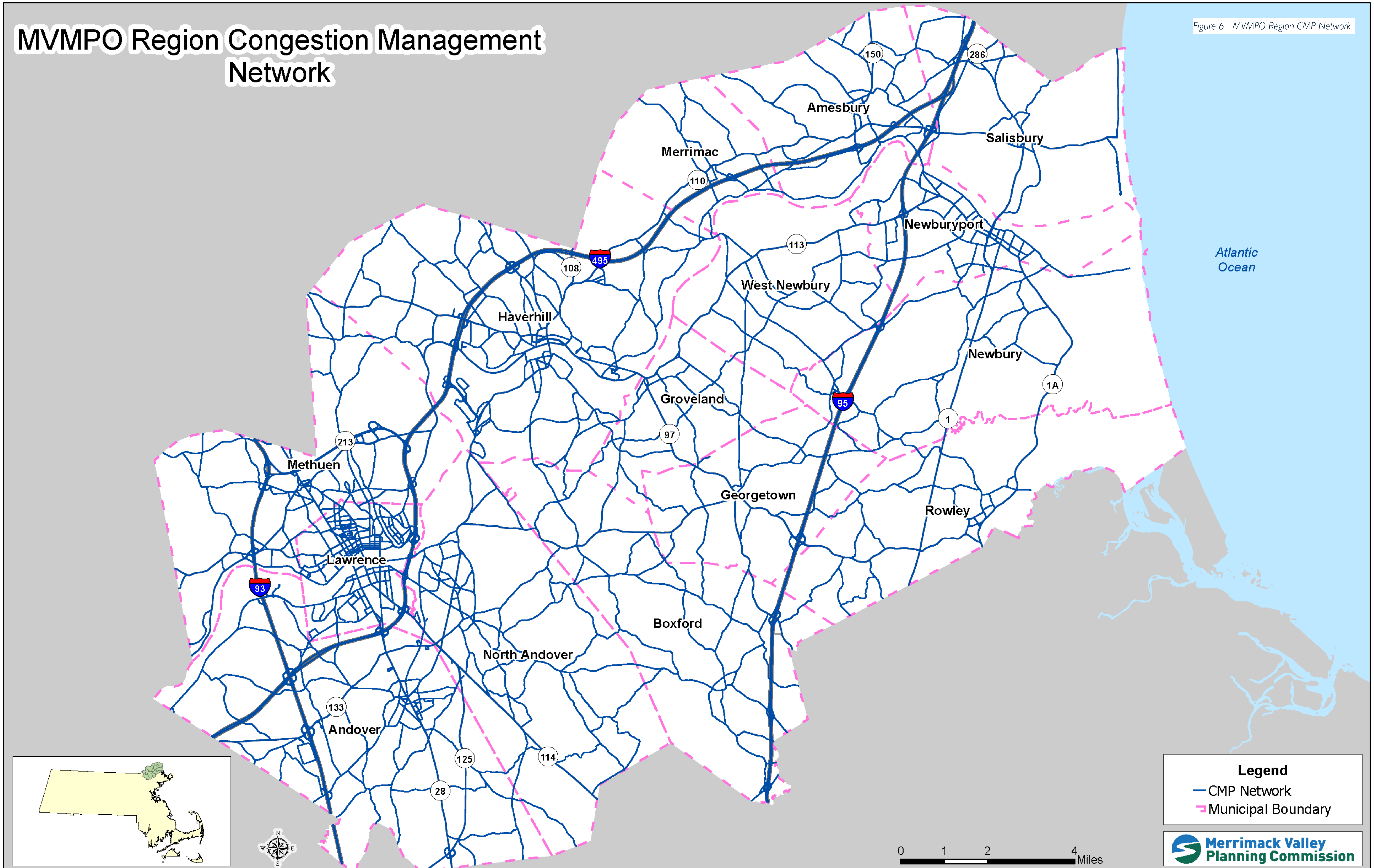


Figure 5 - Merrimack Valley Existing Travel Assets
MVMPO Jurisdiction Map
Merrimack Valley Metropolitan Planning Organization
MVMPO
Legend
MBTA Commuter Rail Stations
MeVa Bus Hubs
Park and Ride Lots
MeVa Bus Routes
MBTA Commuter Rail Lines
Shared Use Paths
Interstate
Major Roads
Local Roads
Municipal Boundaries
Amesbury
Salisbury
Merrimac
Newburyport
West Newbury
Haverhill
Newbury
Groveland
Georgetown
Rowley
Methuen
Lawrence
North Andover
Boxford
Andover
Costello Transportation Center
MBTA Newburyport Commuter Rail Station
MBTA Haverhill Commuter Rail Station
MBTA Bradford Commuter Rail Station
Washington Square Transit Center
MBTA Rowley Commuter Rail Station
McGovern Transportation Center
MBTA Andover Commuter Rail Station
MBTA Ballardvale Commuter Rail Station
South Hampton, NH
Newton, NH
Plaistow, NH
Salem, NH
Dracut
Lowell
Wilmington
North Reading
Middleton
Topsfield
Ipswich
Miles
0
1.5
3


MVMPO Region Congestion Management Network
Figure 6 - MVMPO Region CMP Network
Amesbury
Salisbury
Merrimac
Newburyport
West Newbury
Haverhill
Newbury
Groveland
Methuen
Georgetown
Rowley
Lawrence
Boxford
North Andover
Andover
Atlantic Ocean
150
286
110
113
108
495
95
1A
1
97
213
93
133
125
114
28
Legend
CMP Network
Municipal Boundary
0
1
2
4
Miles
Merrimack Valley Planning Commission

Multimodal Performance Measure Analysis

Bottleneck Rankings

MVMPO staff used the transportation data platform, RITIS, to compile rankings of point-based bottlenecks occurring on roadways in the Merrimack Valley region. A traffic bottleneck is defined as a localized area of roadway where traffic is delayed and moves more slowly than normal. RITIS ranks bottlenecks based on the following metrics:

- *Base Impact* — The sum of queue lengths over the duration of the bottleneck.
- *Total Delay* — Base impact weighted by the difference between free-flow travel time and observed travel time multiplied by the average daily volume (AADT), adjusted by a day-of-the-week factor.

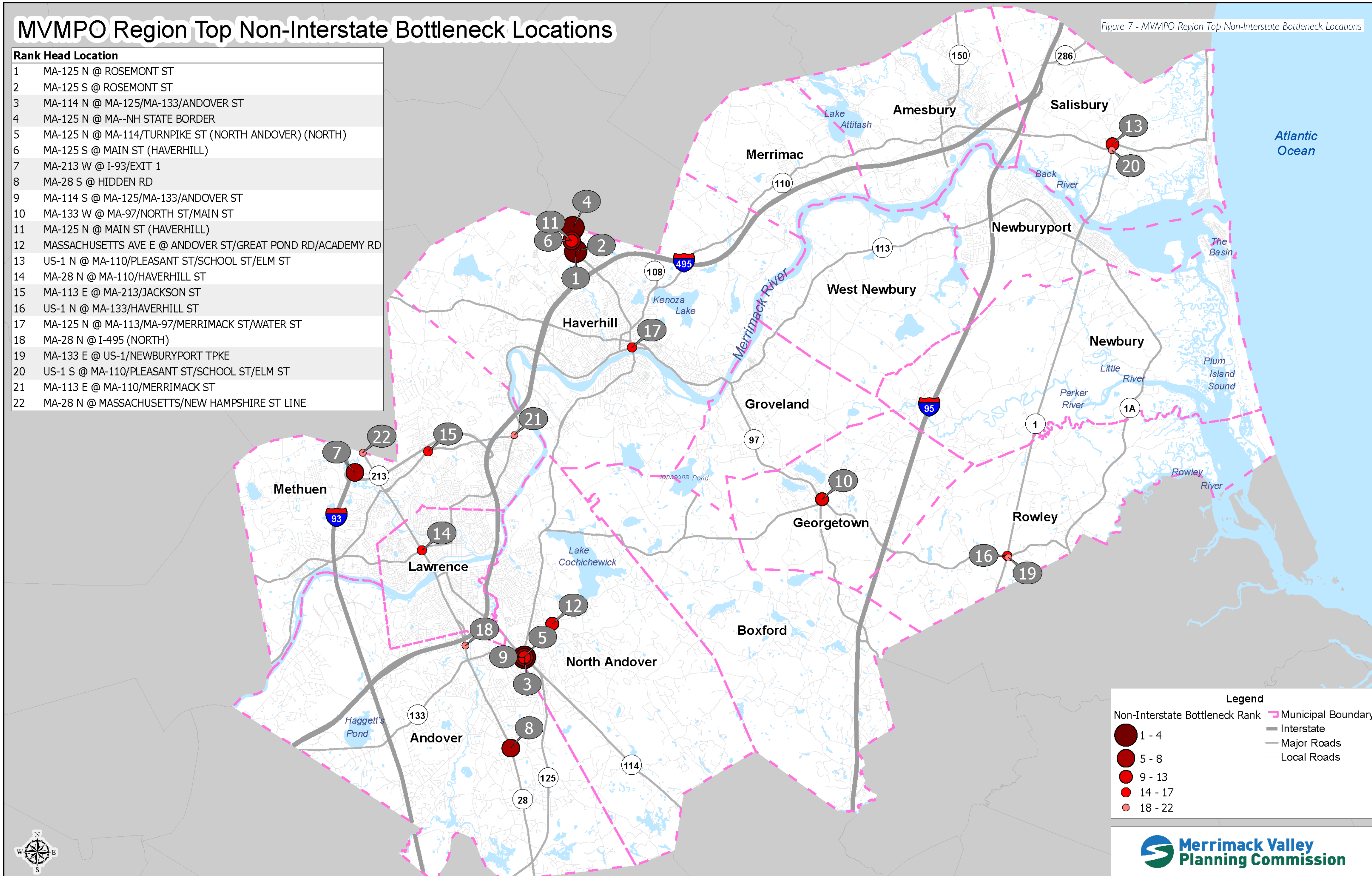
Together these metrics can be used to rank and compare the estimated total delay from all vehicles within a bottleneck.

The maps below show the highest-ranking bottleneck locations in the region on interstates and non-interstate roadways.

Maps in Appendix C show the top bottleneck locations in each community.

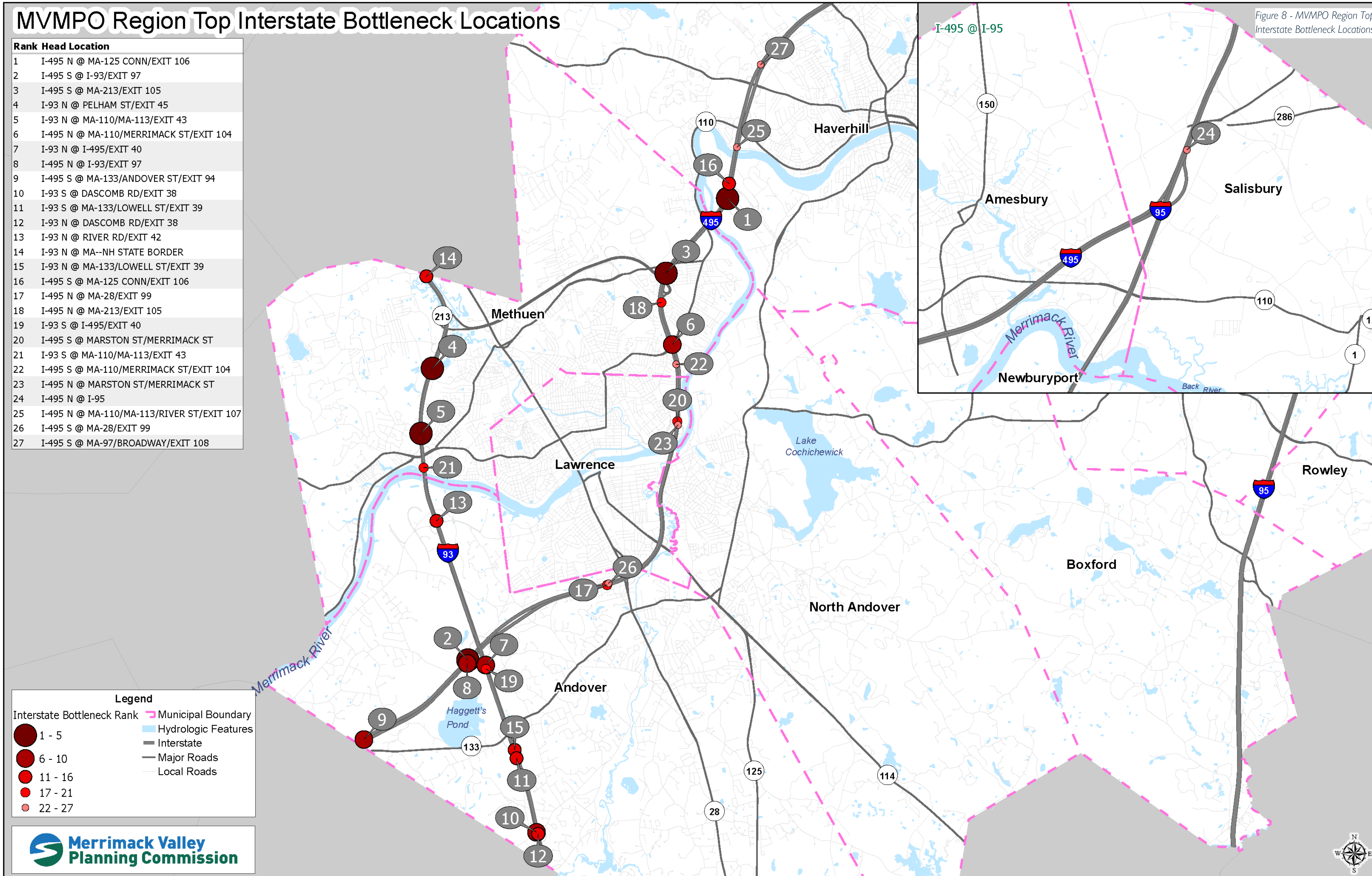
MVMPO Region Top Non-Interstate Bottleneck Locations

Rank	Head Location
1	MA-125 N @ ROSEMONT ST
2	MA-125 S @ ROSEMONT ST
3	MA-114 N @ MA-125/MA-133/ANDOVER ST
4	MA-125 N @ MA--NH STATE BORDER
5	MA-125 N @ MA-114/TURNPIKE ST (NORTH ANDOVER) (NORTH)
6	MA-125 S @ MAIN ST (HAVERHILL)
7	MA-213 W @ I-93/EXIT 1
8	MA-28 S @ HIDDEN RD
9	MA-114 S @ MA-125/MA-133/ANDOVER ST
10	MA-133 W @ MA-97/NORTH ST/MAIN ST
11	MA-125 N @ MAIN ST (HAVERHILL)
12	MASSACHUSETTS AVE E @ ANDOVER ST/GREAT POND RD/ACADEMY RD
13	US-1 N @ MA-110/PLEASANT ST/SCHOOL ST/ELM ST
14	MA-28 N @ MA-110/HAVERHILL ST
15	MA-113 E @ MA-213/JACKSON ST
16	US-1 N @ MA-133/HAVERHILL ST
17	MA-125 N @ MA-113/MA-97/MERRIMACK ST/WATER ST
18	MA-28 N @ I-495 (NORTH)
19	MA-133 E @ US-1/NEWBURYPORT TPKE
20	US-1 S @ MA-110/PLEASANT ST/SCHOOL ST/ELM ST
21	MA-113 E @ MA-110/MERRIMACK ST
22	MA-28 N @ MASSACHUSETTS/NEW HAMPSHIRE ST LINE



MVMPO Region Top Interstate Bottleneck Locations

Rank	Head Location
1	I-495 N @ MA-125 CONN/EXIT 106
2	I-495 S @ I-93/EXIT 97
3	I-495 S @ MA-213/EXIT 105
4	I-93 N @ PELHAM ST/EXIT 45
5	I-93 N @ MA-110/MA-113/EXIT 43
6	I-495 N @ MA-110/MERRIMACK ST/EXIT 104
7	I-93 N @ I-495/EXIT 40
8	I-495 N @ I-93/EXIT 97
9	I-495 S @ MA-133/ANDOVER ST/EXIT 94
10	I-93 S @ DASCOMB RD/EXIT 38
11	I-93 S @ MA-133/LOWELL ST/EXIT 39
12	I-93 N @ DASCOMB RD/EXIT 38
13	I-93 N @ RIVER RD/EXIT 42
14	I-93 N @ MA--NH STATE BORDER
15	I-93 N @ MA-133/LOWELL ST/EXIT 39
16	I-495 S @ MA-125 CONN/EXIT 106
17	I-495 N @ MA-28/EXIT 99
18	I-495 N @ MA-213/EXIT 105
19	I-93 S @ I-495/EXIT 40
20	I-495 S @ MARSTON ST/MERRIMACK ST
21	I-93 S @ MA-110/MA-113/EXIT 43
22	I-495 S @ MA-110/MERRIMACK ST/EXIT 104
23	I-495 N @ MARSTON ST/MERRIMACK ST
24	I-495 N @ I-95
25	I-495 N @ MA-110/MA-113/RIVER ST/EXIT 107
26	I-495 S @ MA-28/EXIT 99
27	I-495 S @ MA-97/BROADWAY/EXIT 108



Volume-to-Capacity Ratios

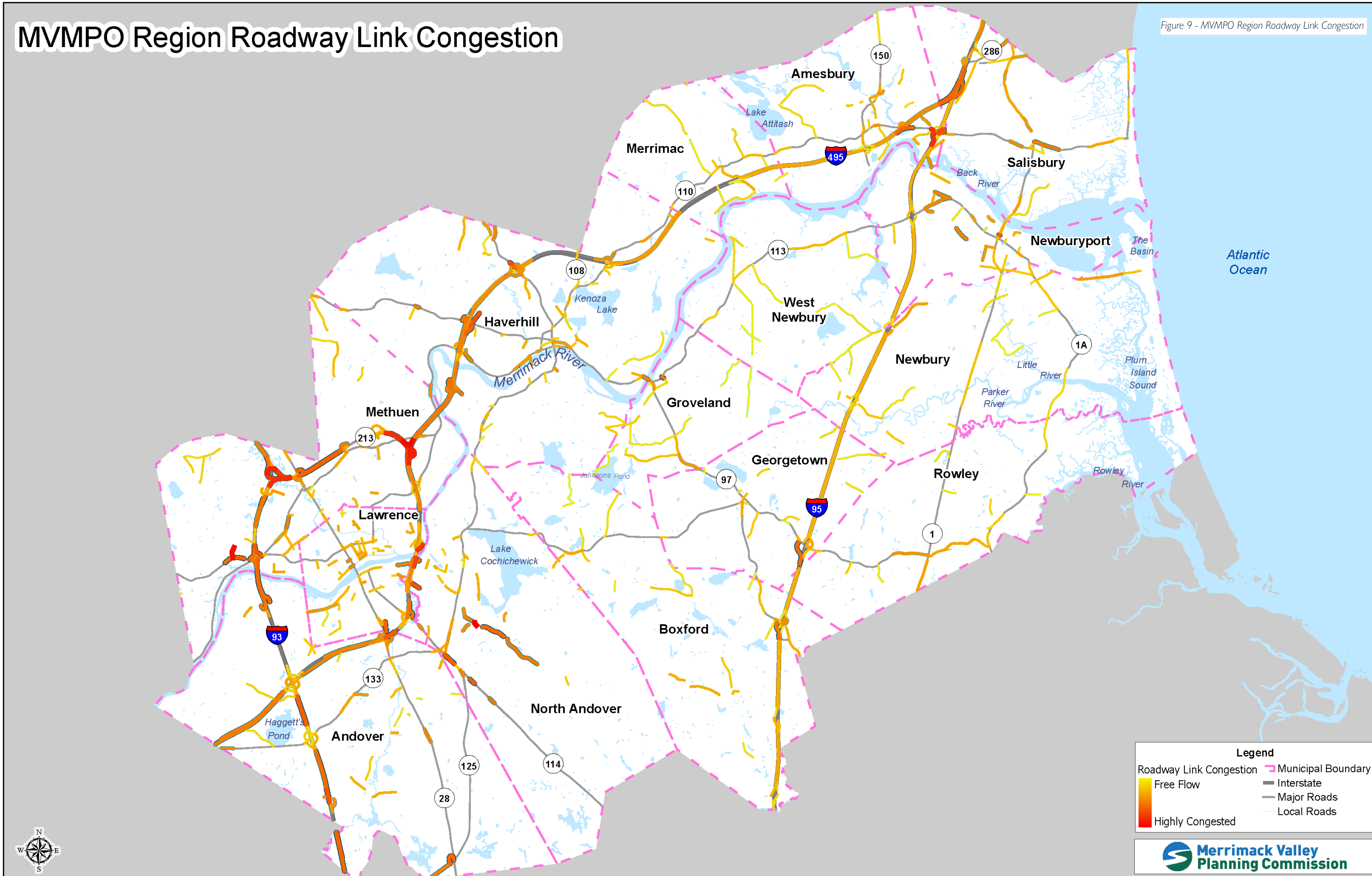
MVMPO Staff calculated volume-to-capacity ratios for roadway links included in the CMP network. For detailed information on the process for calculating these ratios, see Appendix B. Tables below show roadway links with the ten highest volume-to-capacity ratios among collectors, minor arterials, major arterials, and local roads, and interstates, ramps, and limited-access roadways. Tables in Appendix A show all locations from this analysis where peak hour volumes exceed roadway capacities.

Table 1 - Top 10 Collectors, Minor Arterials, Major Arterials, and Local Roads

Community	Street Name	From	To	Facility	Direction	Free Flow Speed	Capacity	Link Direction	K Factor	AADT	Total Lanes	V/C Ratio	Length (Miles)
Methuen	Hill Street	Route 113	Meetinghouse Road	Local Road	Two-way	30	500	N	0.103	17690	2	1.824	0.25
North Andover	Johnson Street	Salem Street	North Pond Road	Collector	Two-way	32.5	500	NW	0.119	16387	2	1.943	0.08
Groveland	King Street	Route 113	Union Street	Collector	Two-way	35	500	SE	0.102	9850	2	1.009	0.05
Amesbury	Macy Street	495 Ramp EB	Rocky Hill Road	Major Arterial	Two-way	30	950	E	0.118	33713	4	1.050	0.07
Haverhill	Main Street	Northwood Terrace	943 Main Street	Major Arterial	One-way	30	950	NW	0.080	15565	1	1.317	0.03
Haverhill	Main Street	946 Main Street	Smiley Ave	Major Arterial	Two-way	30	950	NW	0.080	12841	1	1.087	0.02
Haverhill	Main Street	946 Main Street	I-495	Major Arterial	One-way	35	950	SE	0.080	12841	1	1.087	0.15
North Andover	Massachusetts Avenue	Marblehead Street	Danvers Street	Minor Arterial	Two-way	30	750	NW	0.100	19036	2	1.268	0.19
Haverhill	Monument Street	Route 97	N Broadway	Minor Arterial	Two-way	25.5	750	NE	0.166	11505	2	1.274	0.29
Methuen	North Lowell Street	Young Farm Road	Albert Street	Minor Arterial	Two-way	33	750	E	0.101	17327	2	1.169	0.20

Table 2 - Top 10 Interstates, Ramps, and Limited Access Roadways

Community	Street Name	From	To	Facility	Direction	Free Flow Speed	Capacity	Link Direction	K Factor	AADT	Total Lanes	V/C Ratio	Length (Miles)
Methuen	Ramp-Rt 495 Sb To Rt 213 Wb	I-495 SB	Route 213 WB	Other Ramp	One-way	53.4	1000	W	0.143	13099	1	1.871	0.28
Methuen	Ramp-Rt 213 Eb To Rt 495 Nb	Route 213 EB	I-495 NB	Other Ramp	One-way	53	1000	SE	0.113	15200	1	1.722	0.59
Methuen	Albert Slack Highway	Route 213 EB	I-93 SB	Expressway	One-way	49	950	SW	0.104	15274	1	1.664	0.25
Methuen	Ramp-Rt 495 Nb To Rt 213 Wb	I-495 NB	Route 213 WB	Other Ramp	One-way	49	1000	N	0.125	13141	1	1.648	0.65
Methuen	Albert Slack Highway	I-93 NB Exit 46 Ramp	Methuen Rail Trail Bridge	Expressway	One-way	54	1050	E	0.113	29478	2	1.587	0.24
Methuen	Albert Slack Highway	Ramp-Route 113 to Route 213	Exit 5A	Expressway	One-way	60	1050	SE	0.113	29012	2	1.562	0.52
Methuen	Ramp-Rt 93 Nb To Rt 213 Eb	I-93 NB	Route 213 EB	Other Ramp	One-way	48	1000	NE	0.113	13810	1	1.561	0.27
Amesbury	Ramp-Rt 110 Eb To Rt 95 Sb	Route 110 EB	I-95 SB	Other Ramp	One-way	42.6	1000	S	0.212	7232	1	1.533	0.40
Lawrence	Ramp-Rt 495 Nb To Rt 495 Sb/ Marston St	I-495 NB	I-495 SB/Marston Street	Other Ramp	One-way	41	1000	NE	0.110	13609	1	1.492	0.16
Methuen	Albert Slack Highway	I-93 SB Exit 46 Ramp	Route 213	Expressway	One-way	52	950	E	0.107	13064	1	1.466	0.31


MVMPO Region Roadway Link Congestion
Figure 9 - MVMPO Region Roadway Link Congestion
Amesbury
Merrimac
Salisbury
Newburyport
Haverhill
West Newbury
Newbury
Methuen
Groveland
Georgetown
Rowley
Lawrence
Boxford
North Andover
Andover
Lake Attitash
Back River
The Basin
Atlantic Ocean
Kenoza Lake
Merrimack River
Little River
Plum Island Sound
Parker River
Johnsons Pond
Rowley River
Lake Cochichewick
Haggett's Pond
150
286
495
110
113
108
1A
213
97
95
1
93
133
125
114
28
Legend
Roadway Link Congestion
Free Flow
Highly Congested
Municipal Boundary
Interstate
Major Roads
Local Roads
Merrimack Valley Planning Commission

Park and Ride Lot and Commuter Rail Parking Lot Usage

MVMPO Staff most recently collected park and ride and commuter rail parking lot usage data in the fall of 2022 between September 27 and October 12. Park and ride usage rates show sufficient parking supply at these locations. The Dascomb Road Park and Ride and Costello Lot in Amesbury had the highest usage rates, approaching capacity.

Table 3 - Commuter Rail Stations Lot Usage

Community	Location	Total Spaces	Spaces Occupied	Usage Rate All Spaces	Bike Spaces Used
Andover	Railroad Ave.	151	57	38%	7
Andover	Ballardvale	114	63	55%	2
Haverhill	Bradford	203	45	22%	1
Haverhill	Railroad Square	149	79	53%	1
Haverhill	Intermodal Center	315	147	47%	3
Lawrence	McGovern*	900	229	25%	1
Newburyport	Rte.1 (Lot A)	317	52	16%	0
Newburyport	Rte.1 (Lot B)	301	59	20%	1
Rowley	Railroad Ave.	278	63	23%	5
	Totals	2728	794	29%	21

*At the time of data collection, McGovern listed 781 available spaces to MBTA; Other spaces leased to LPD and area businesses & housing

Table 4 - Park and Ride Lots

Community	Location	Total Spaces	Spaces Occupied	Usage Rate All Spaces	Bike Spaces Used
Andover	Dascomb Road	154	146	95%	0
Andover	Faith Lutheran Church	69	0	0%	0
Andover	Shawsheen Square	31	4	13%	0
Methuen	Pelham Street	200	45	23%	0
Newburyport	Storey Ave.	850	26	3%	0
Salem, NH	Exit 2/Pelham Rd	479	163	34%	0
	Totals	1783	384	22%	0

Table 5 - Other Lots

Community	Location	Total Spaces	Spaces Occupied	Usage Rate All Spaces	Bike Spaces Used
Amesbury	Costello	46	41	89%	1
Boxford	Middleton Road	23	16	70%	0
Georgetown	Rte. 133 / Main St.	106	36	34%	0
Lawrence	Buckley	600	399	67%	5
	Totals	775	492	63%	6

Figure 10 - Dascomb Road Park and Ride, Andover

Figure 11 - Costello Parking Lot, Amesbury

Transit Ridership

The MVMPO region is served by MeVa Transit fixed route bus and paratransit service. Since March of 2022, MeVa has provided fare-free service. Since going fare free, MeVa has also changed its service in several ways.

- Summer 2022, the transit agency rebranded from MVRTA to MeVa
- Spring 2022, MeVa permanently suspended its Boston Commuter bus and doubled service in Lawrence
- Summer 2023, MeVa extended the span of service to 10pm on Routes 1, 2, 8, 10, 13, 17, and 24
- Winter 2024, MeVa added new Sunday service on Routes 1, 2, 8, 10, 13, 17, and 24
- Winter 2024, MeVa extended Route 14 to Osgood Landing/Amazon and Lawrence
- Fall 2024, MeVa moved its Lawrence bus hub to the McGovern Transportation Center and added the new Route 11 between Lawrence and Newburyport

After declining during the COVID-19 pandemic, MeVa's annual ridership has rebounded and now exceeds pre-pandemic levels. Unlinked passenger trips per vehicle revenue hour and unlinked passenger trips per vehicle revenue mile also exceed pre-pandemic levels in FY24.This shows that increases in ridership have outpaced MeVa's expansion of service.

Table 6 - MeVa Transit Ridership Metrics

Performance Measure	FY19	FY20	FY21	FY22	FY23	FY24
Annual Ridership (Fixed Route Bus)	1,952,888	1,501,464	994,873	1,198,037	1,792,290	2,848,698
Annual Ridership (Paratransit)	91,944	71,087	46,370	62,767	92,674	102,222
Unlinked Passenger Trips per Vehicle Revenue Hour (Fixed Route Bus)	15.37	12.13	7.51	9.28	12.82	19.20
Unlinked Passenger Trips per Vehicle Revenue Hour (Paratransit)	1.69	1.61	1.46	1.65	1.75	1.64
Unlinked Passenger Trips per Vehicle Revenue Mile (Fixed Route Bus)	1.38	1.10	0.69	0.84	1.19	1.76
Unlinked Passenger Trips per Vehicle Revenue Mile (Paratransit)	0.10	0.10	0.09	0.10	0.11	0.10

Figure 12 - MeVa Transit Annual Ridership (Fixed Route Bus)

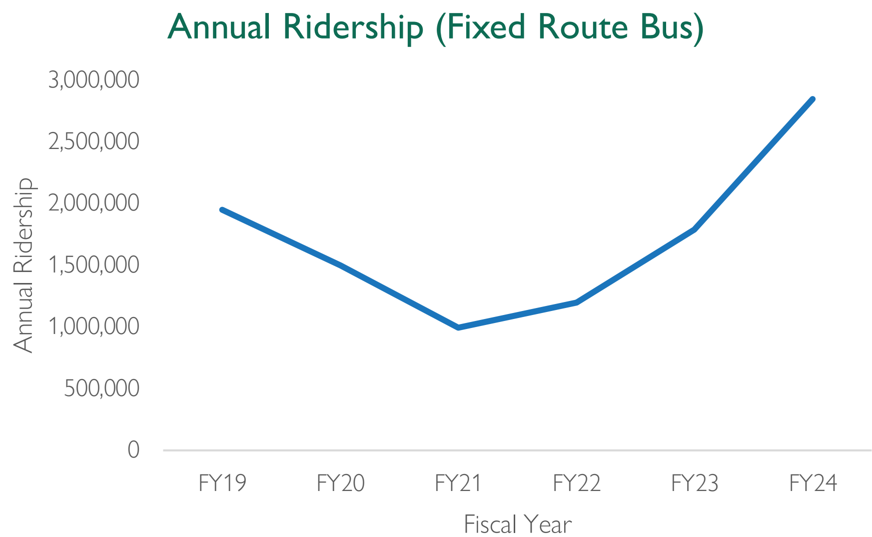


Figure 13 - MeVa Transit Unlinked Passenger Trips per Vehicle Revenue Hour (Fixed Route Bus)

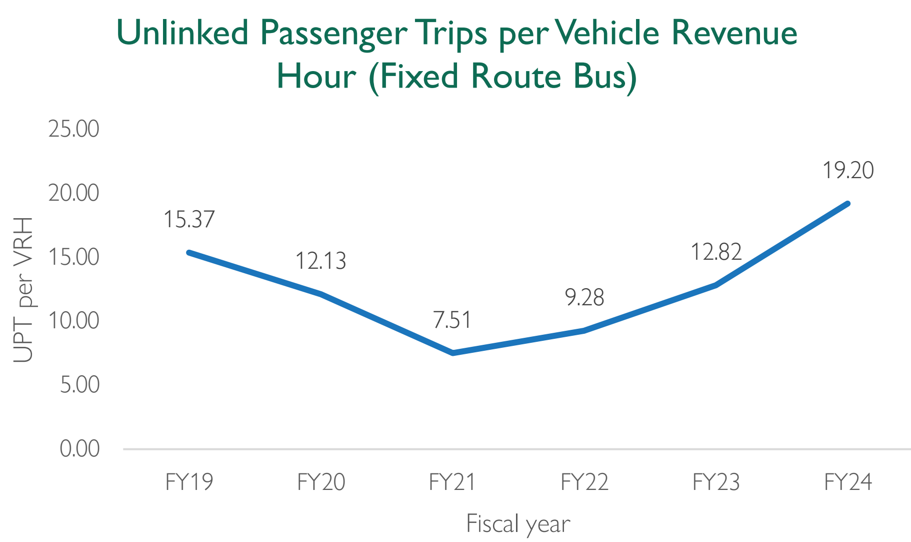
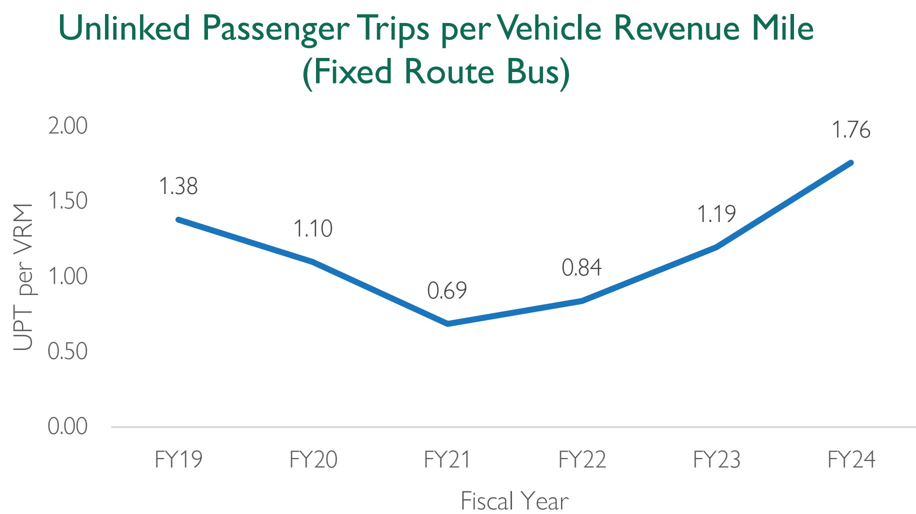


Figure 14 - MeVa Transit Unlinked Passenger Trips per Vehicle Revenue Mile (Fixed Route Bus)



The MVMPO region is served by two MBTA Commuter Rail Lines, the Haverhill Line and the Newburyport/Rockport Line, with seven stations within the MVMPO region. The most recent stop level ridership available from the MBTA dates to spring of 2018, as provided in Table 7.

Table 7 - MVMPO Region Commuter Rail Stop Ridership (2018)

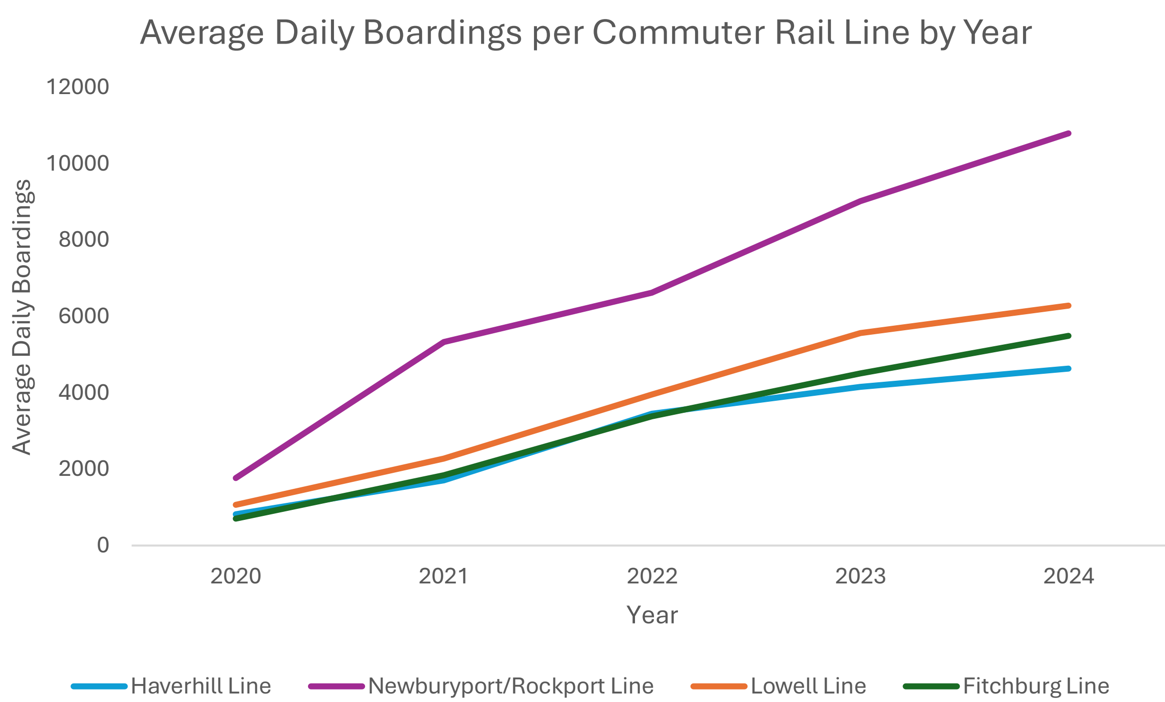
Route	Stop	Average Boardings	Average Alightings
Haverhill Line	Andover	409	356
Haverhill Line	Ballardvale	200	246
Haverhill Line	Bradford	170	205
Haverhill Line	Haverhill	290	308
Haverhill Line	Lawrence	482	479
Newburyport/Rockport Line	Newburyport	463	449
Newburyport/Rockport Line	Rowley	113	86

Table 8 shows MBTA's Commuter Rail line level ridership. This ridership includes stops outside of the MVMPO region and includes all northside commuter rail lines for comparison purposes.

Table 8 - MBTA Northside Commuter Rail Line Ridership (2024)

Line	2020 Average Daily Boardings	2021 Average Daily Boardings	2022 Average Daily Boardings	2023 Average Daily Boardings	2024 Average Daily Boardings
Haverhill Line	819	1,709	3,450	4,162	4,634
Newburyport/ Rockport Line	1,767	5,332	6,613	9,026	10,795
Lowell Line	1,066	2,279	3,959	5,560	6,283
Fitchburg Line	705	1,842	3,391	4,510	5,491

Figure 15 - Average Daily Boardings per Commuter Rail Line by Year



Bicycle and Pedestrian Counts

In support of the Merrimack Valley's active transportation plan, *MV Moves*, MVMPO staff collected bicycle and pedestrian counts on shared-use paths throughout the Merrimack Valley region. These counts were conducted using temporary counters. Table 9 and Table 10 show the results of these path user counts. MVMPO staff have procured and installed permanent path user counters in several locations to collect continuous up-to-date path user count data to support its active transportation planning work. Supporting active modes such as walking and biking can help relieve congestion by keeping vehicles off the roads.

Table 9 - Path User Counts by Day

Count Location	Collection Period	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average Daily
Bradford Rail Trail	9/20/23 - 9/26/23	157	272	373	317	281	294	221	274
Methuen RT	9/20/23 - 9/26/23	61	177	176	230	182	96	126	150
Clipper City RT @ Gillis	9/20/23 - 9/26/23	451	661	801	790	847	518	1392	780
Old Eastern Marsh @ Lions	9/20/23 - 9/26/23	173	320	455	428	458	611	367	402
Groveland Rail Trail	10/3/23 - 10/9/23	126	101	97	104	108	70	153	108
Clipper City RT @ Parker	10/3/23 - 10/9/23	629	486	471	432	419	307	757	500
East Marsh Trail @ Gillis	10/3/23 - 10/9/23	563	376	476	314	297	266	634	418
Spicket River @ Manch. Park	10/3/23 - 10/9/23	52	86	77	44	71	27	87	63
Amesbury Riverwalk	10/18/24 - 10/24/23	246	249	268	303	217	71	351	244
Spicket River @ Short St.	11/14/23 - 11/20/23	76	93	92	125	116	107	51	94

Table 10 - Path User Counts Collection Period Summary

Count Location	Collection Period	Pedestrians	Cyclists	% Walking	% Biking	Total Users
Bradford Rail Trail	9/20/23 - 9/26/23	1704	211	89%	11%	1915
Methuen RT	9/20/23 - 9/26/23	596	452	57%	43%	1048
Clipper City RT @ Gillis	9/20/23 - 9/26/23	4749	720	87%	13%	5469
Old Eastern Marsh @ Lions	9/20/23 - 9/26/23	1449	1786	45%	55%	3235
Groveland Rail Trail	10/3/23 - 10/9/23	522	237	69%	31%	759
Clipper City RT @ Parker	10/3/23 - 10/9/23	2553	948	73%	27%	3501
East Marsh Trail @ Gillis	10/3/23 - 10/9/23	1449	1477	50%	50%	2926
Spicket River @ Manch. Park	10/3/23 - 10/9/23	327	117	74%	26%	444
Amesbury Riverwalk	10/18/24 - 10/24/23	1364	341	80%	20%	1705
Spicket River @ Short St.	11/14/23 - 11/20/23	531	129	80%	20%	660

Non-Single Occupancy Vehicle (SOV) Travel to Work

Non-SOV travel to work is measured by the percentage of travel to work that is done by a mode other than driving alone. This includes transit, active modes, carpooling, and working from home. The data source for this measure is the American Community Survey 5-year Estimates Table B08301. Non-SOV commuting in the Merrimack Valley has increased since 2019 largely due to increases in the percentage of people working from home since the start of the COVID-19 pandemic.

Figure 16 - Percentage of Non-SOV Commuting in the MVPC Region

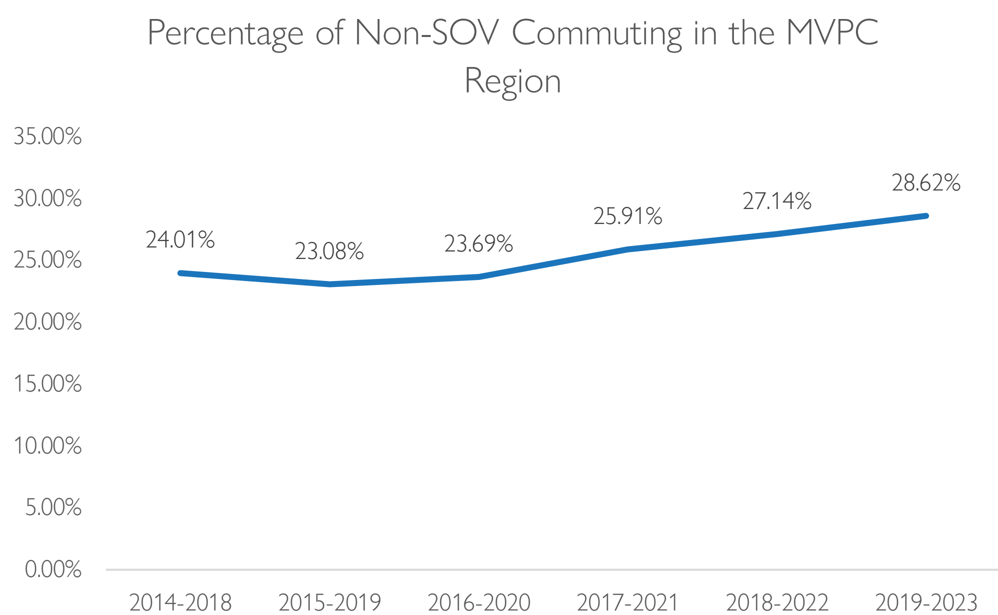


Table 11 - MVMPO Region Commute Mode Comparison

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	85.84%	86.54%	85.36%	82.66%	80.71%	79.10%
Drove Alone	75.99%	76.92%	76.31%	74.09%	72.86%	71.38%
Carpooled	9.85%	9.62%	9.06%	8.57%	7.85%	7.72%
Public Transportation	3.47%	3.26%	2.86%	2.54%	2.24%	2.06%
Bicycle	0.20%	0.19%	0.11%	0.12%	0.15%	0.17%
Walked	2.68%	2.45%	2.36%	2.54%	2.39%	2.20%
Worked from Home	5.74%	5.36%	7.31%	10.05%	12.09%	13.84%
Taxicab	0.76%	0.71%	0.74%	0.79%	0.90%	1.02%
Motorcycle	0.03%	0.04%	0.03%	0.03%	0.02%	0.02%
Other means	1.27%	1.45%	1.21%	1.27%	1.49%	1.58%
Non-SOV	24.01%	23.08%	23.69%	25.91%	27.14%	28.62%

Average Commute Time by Community

Average Commute Time is sourced from the American Community Survey 5-year Estimates.

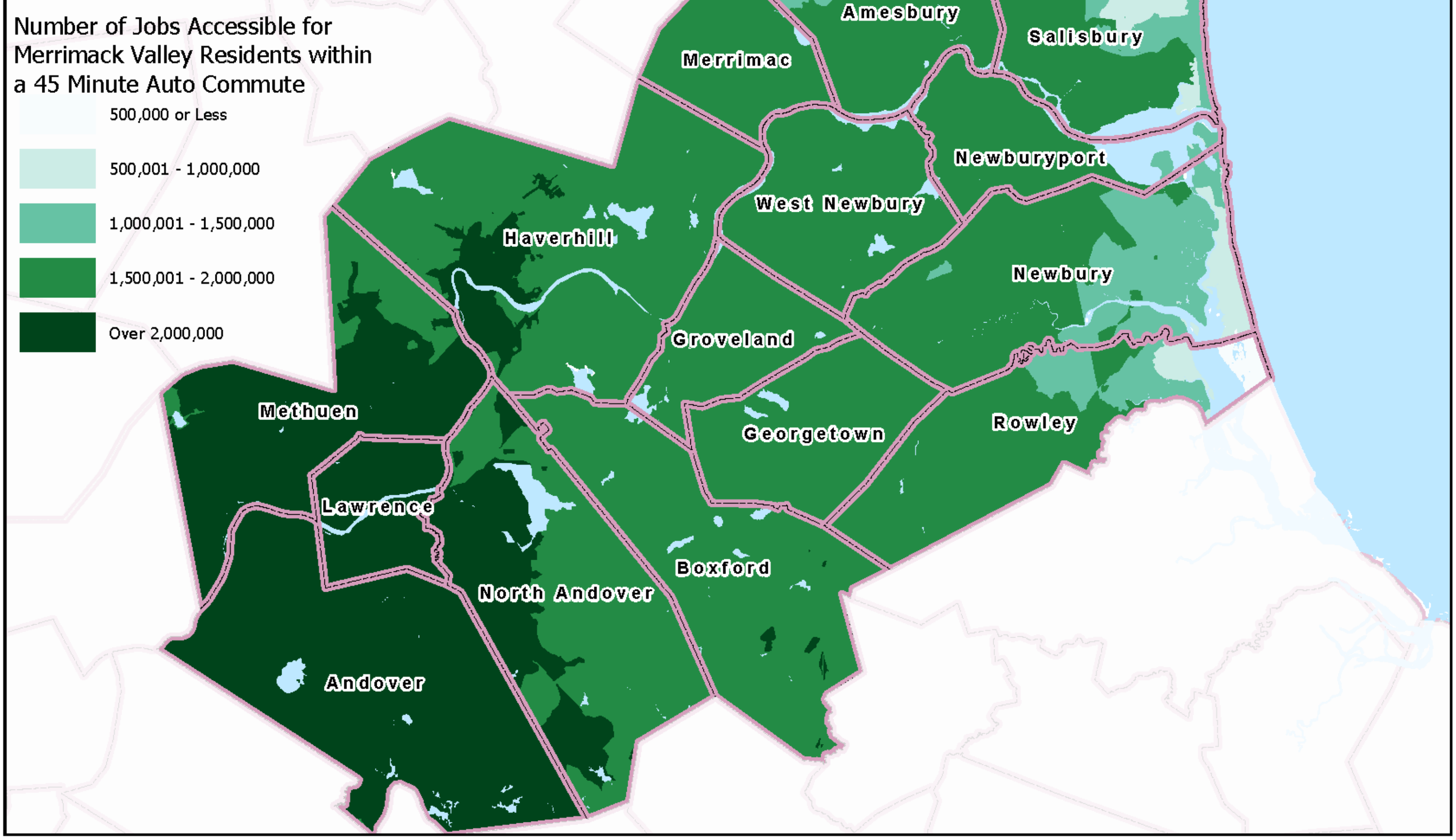
Table 12 - Average Commute Time by Community

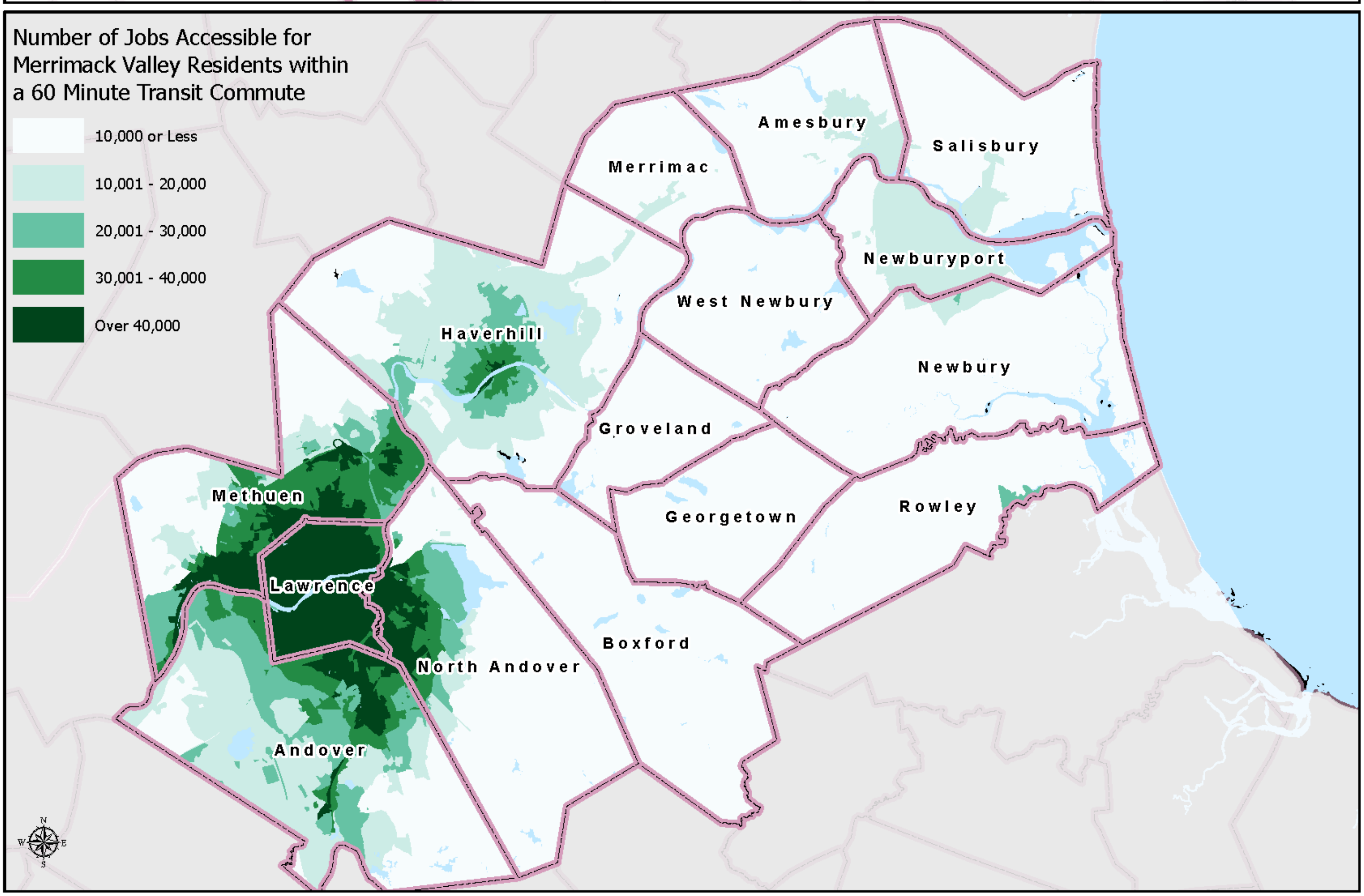
	Average Commute Time (minutes)		
Community	2017-2021	2018-2022	2019-2023
Boxford	38.9	36.9	34.5
Groveland	32.2	33.4	34
West Newbury	34.6	33.1	33.3
North Andover	31.7	32.1	32.4
Newburyport	34.6	34	32.3
Georgetown	35.1	33.2	31.8
Amesbury	31.2	30.9	30.6
Merrimac	28.7	27.7	30.3
Salisbury	29.3	29.1	30.1
Andover	32.1	30.3	29.6
Rowley	31.5	30.1	29.4
Methuen	27.5	28.1	28.3
Haverhill	27.4	27.2	26.8
Newbury	25	26.3	24.7
Lawrence	22.3	22.6	23.3

Figure 17 shows the number of jobs accessible by car in 45 minutes and by transit in 60 minutes from each Census Block in the Merrimack Valley region during the AM peak period in 2021, based on Accessibility Observatory data. This data reveals that significantly more jobs are accessible within 45 minutes by car as compared to 60 minutes by transit. Andover and Lawrence have the greatest access to jobs within a 45-minute drive, with more than 2 million jobs accessible from all census blocks in these communities. Methuen, North Andover, and Haverhill also have significant access to jobs within a 45-minute drive due to convenient access to interstates 93 and 495. Lawrence has access to the most jobs within one hour by transit, yet the number of jobs accessible by transit is significantly lower than those accessible within a 45-minute drive, with less than 90,000 jobs accessible within 1 hour by transit and more than 2 million jobs accessible within a 45-minute drive.

Along with Lawrence, residents of Andover, North Andover, Methuen and portions of Haverhill have the best access to jobs by transit along. MeVa bus service helps connect communities to employment in the region, and MBTA commuter rail service connects communities such as Andover, Haverhill, Lawrence, Newburyport, and Rowley with job opportunities in the Boston Metropolitan area. While there are commuter rail stops in these communities, the frequency of service and travel times limit the number of jobs that can conveniently be accessed by transit.

Figure 17 - Comparison of the Number of Jobs Accessible for Merrimack Valley Residents within a 45 Minute Auto Commute and a 60 Minute Transit Commute

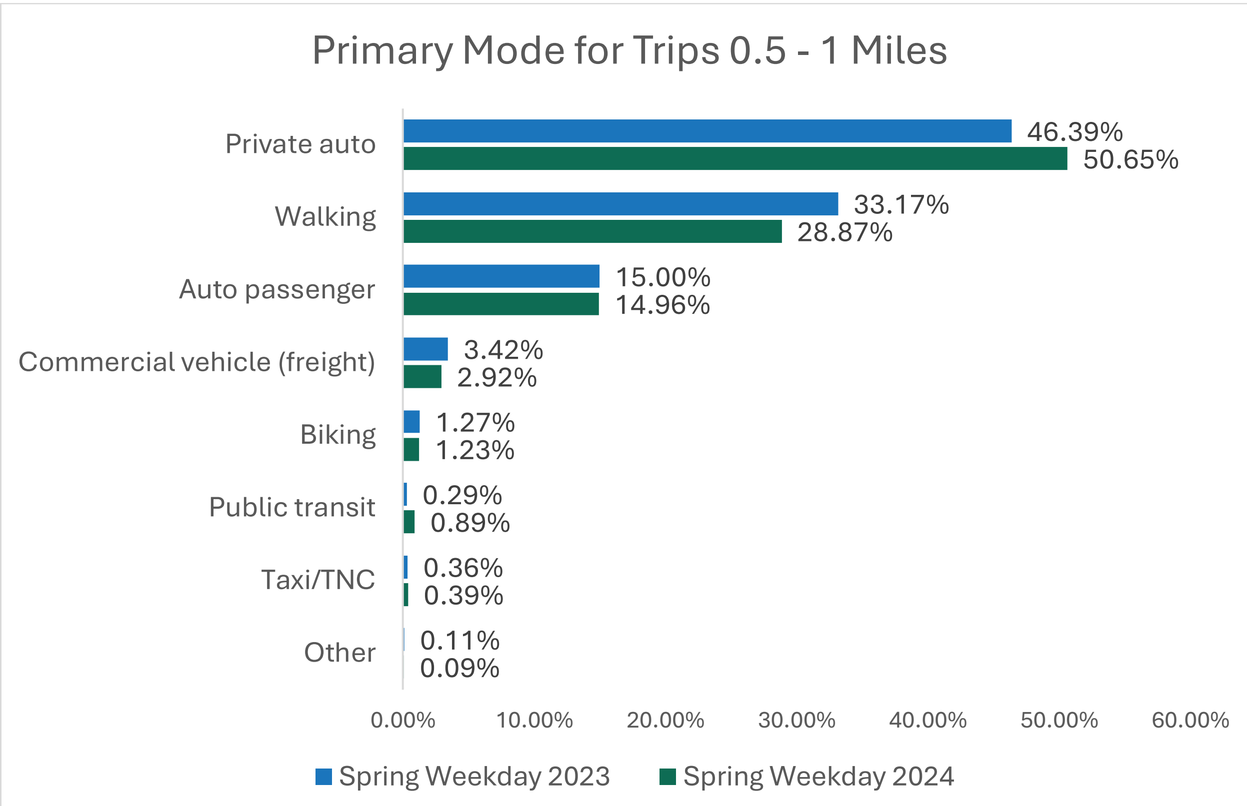




Mode Share of Short Trips (0.5-1 mile)

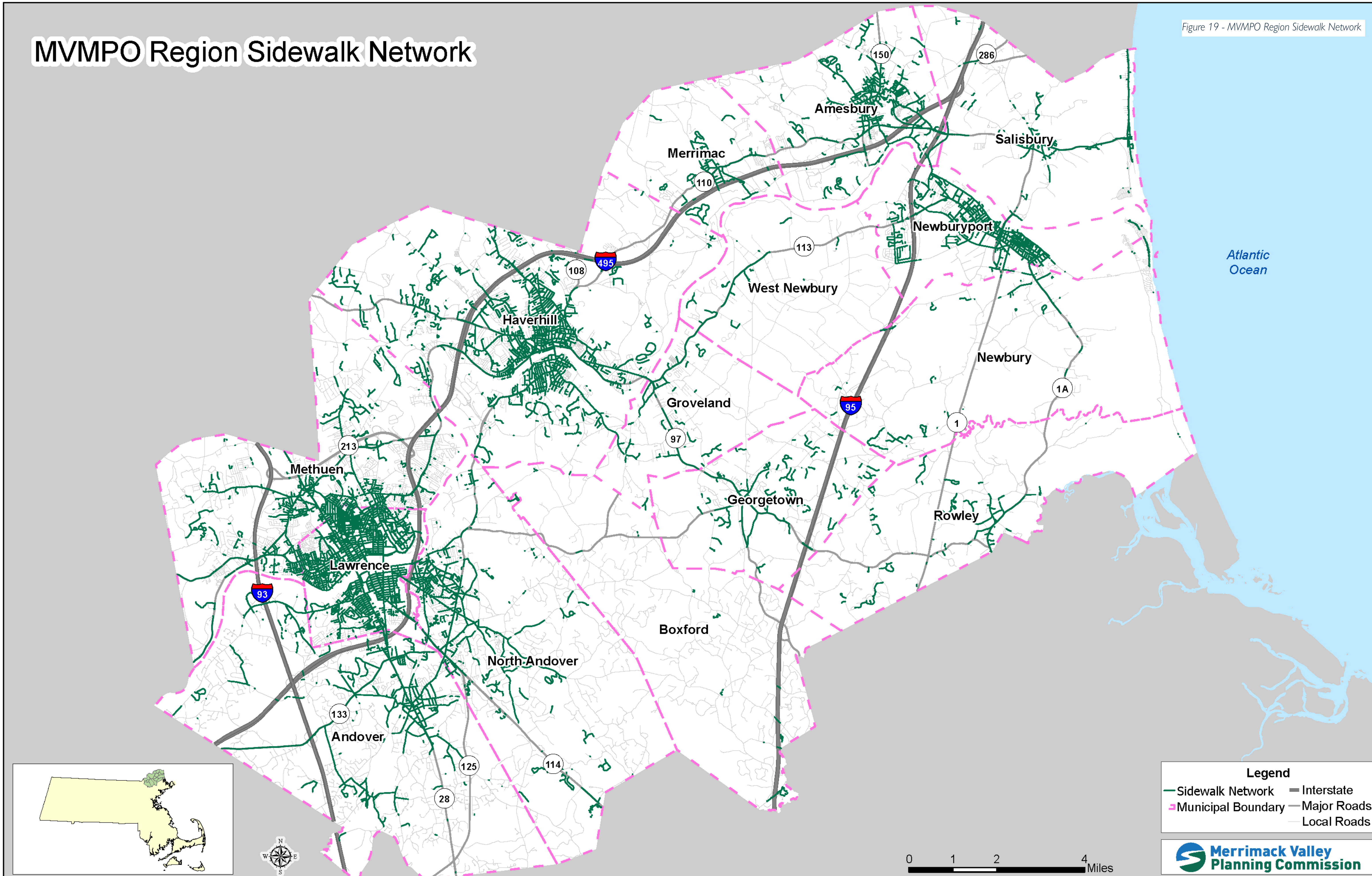
While commuting to work is a significant contributor to congestion, commute trips only accounted for 12.8% of all trips taken in the Merrimack Valley region, according to an analysis using Replica based on spring 2024 trips. Short trips are most feasible to be replaced by active modes such as walking and biking. In the Merrimack Valley in the spring of 2024, 33% of trips 0.5 to 1 mile were made by walking, and 1.2% of trips between these distances were made by bike. Improving infrastructure to support safe and comfortable walking and biking can help reduce the number of short trips made by car.

Figure 18 - Merrimack Valley Region Primary Mode for Trips 0.5 - 1 Miles (Source: Replica)



Presence of Sidewalks

Providing infrastructure such as sidewalks to support walking trips can help reduce the number of short trips made by car, which in turn can help reduce congestion. Table 13 shows the percentage of roadways in the Merrimack Valley that have sidewalks by functional classification and jurisdiction based on the MassDOT 2022 Road Inventory, and Ecopia data from 2023. These calculations exclude interstate highways, Route 213, highway ramps, private roads, and state park or forest roads. This analysis reveals significant gaps in the sidewalk network. The federal functional classes of roadways with the most significant sidewalk network gaps are local roads and major collectors. Overall, a higher percentage of roadways included in this analysis under MassDOT jurisdiction have sidewalks compared to roadways under city or town jurisdiction, however city or town jurisdiction roadways represent a much higher number of roadway miles.



MVMPO Region Sidewalk Network
Figure 19 - MVMPO Region Sidewalk Network
Amesbury
Salisbury
Merrimac
Newburyport
West Newbury
Haverhill
Newbury
Groveland
Methuen
Georgetown
Rowley
Lawrence
Boxford
North Andover
Andover
Atlantic Ocean
150
286
110
495
108
113
95
1A
1
213
97
93
133
125
114
28
Legend
Sidewalk Network
Municipal Boundary
Interstate
Major Roads
Local Roads
0
1
2
4
Miles
Merrimack Valley Planning Commission

Table 13 - Presence of Sidewalks by Federal Functional Classification and Jurisdiction of Roadway

Federal Functional Class	Jurisdiction	Miles with Sidewalks	Total	Percent with Sidewalks
Principal Arterial – Other	MassDOT	24.7	59.1	41.8%
Principal Arterial – Other	City or Town accepted road	31.3	40.1	78.2%
Minor Arterial	MassDOT	26.6	47.8	55.7%
Minor Arterial	City or Town accepted road	97.3	182.8	53.2%
Major Collector	MassDOT	1.1	4.5	25.1%
Major Collector	City or Town accepted road	53.3	151.0	35.3%
Local	Unaccepted by city or town	26.0	101.9	25.5%
Local	MassDOT	0.8	2.7	30.7%
Local	City or Town accepted road	309.2	1021.2	30.3%
	Overall Totals	570.4	1611.1	35.4%

Figure 20 - Percentage of Roadway with Sidewalks by Federal Functional Classification

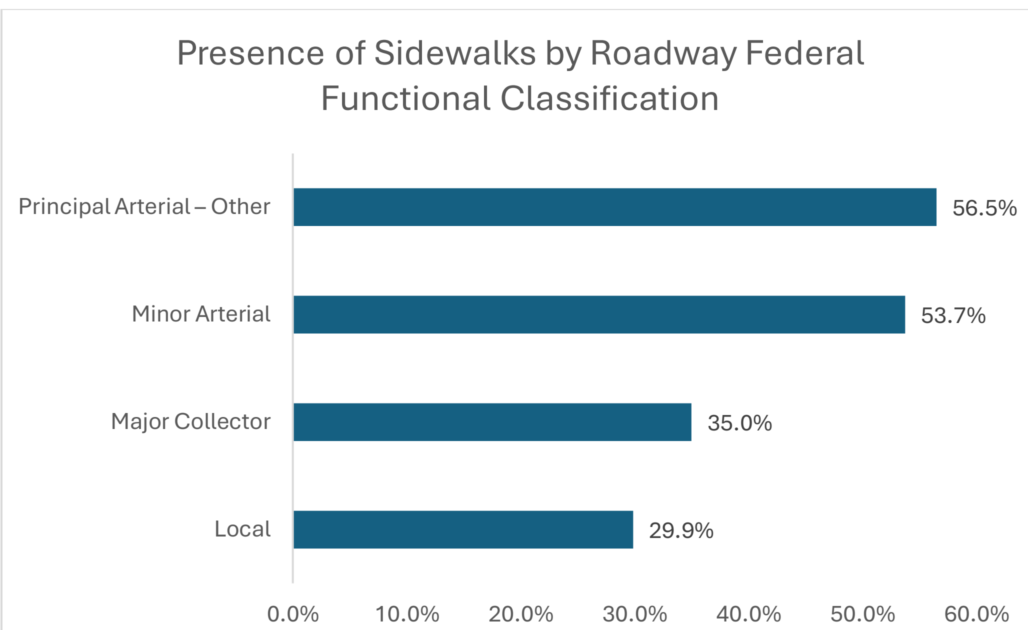
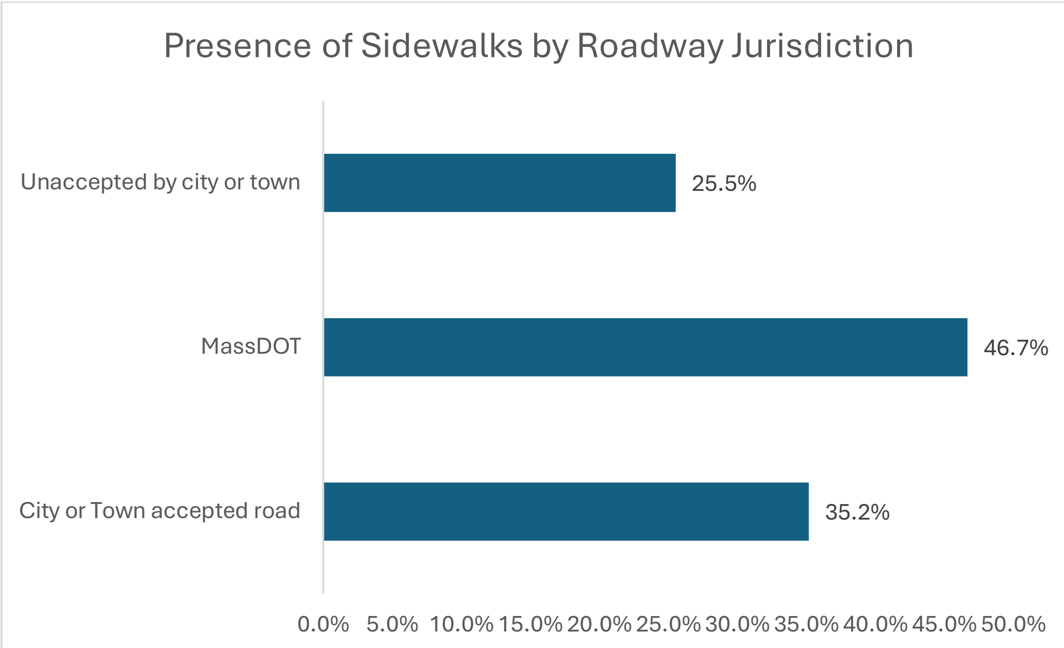


Figure 21 - Percentage of Roadway with Sidewalks by Jurisdiction



Massachusetts Vehicle Census

The Massachusetts Vehicle Census (MVC) shows that the number of active vehicles registered in the Merrimack Valley Region has increased each year since 2020. Average daily miles driven by vehicles registered in the Merrimack Valley have also increased over this period. The MVC represents data based on where vehicles are registered, so this measure includes miles driven outside of the region by vehicles registered in the region. The total daily vehicle miles traveled by vehicles registered in the Merrimack Valley also increased over this period. While the total number of vehicles has increased each year, vehicles per person decreased from 2020 to 2021 as the population increased more rapidly during this period. The vehicles per person ratio increased in 2022 and 2023 but remains below 2020 levels. Vehicles per person shown in Figure 24 is calculated by dividing the number of vehicles in the MVC by the population from American Community Survey 5-year estimates.

Figure 22 - Merrimack Valley Region Active Vehicles

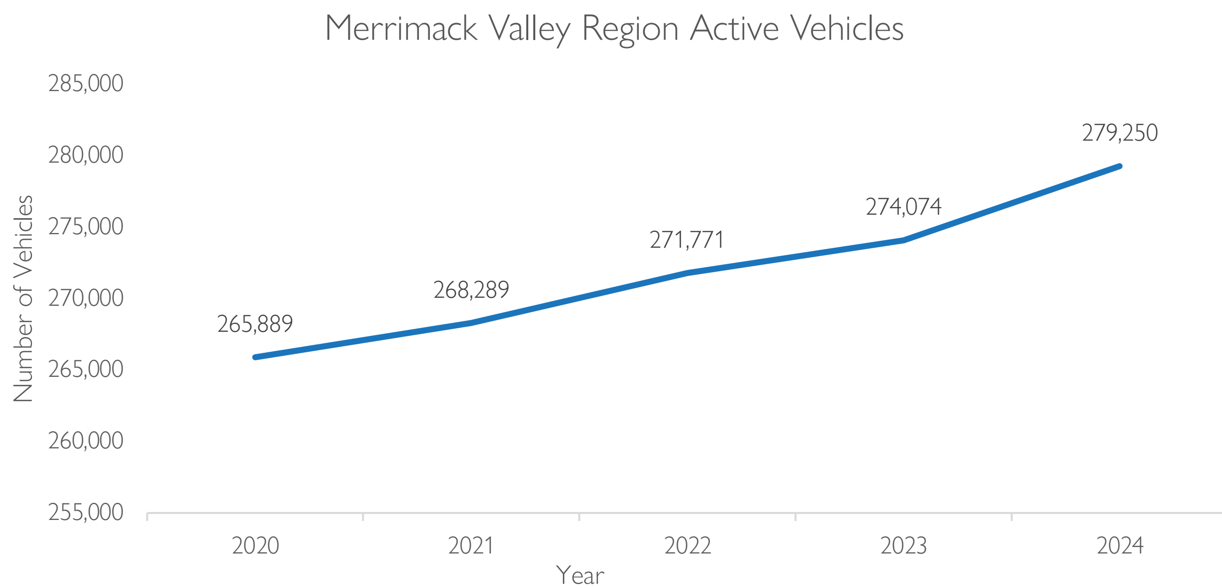


Figure 23 - Average Daily Miles Driven by Vehicles Registered in the Merrimack Valley

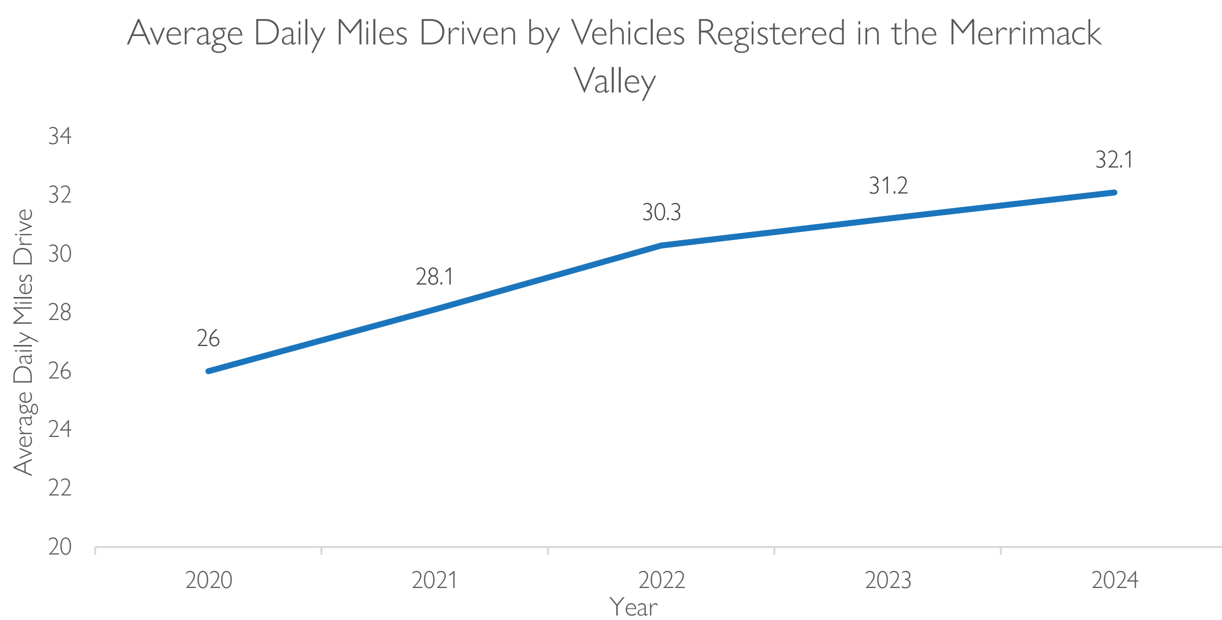
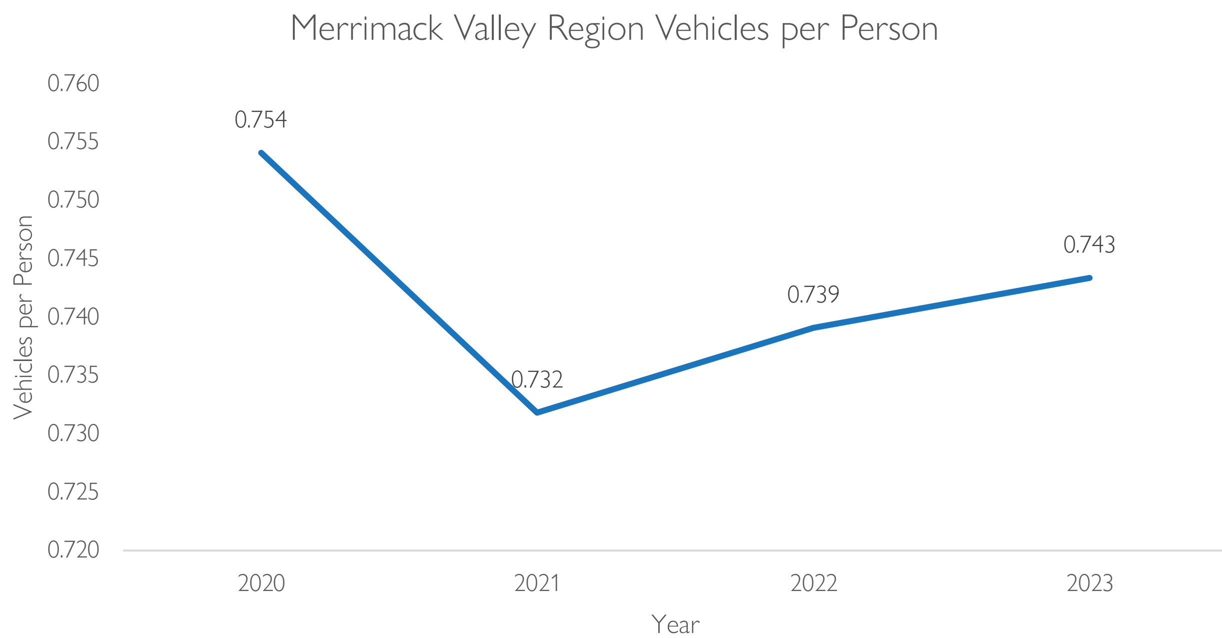


Figure 24 - Merrimack Valley Region Vehicles per Person



Identification/Establishment of Data Collection Program

MVMPO staff currently conduct several data collection tasks that support the multimodal performance measures outlined on page 22.

Regional Traffic Count Program

- Each year, the MVMPO receives a list of state-required traffic counting sites from MassDOT. MVMPO staff supplement these counts with additional locations in the region. This traffic volume data is then uploaded to the MS2 platform.

Path User Counts

- MVPC has procured permanent counters that will be used to track activity on the network of shared use paths throughout the region.
- MVPC also has Miovision temporary counters which can be used for vehicle and non-motorist counts for use in projects such as corridor studies.

MeVa Transit Data Collection Efforts

- Early in FFY25 staff conducted APC validations for MeVa Transit buses. This ensures accurate counting of bus transit ridership.
- MVMPO staff will continue to support MeVa Transit with similar data collection efforts in the future.
- MVMPO staff will track ridership year-over-year ridership trends in data provided by MeVa Transit

Sidewalk/Walkability Assessments

- While MVMPO has data on the presence of sidewalks, less up-to-date data is available on sidewalk conditions, which is an important factor in walkability
- As part of the Active Transportation Plan Phase Two, MVMPO staff have conducted sidewalk condition and walkability assessments in the Lower Tower Hill neighborhood in Lawrence. Staff will conduct similar assessments on an ongoing basis, as warranted, to collect up-to-date sidewalk condition data.

Park and Ride and Commuter Rail Parking Lot Utilization

- In the past MVMPO Staff have collected data on Park and Ride and Commuter Rail Parking Lot Utilization. Staff will collect this data for future CMP updates.
- Staff will explore other possibilities for collecting this data such as using aerial imagery.

Location-Based Services (LBS) and Big Data

- MVPC has access to third-party LBS vendors, such as Replica and INRIX, as well as Big Data cooperative RITIS, through its relationship with the Massachusetts Department of Transportation. MVPC occasionally uses other third-parties, such as Strava Metro, as appropriate.
- MVMPO staff will track mode share of trips 0.5-1 mile using Replica as warranted and as new data becomes available
- MVMPO staff will monitor regional bottleneck locations using INRIX

US Census Bureau Data

- MVMPO staff use publicly available data from the US Census Bureau to track multiple metrics
- Staff use American Community Survey (ACS) data to track average commute time and means of travel to work. Staff will update these metrics as new data becomes available

Summary of Existing Conditions Findings

Based on analysis of the multimodal performance measures included in this document, MVMPO has identified the following congestion problems and needs.

- Highly congested conditions and traffic bottlenecks at noted locations during peak periods
    - Top Interstate bottleneck locations are concentrated in the western portion of the Merrimack Valley region, with 24 of the top 25 Interstate bottleneck locations in the region along I-93 and I-495 in Andover, Lawrence, Methuen, and Haverhill.
    - Top non-interstate bottleneck locations are largely located on principal arterials, with 18 of the top 20 non-interstate bottlenecks being located on principal arterials (including Routes 1, 28, 97, 114, 125, 133, and 213). Principal arterials such as these routes connect communities throughout the region. Reducing congestion and improving multimodal transportation options along these corridors is important for improving regional connectivity.
- Gaps in the sidewalk network
    - 35.4% of roadway segments in the Merrimack Valley region (excluding Interstates, ramps, Route 213, and state park or forest roads) have sidewalks. Major collectors and local roads constitute the lowest percentage roads with sidewalks at 35.0% and 29.9% respectively
    - Increasing the percentage of road segments with sidewalks can help replace some auto trips with walking trips, reducing roadway congestion.
- Significant share of trips to work and short trips for all purposes taken by private vehicles

- Per 2019-2023 ACS 5-year estimates, more than 79% of commute trips were made by car, truck or van.
- Per Replica data for the typical weekday in Spring 2024, 50.65% of trips 0.5-1 mile were made by private auto.
- Promoting non-auto modes such as transit, walking, and biking can help reduce roadway congestion.

- Need for improved transit travel time competitiveness and regional connectivity
  - Comparing job accessibility for Merrimack Valley residents traveling by private auto and by transit, based on Accessibility Observatory data, reveals vast differences between the number of jobs accessible by private auto versus the number of jobs accessible by transit.
  - Improving travel time competitiveness between transit and auto trips and increasing the number of destinations accessible by transit can help replace car trips with transit trips and reduce roadway congestion.

III. Strategies

MVMPO's most recent Metropolitan Transportation Plan (MTP), endorsed in 2023, includes the following Congestion Management Strategies:

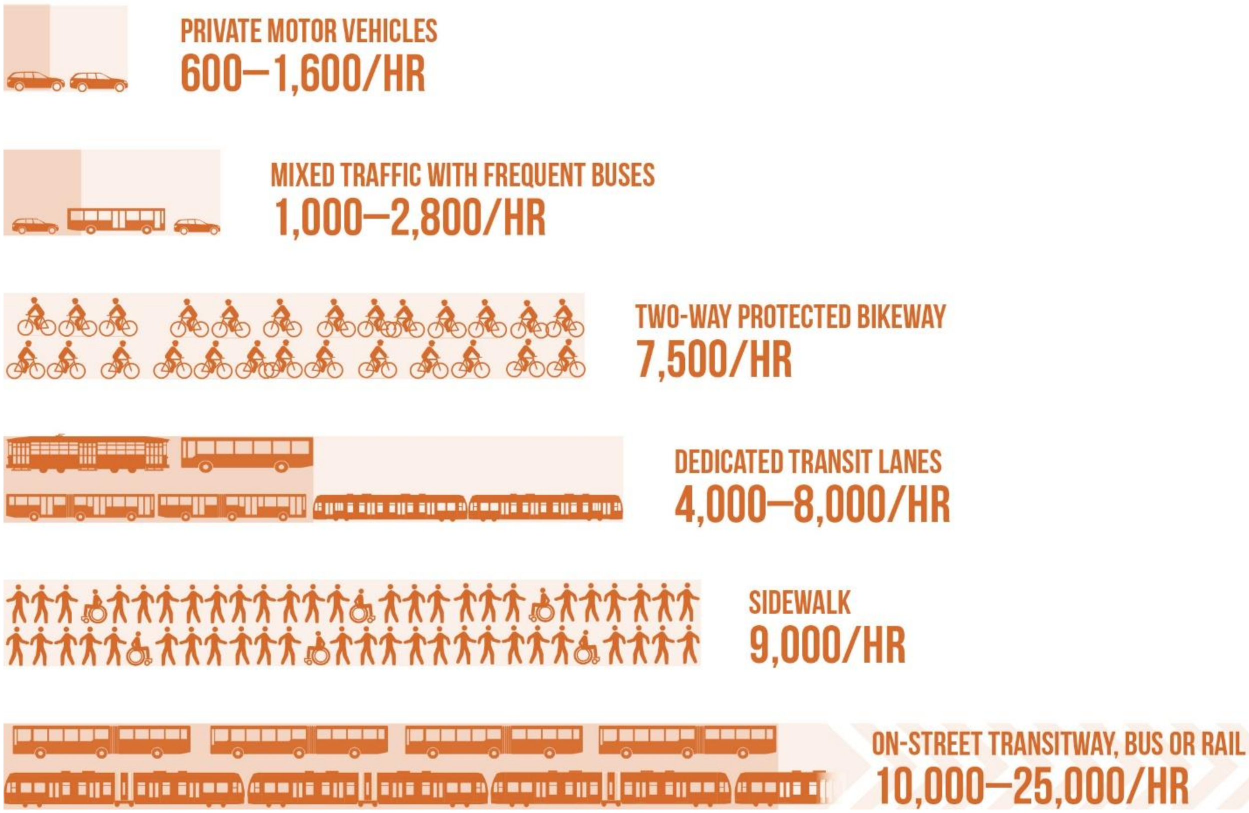
- Monitor congestion of federal aid roadways
- Deemphasize auto capacity enhancement related projects
- Develop a regional wayfinding plan (including transit services)
- Prioritize pavement management of multimodal corridors

In line with the strategy of deemphasizing auto capacity enhancement related projects, the strategies outlined in this update to the CMP will follow a framework of promoting demand management, mode shift, and operational improvements over increasing roadway capacity. While congestion can be costly, it is important to consider whether increased roadway capacity is necessary. Unused road capacity can present several challenges.

- Below-capacity roads can contribute to speeding, which in turn can increase the frequency and severity of crashes.
- Larger intersections can present safety challenges for people walking and biking due to increased traffic exposure and, depending on the intersection, additional conflict points.
- Increasing the number of travel lanes can lead to longer wait times for all modes, as there are longer cycle lengths and less efficient signal phasing.
- Expanding roadway widths takes away space from other uses such as development, public spaces, and space for people to walk and bike.

While a common performance measure for streets is their ability to move vehicles, assessing streets based on person throughput highlights the benefits of transit and bike and pedestrian improvements. The graphic below shows the capacity of a single standard width travel lane when used for different modes, highlighting the potential of sidewalks, bike lanes and transit lanes for moving people efficiently.

Figure 25 - Capacity of a single standard width travel lane by mode at peak conditions with normal operations (Source: NACTO Transit Street Design Guide)



CMP Strategies fall into five categories:

1. Transit
2. Bike and Pedestrian
3. Transportation Demand Management
4. Optimization of Traffic Signals
5. Roadway Enhancements

Future updates to the TIP, UPWP and MTP will consider the following strategies in projects, studies and programming decisions.

Transit

The MTP includes several transit strategies relevant to the CMP. These strategies include the following actions:

- Plan for transit capacity improvements such as queue jumps, signal priority, and dedicated bus lanes.
- Study costs associated with transit capacity improvements.
- Complete a comparative study of transit travel time and vehicular travel time.
- Study MeVa service to connect multifamily housing neighborhoods created through MBTA Communities Legislation.
- Complete an evaluation and business case of free MeVa bus service.
- Analyze MeVa transit service connections with MBTA commuter rail stations.

- Conduct walkability assessment of transit hubs.

The MVMPO will also support the implementation of the following projects which allow for greater frequency, hours of operation, and accessibility of transit services.

- Maintain MeVa rolling stock's state of good repair.
- Rehab and expand McGovern Transportation Center to become Lawrence's transportation hub.
- Expand maintenance and administration facilities at Bradford.
- Upgrade Bradford and Washington Square station facilities in Haverhill.
- Implement bus shelter and stop program.
- Procure low-floor cutaway vans.
- Study solar ferry boat services.

Bike and Pedestrian

- Improve the connectivity, state of good repair, and ADA accessibility of sidewalks, particularly along major corridors.
- Improve and expand the regional network of shared-use paths.
- Expand and improve the safety of the on-road bike lane network and implement traffic calming initiatives to improve safety.
- Increase prevalence of pedestrian safety measures such as high visibility crosswalks and RRFBs.
- Support Newburyport's bike share pilot and study feasibility of expanding bike share to additional communities.

Transportation Demand Management

- Collaborate with Merrimack Valley TMA, municipalities, and employers to promote and implement transportation demand management best practices.
- Promote measures to reduce demand for single occupancy vehicle travel.
- Promote multimodal access in areas with a greater housing density and mixed-use districts.

Optimization of Traffic Signals

- Study signal timing of non-interstate bottleneck locations to allow for optimal flow through congested locations.
- Support use of adaptive signal technology.
- Reduce delay for transit, pedestrians, and bicyclists at signalized intersections to encourage non-auto modes of travel and reduce potential of unsafe noncompliance.

Roadway Geometric Improvements:

- Study identified bottleneck locations, emphasizing improvements that do not degrade safety and support multimodal travel.

Planned Actions and Studies:

The FFY25 UPWP contains several tasks and studies relevant to the CMP, including:

- Regional and Statewide Community Traffic Program (MS2)
- Valley Tally Program, Program Continuity: Path User Counts

- Travel Time Reliability & Competitiveness Assessment
- Active Transportation Plan Phase Two
- Fare Free Transit Evaluation
- Age-Friendly Transit/Council on Aging Coordination
- Automatic Passenger Counter Validation
- Transit Enhancement Scope
- Ferryboat Business Plan Development
- Development of a Public-facing Multimodal Transportation Data Viewer

CMP related actions and studies will be programmed in future years' UPWPs to inform development of the TIP and MTP. These actions and studies will include completion of the transit enhancement assessment, continuation of the Active Transportation Plan Phase 2, and updates to public facing multimodal transportation data viewer.

Evaluate Strategy Effectiveness

Evaluation of strategy effectiveness will involve ongoing updates of the multimodal transportation data viewer as data becomes available, including annual updates to V/C ratios for CMP network segments and monitoring of RITIS top bottleneck locations. The multimodal transportation data viewer will include the following data points, where available:

- Traffic segment volume data
- Traffic segment congestion (V/C ratios, where available)
- Traffic segment speed data (where available)
- Traffic segment vehicle classification data (where available)
- Trail segment volume data
- Boarding and alighting at MeVa bus stop locations

Staff will also track progress on the performance measures included in Section III, as updated data becomes available. Performance measures and target trends are as follows:

- Transit ridership
    - Increases in MeVa Transit total ridership and unlinked passenger trips per vehicle revenue mile and vehicle revenue hour
    - Increases in MBTA Commuter Rail line and stop level ridership
- Percentage of non-SOV commuting
    - Increases in non-SOV commuting, including increases in travel to work by walking, biking, public transportation, and carpooling
- Average commute times
    - Decreases in mean travel time to work
- Mode share of short trips (0.5-1 mile)
    - Increases in the percentage of short trips made by walking and biking
- Percentage of roadway with sidewalks
    - Increases in the overall percentage of roadway with sidewalks
- Massachusetts Vehicle Census data

- Decreases in average daily miles driven and total daily miles driven by vehicles registered in the Merrimack Valley region

IV. Appendices

Appendix A: Volume-to-Capacity Ratios by Community for CMP Network Segments

The tables below show locations where peak volumes exceed capacity. Segments are organized alphabetically by community and street name. Only segments with available volume data are included.

Table 14 - Collectors, Minor Arterials, Major Arterials, and Local Roads where Peak Volumes Exceed Capacity

Community	Street Name	From	To	Facility	Direction	Free Flow Speed	Capacity	Link Direction	K Factor	AADT	Total Lanes	V/C Ratio	Length (Miles)
Amesbury	Macy Street	495 Ramp EB	Rocky Hill Road	Major Arterial	Two-way	30	950	E	0.118	33713	4	1.050	0.07
Andover	South Street	S Union Street	E Sylvester Street	Major Arterial	One-way	27	950	N	0.099	11099	1	1.154	0.05
Andover	South Union Street	S Union Street	S Union Extension Street	Minor Arterial	One-way	24	750	N	0.099	11099	1	1.154	0.15
Andover	South Union Street	Shepley Street	South Street	Major Arterial	One-way	34.2	950	N	0.099	11099	1	1.154	0.07
Groveland	King Street	Route 113	Union Street	Collector	Two-way	35	500	SE	0.102	9850	2	1.009	0.05
Haverhill	Main Street	946 Main Street	Smiley Ave	Major Arterial	Two-way	30	950	NW	0.080	12841	1	1.087	0.02
Haverhill	Main Street	946 Main Street	I-495	Major Arterial	One-way	35	950	SE	0.080	12841	1	1.087	0.15
Haverhill	Main Street	Northwood Terrace	943 Main Street	Major Arterial	One-way	30	950	NW	0.080	15565	1	1.317	0.03
Haverhill	Monument Street	Route 97	N Broadway	Minor Arterial	Two-way	25.5	750	NE	0.166	11505	2	1.274	0.29
Methuen	Hill Street	Route 113	Meetinghouse Road	Local Road	Two-way	30	500	N	0.103	17690	2	1.824	0.25
Methuen	North Lowell Street	Moffett Street	Hill Street	Minor Arterial	Two-way	33.6	750	NE	0.091	17709	2	1.079	0.21
Methuen	North Lowell Street	Young Farm Road	Albert Street	Minor Arterial	Two-way	33	750	E	0.101	17327	2	1.169	0.20
Methuen	North Lowell Street	Hill Street	Young Farm Road	Minor Arterial	Two-way	33	750	E	0.101	17327	2	1.169	0.07
Newburyport	Washington Street	Winter Street	Summer Street	Local Road	Two-way	30	500	SE	0.113*	10403	2	1.176	0.03
North Andover	Johnson Street	Salem Street	North Pond Road	Collector	Two-way	32.5	500	NW	0.119	16387	2	1.943	0.08
North Andover	Massachusetts Avenue	Marblehead Street	Danvers Street	Minor Arterial	Two-way	30	750	NW	0.100	19036	2	1.268	0.19

North Andover	Salem Street	Marbleridge Road	Milk Street	Collector	Two-way	33.3	500	NW	0.100	11036	2	1.104	0.54
North Andover	Turnpike Street	Hillside Road	643 Turnpike Street	Major Arterial	Two-way	39	950	SE	0.088	25927	2	1.206	0.15
North Andover	Turnpike Street	Royal Crest Drive	Wilson Road	Major Arterial	One-way	35	1050	NW	0.113*	20071	2	1.194	0.24
North Andover	Turnpike Street	Andover Street	Merrimack College Parking Lot	Major Arterial	One-way	37	950	SE	0.113*	20431	2	1.216	0.17

Table 15 - Interstates, Ramps, and Limited Access Roadways where Peak Hour Volumes Exceed Capacity

Community	Street Name	From	To	Facility	Direction	Free Flow Speed	Capacity	Link Direction	K Factor	AADT	Total Lanes	V/C Ratio	Length (Miles)
Amesbury	Ramp-Rt 110 Eb To Rt 95 Sb	Route 110 EB	I-95 SB	Other Ramp	One-way	42.6	1000	S	0.212	7232	1	1.533	0.40
Amesbury	Ramp-Rt 495 Nb To Rt 110	I-495 NB	Route 110	Other Ramp	One-way	63.5	1000	E	0.113	10042	1	1.136	0.34
Amesbury	Ramp-Rt 95 Nb To Rt 110 Wb	I-95 NB	Route 110 WB	Other Ramp	One-way	39.1	1000	NW	0.187	7047	1	1.315	0.36
Andover	Interstate 495	N Main Street	Lawrence Line	Interstate	One-way	66	1750	NE	0.113	55141	3	1.187	0.26
Andover	Interstate 495	Lawrence Line	Union Street	Interstate	One-way	64	1750	SW	0.113	55927	3	1.204	0.22
Andover	Interstate 93	Tewksbury Line N	Tewksbury Line S	Interstate	One-way	67	1750	S	0.085	69487	3	1.124	0.90
Andover	Interstate 93	Dascomb Road	Exit 39	Interstate	One-way	65	1750	N	0.082	71415	3	1.111	1.11
Andover	Interstate 93	Gillette	Tewksbury Line	Interstate	One-way	66	1750	N	0.085	72790	3	1.183	0.59
Andover	Interstate 93	Exit 38	Dascomb Road	Interstate	One-way	67	1750	S	0.081	82826	3	1.273	0.30
Andover	Interstate 93	High Plain Road	Exit 39 B	Interstate	One-way	64	1750	S	0.087	72304	3	1.195	0.61

Andover	Interstate 93	Ramp-Route 133 to I-93 NB	High Plain Road	Interstate	One-way	64	1750	N	0.084	69096	3	1.104	0.67
Andover	Interstate 93	Old River Road	Methuen Line	Interstate	One-way	66	1750	S	0.085	66770	3	1.075	0.48
Andover	Interstate 93	River Road	Chestnut Lane	Interstate	One-way	66	1750	N	0.081	69677	3	1.078	0.27
Andover	Interstate 93	Chestnut Lane	Riverside Drive, Methuen	Interstate	One-way	65.5	1750	N	0.085	68751	3	1.107	0.49
Andover	Ramp-River Rd To Rt 93 Nb	River Road	I-93 NB	Other Ramp	One-way	38	1000	NW	0.113	9437	1	1.067	0.36
Andover	Ramp-Rt 125 To Rt 28 Sb	Route 125	Route 28 SB	Other Ramp	One-way	36.7	1000	NE	0.115	9694	1	1.113	0.33
Boxford	Ramp-Rt 97 To Rt 95 Sb	Route 97	I-95 SB	Other Ramp	One-way	46.2	1000	S	0.217	4795	1	1.042	0.36
Georgetown	Ramp-Rt 133 To Rt 95 Sb	Route 133	I-95 SB	Other Ramp	One-way	45.9	1000	S	0.145	7491	1	1.086	0.52
Haverhill	Ramp-Rt 125 Conn To Rt 495 Sb	Route 125 Connector	I-495 SB	Other Ramp	One-way	38.3	1000	SE	0.120	9004	1	1.079	0.32
Haverhill	Ramp-Rt 495 Nb To Rt 97	I-495 NB	Route 97	Other Ramp	One-way	36.8	1000	NE	0.132	8632	1	1.135	0.25
Haverhill	Ramp-Rt 97 To Rt 495 Sb	Route 97	I-495 SB	Other Ramp	One-way	33	1000	E	0.108	9358	1	1.010	0.21
Lawrence	Interstate 495 Nb Cd Road	North Andover Line	I-495 NB	Other Ramp	One-way	45.8	1000	N	0.102	13684	1	1.397	0.20
Lawrence	Ramp-Rt 114 To Rt 495 Nb	Route 114	I-495 NB	Other Ramp	One-way	38	1000	N	0.110	9358	1	1.033	0.35

Lawrence	Ramp-Rt 495 Nb To Rt 495 Sb/ Marston St	I-495 NB	I-495 SB/Marston Street	Other Ramp	One-way	41	1000	NE	0.110	13609	1	1.492	0.16
Lawrence	Ramp-Sutton St To Rt 495 Nb	Sutton Street	I-495 NB	Other Ramp	One-way	35	1000	E	0.136	8212	1	1.118	0.08
Methuen	Albert Slack Highway	Route 213 EB	I-93 SB	Expressway	One-way	49	950	SW	0.104	15274	1	1.664	0.25
Methuen	Albert Slack Highway	Route 28	Exit 3	Expressway	One-way	55	1050	NE	0.084	28769	2	1.151	1.12
Methuen	Albert Slack Highway	Route 213 WB	I-93 NB	Expressway	One-way	55.3	1050	NW	0.113	26855	2	1.446	0.41
Methuen	Albert Slack Highway	I-93 NB Exit 46 Ramp	Methuen Rail Trail Bridge	Expressway	One-way	54	1050	E	0.113	29478	2	1.587	0.24
Methuen	Albert Slack Highway	I-93 SB Exit 46 Ramp	Route 213	Expressway	One-way	52	950	E	0.107	13064	1	1.466	0.31
Methuen	Albert Slack Highway	Ramp-Howe Street to Route 213 WB	Ramp-213 WB to Route 28	Expressway	One-way	60	1050	SW	0.084	29490	2	1.180	0.82
Methuen	Albert Slack Highway	Ramp-Route 113 to Route 213	Exit 5A	Expressway	One-way	60	1050	SE	0.113	29012	2	1.562	0.52
Methuen	Albert Slack Highway	Ramp-I-495 SB to Route 213 WB	Exit 4	Expressway	One-way	60	1050	NW	0.113	26448	2	1.424	0.34
Methuen	Interstate 93 Nb Cd Road	I-93 NB	Exits 45 & 46	Other Ramp	One-way	52	1000	NE	0.113	17763	2	1.004	0.18
Methuen	Interstate 93 Sb Cd Road	Ramp-Pelham Street to I-93 SB CD Road	I-93 SB	Other Ramp	One-way	53	1000	S	0.113	17809	2	1.007	0.19
Methuen	Ramp-Rt 213 Eb To Rt 495 Nb	Route 213 EB	I-495 NB	Other Ramp	One-way	53	1000	SE	0.113	15200	1	1.722	0.59

Methuen	Ramp-Rt 213 Eb To Rt 495 Sb	Route 213 EB	I-495 SB	Other Ramp	One-way	56.4	1000	S	0.095	14790	1	1.408	0.34
Methuen	Ramp-Rt 213 Wb To Rt 28	Route 213 WB	Route 28	Other Ramp	One-way	35.6	1000	W	0.122	9412	1	1.146	0.24
Methuen	Ramp-Rt 495 Nb To Rt 213 Wb	I-495 NB	Route 213 WB	Other Ramp	One-way	49	1000	N	0.125	13141	1	1.648	0.65
Methuen	Ramp-Rt 495 Sb To Rt 213 Wb	I-495 SB	Route 213 WB	Other Ramp	One-way	53.4	1000	W	0.143	13099	1	1.871	0.28
Methuen	Ramp-Rt 93 Nb To Rt 213 Eb	I-93 NB	Route 213 EB	Other Ramp	One-way	48	1000	NE	0.113	13810	1	1.561	0.27
Methuen	Ramp-Rt 93 Nb To Rts 110 And 113	I-93 NB	Routes 110 & 113	Other Ramp	One-way	43	1000	N	0.113	10066	1	1.138	0.22
Methuen	Ramp-Rt 93 Sb To Rt 213 Eb	I-93 SB	Route 213 EB	Other Ramp	One-way	51	1000	S	0.113	9237	1	1.044	0.37
Methuen	Ramp-Rt 93 Sb To Rts 110 And 113	I-93 SB	Routes 110 & 113	Other Ramp	One-way	31.5	1000	S	0.113	9060	1	1.024	0.37
Methuen	Ramp-Rts 110 And 113 To Rt 93 Nb	Routes 110 & 113	I-93 NB	Other Ramp	One-way	43	1000	NW	0.113	10984	1	1.242	0.32
Salisbury	Interstate 495	I-95 SB Exit 89	Amesbury Line	Interstate-Interstate Ramp	One-way	65	1500	SW	0.133	25705	2	1.142	0.68
Salisbury	Interstate 495	Amesbury Line	I-95 NB	Interstate-Interstate Ramp	One-way	61.4	1500	NE	0.136	25517	2	1.155	1.06

Appendix B: Volume-to-Capacity Ratio Calculation Methodology

Introduction

This document provides an overview of the process MVMPO staff followed for estimating volume-to-capacity (V/C) ratios for roadway links included in the CMP network. MVMPO staff compiled a Python notebook for this process that works in tandem with ArcGIS Pro. The V/C ratios estimated through this process help assess road segment congestion to prioritize the most congested locations through strategies identified in the Congestion Management Process.

Data Inputs

Below is a table of the inputs used to calculate the V/C ratios and their data sources.

Data	Source	Information	Format
AADT Counts	MS2 - MassDOT and regional traffic counts	Traffic volumes[1], count locations, count year, K-factor (i.e. peak hour factor)	File geodatabase, points
Regional Travel Demand Model Inputs	Boston Region MPO	Roadway link capacities, lane assignments, roadway geospatial data	Shapefile, lines

Map Traffic Count Points

MVMPO staff previously compiled and mapped traffic volume data from MS2, a third-party database that includes data from traffic counts conducted by MassDOT and regional staff. The data compiled from MS2 includes count location information including latitude, longitude, Average Annual Daily Traffic (AADT, for the years data is available for up through 2023), and K-factors (a value representing the percentage of daily volumes occurring during the peak hour). MVMPO staff mapped these count locations based on the latitude and longitude, creating a Feature Class in ArcGIS Pro. For locations where no K-factor was available, MVMPO staff used the average value of all traffic count locations, 11.3%.

MVMPO staff calculated a new field called *Most Recent AADT*. This field is equal to 2023 AADT when available or the AADT value for the most recent year of data available going back to 2018.

Add Capacity Data to Map and Conduct Spatial Join

MVMPO staff worked with Boston Region MPO staff to access roadway link data from the statewide Travel Demand Model, which includes total capacity per lane and number of lanes for each roadway link. MVMPO staff conducted a spatial join of the travel demand model link data to the traffic count points, using a match option of *closest* and search radius of 50 feet. This process assigns a capacity per lane and number of lanes to each traffic count point based on the closest link within 50 feet.

Before calculating the V/C ratios, MVMPO staff checked lane assignments against aerial imagery to ensure the number of lanes per link was correct. Staff updated link inputs where necessary. In instances where road segments were provided as separate one-way links, such as interstates and divided roadways, MVMPO staff

1 Some volumes are interpolated using a growth rate calculated as the weighted average of the simple year-over-year AADT growth rates for all count stations. They are weighted by the AADT of each station. For example, a 50% growth for an AADT of 100 does not contribute as much to the calculation as a 50% growth for an AADT of 1,000 does (Source MS2).

updated AADT values to the directional AADT value corresponding to each link. Staff accomplished this by duplicating traffic count points, aligning them with the correct directional link and inputting directional AADT values available from MS2. After checking the lane assignments, MVMPO staff calculated a new field called *Total Lanes* by summing the lanes in each direction for each link.

V/C Ratio Calculation

MVMPO staff then calculated V/C ratios using the following formula:

$$V/C\ Ratio = (V * K) / (C * L)$$

V = Most Recent AADT
K = Peak hour factor, percentage of AADT occurring in the peak hour
C = Capacity per lane
L = Total lanes per link

Spatial Join of AADT Locations to Roadway Links

After calculating the V/C ratios, MVMPO staff conducted a spatial join of the AADT count locations with the V/C ratios to the roadway link data from the travel demand model, using a match option of closest and search radius of 50 feet. This step assigns a V/C ratio to each segment where AADT data is available.

Assignment of Congestion Level

MVMPO staff then calculated a new field called *Congestion Level* assigning a qualitative value to V/C ratios as follows:

Congestion Level	V/C Ratio
Free Flow	≤ .6
Stable Flow	> .6 and ≤.7
Mostly Stable Flow	>.7 and ≤ .8
Approaching Instability	> .8 and ≤ .9
Congested	> .9 and ≤ 1.0
Highly congested	> 1.0

Staff mapped and symbolized road segments based on V/C values to identify the most congested locations in the region. Thicker and darker roadways indicate higher levels of congestion, while thinner, lighter lines offer more stable conditions.

Appendix C: Top Bottlenecks by Community Maps

The maps below show the five highest ranking bottlenecks in each community in the Merrimack Valley region.

Amesbury Top Bottleneck Locations

Head Location	Regional Rank
MA-110 W @ I-95	64
MA-110 W @ MA-150/HILLSIDE AVE	82
I-95 N @ MA-110/MACY ST/ELM ST/EXIT 88	96
I-495 N @ MA-110/MACY ST/EXIT 119	102
I-495 N @ MA-150/HILLSIDE AVE/EXIT 118	119
MAIN ST N @ RT-150/SPARHAWK ST	134
MA-110 E @ MA-150/HILLSIDE AVE	146
I-95 S @ MA-110/MACY ST/ELM ST/EXIT 88	161
MA-110 W @ I-495 (AMESBURY)	195
I-495 S @ MA-150/HILLSIDE AVE/EXIT 118	208

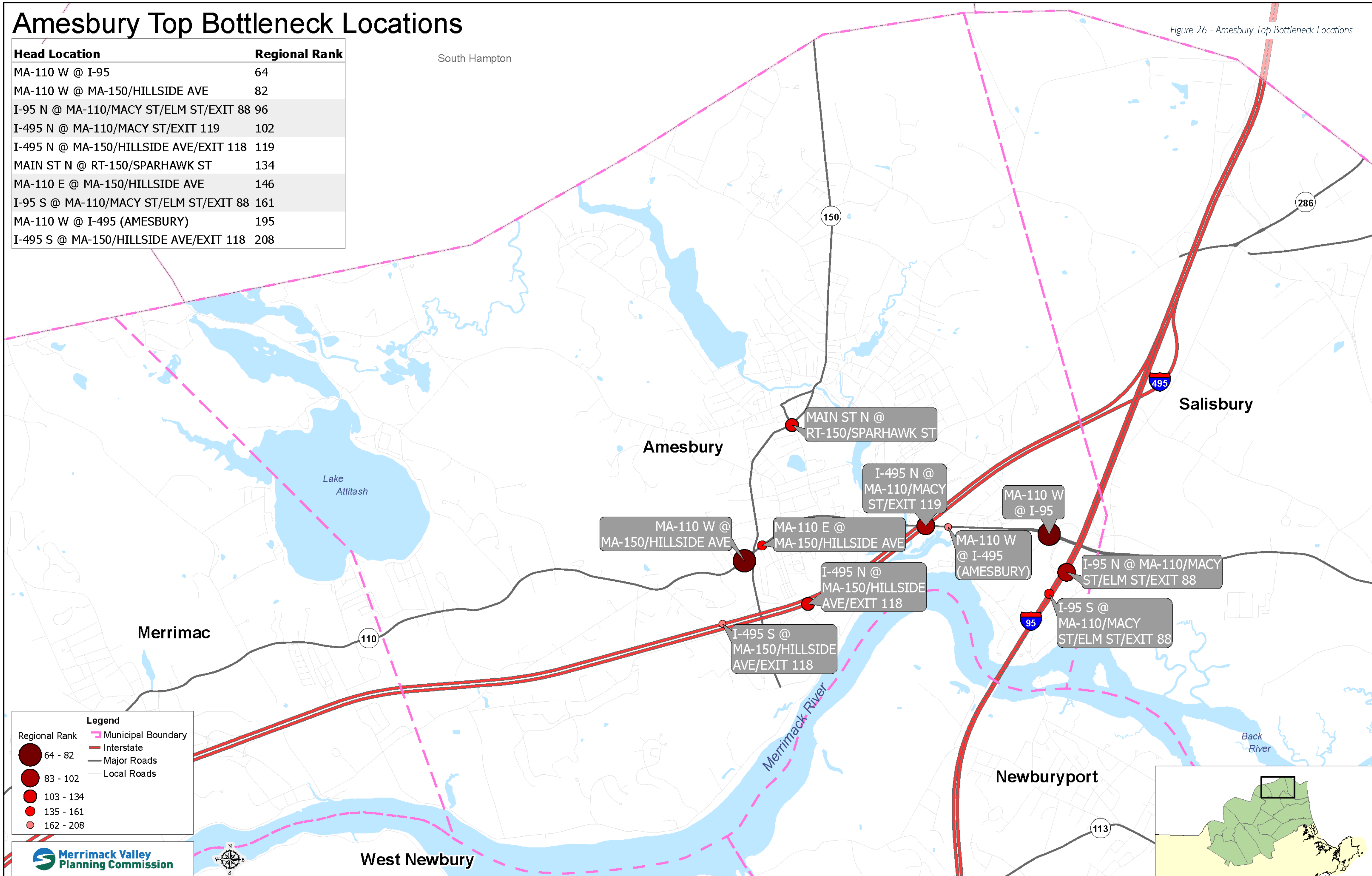
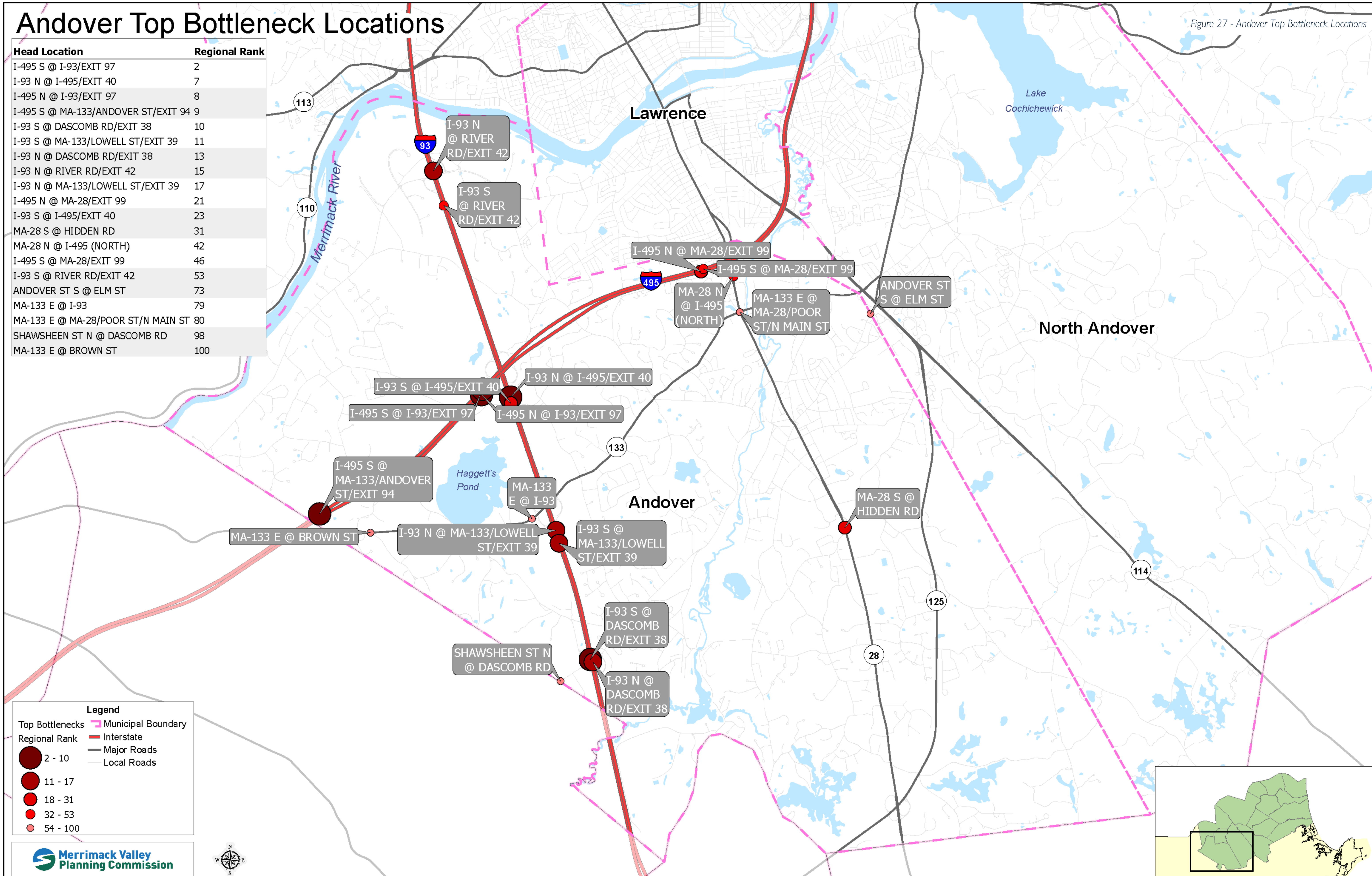


Figure 26 - Amesbury Top Bottleneck Locations

Andover Top Bottleneck Locations

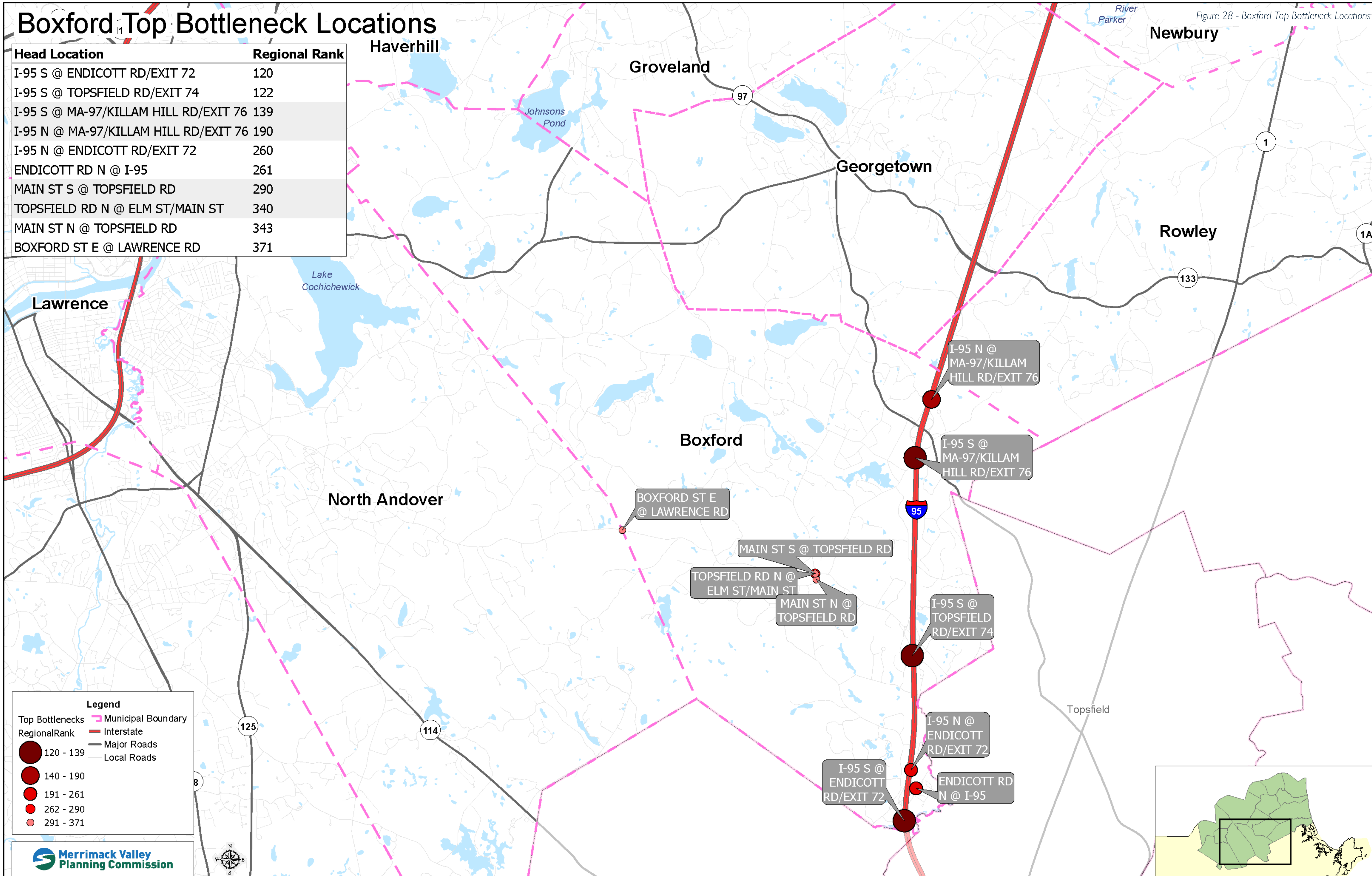
Figure 27 - Andover Top Bottleneck Locations

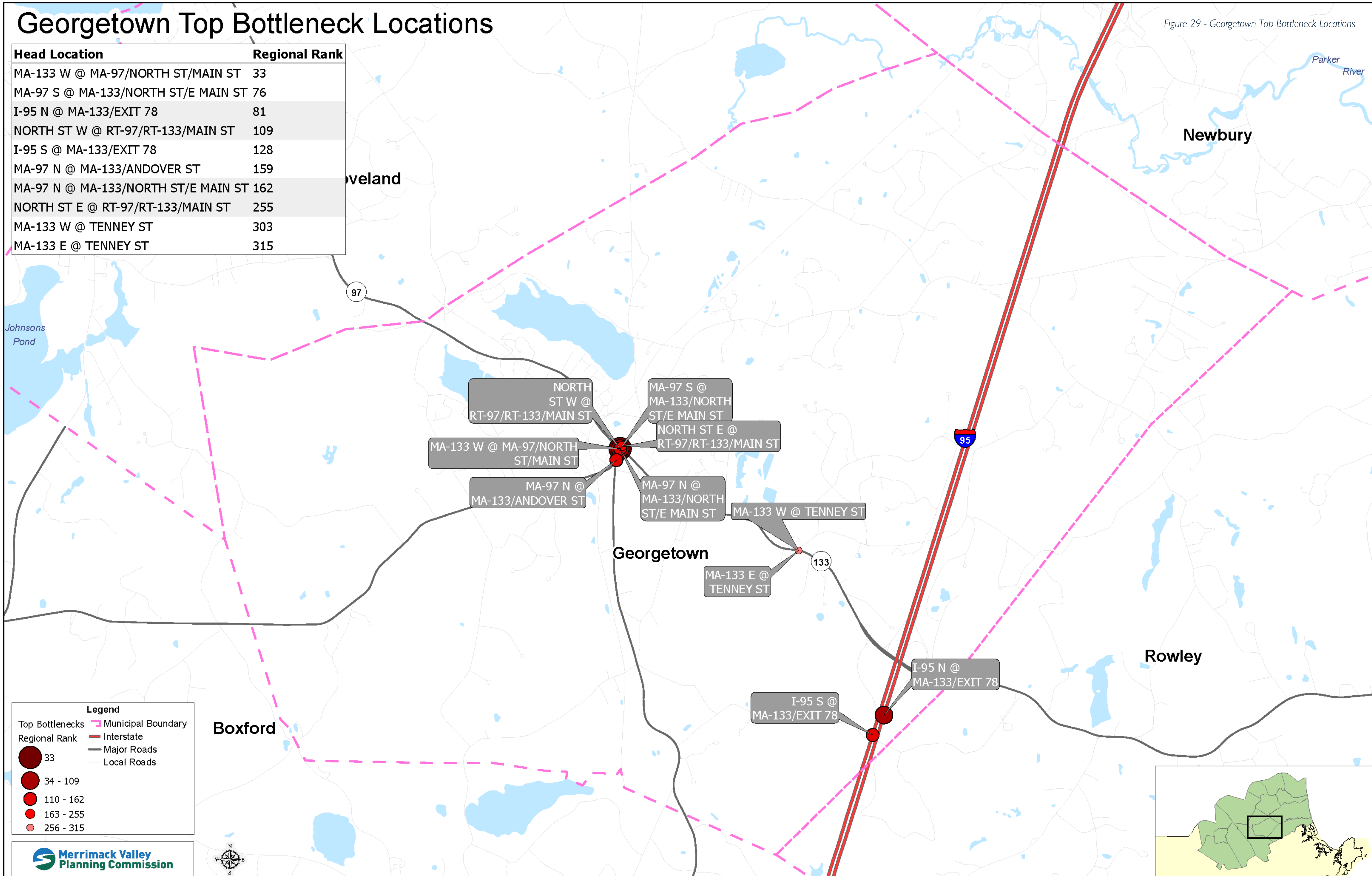
Head Location	Regional Rank
I-495 S @ I-93/EXIT 97	2
I-93 N @ I-495/EXIT 40	7
I-495 N @ I-93/EXIT 97	8
I-495 S @ MA-133/ANDOVER ST/EXIT 94	9
I-93 S @ DASCOMB RD/EXIT 38	10
I-93 S @ MA-133/LOWELL ST/EXIT 39	11
I-93 N @ DASCOMB RD/EXIT 38	13
I-93 N @ RIVER RD/EXIT 42	15
I-93 N @ MA-133/LOWELL ST/EXIT 39	17
I-495 N @ MA-28/EXIT 99	21
I-93 S @ I-495/EXIT 40	23
MA-28 S @ HIDDEN RD	31
MA-28 N @ I-495 (NORTH)	42
I-495 S @ MA-28/EXIT 99	46
I-93 S @ RIVER RD/EXIT 42	53
ANDOVER ST S @ ELM ST	73
MA-133 E @ I-93	79
MA-133 E @ MA-28/POOR ST/N MAIN ST	80
SHAWSHEEN ST N @ DASCOMB RD	98
MA-133 E @ BROWN ST	100



Boxford Top Bottleneck Locations

Head Location	Regional Rank
I-95 S @ ENDICOTT RD/EXIT 72	120
I-95 S @ TOPSFIELD RD/EXIT 74	122
I-95 S @ MA-97/KILLAM HILL RD/EXIT 76	139
I-95 N @ MA-97/KILLAM HILL RD/EXIT 76	190
I-95 N @ ENDICOTT RD/EXIT 72	260
ENDICOTT RD N @ I-95	261
MAIN ST S @ TOPSFIELD RD	290
TOPSFIELD RD N @ ELM ST/MAIN ST	340
MAIN ST N @ TOPSFIELD RD	343
BOXFORD ST E @ LAWRENCE RD	371

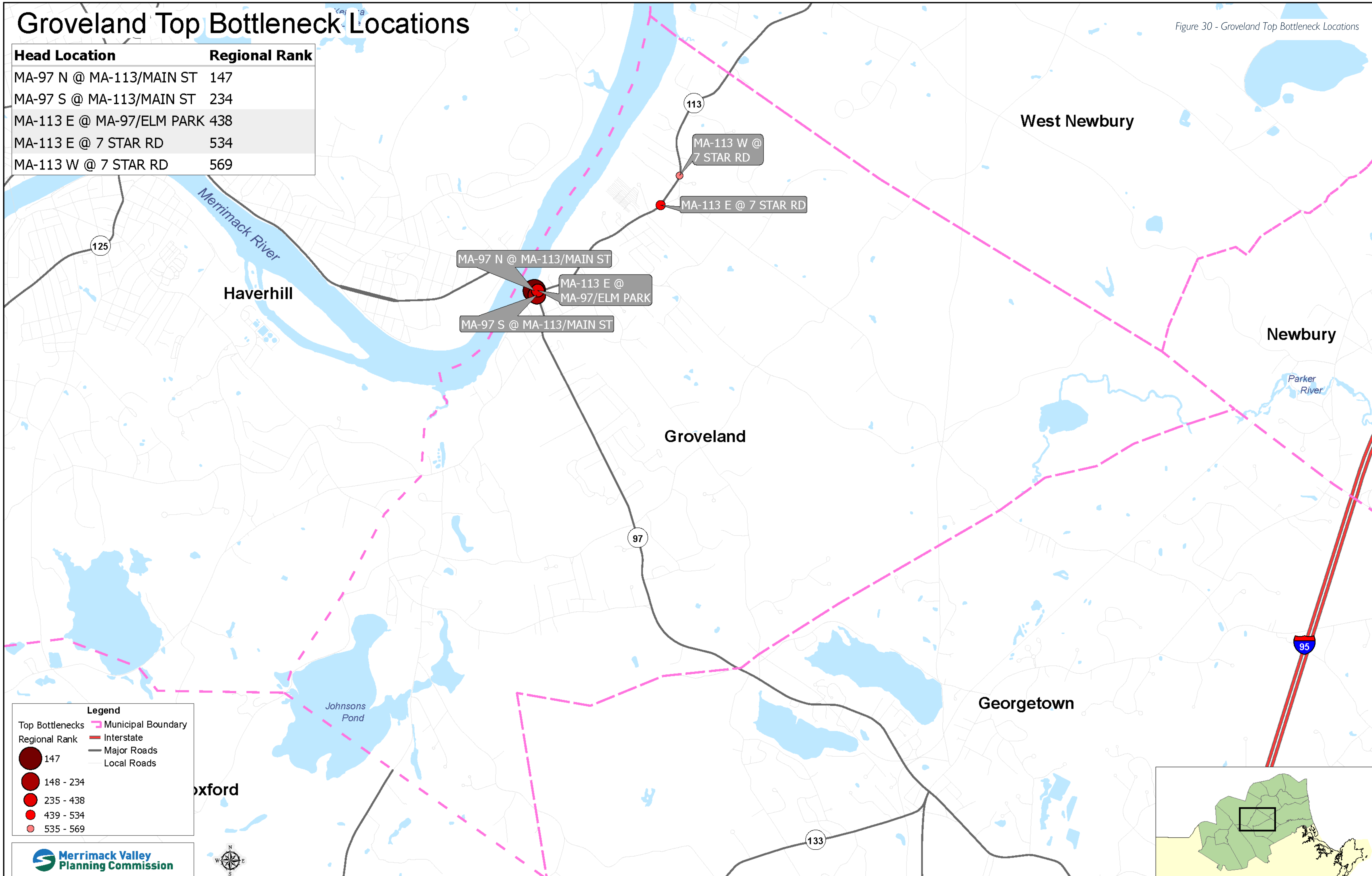




Head Location	Regional Rank
MA-133 W @ MA-97/NORTH ST/MAIN ST	33
MA-97 S @ MA-133/NORTH ST/E MAIN ST	76
I-95 N @ MA-133/EXIT 78	81
NORTH ST W @ RT-97/RT-133/MAIN ST	109
I-95 S @ MA-133/EXIT 78	128
MA-97 N @ MA-133/ANDOVER ST	159
MA-97 N @ MA-133/NORTH ST/E MAIN ST	162
NORTH ST E @ RT-97/RT-133/MAIN ST	255
MA-133 W @ TENNEY ST	303
MA-133 E @ TENNEY ST	315

Groveland Top Bottleneck Locations

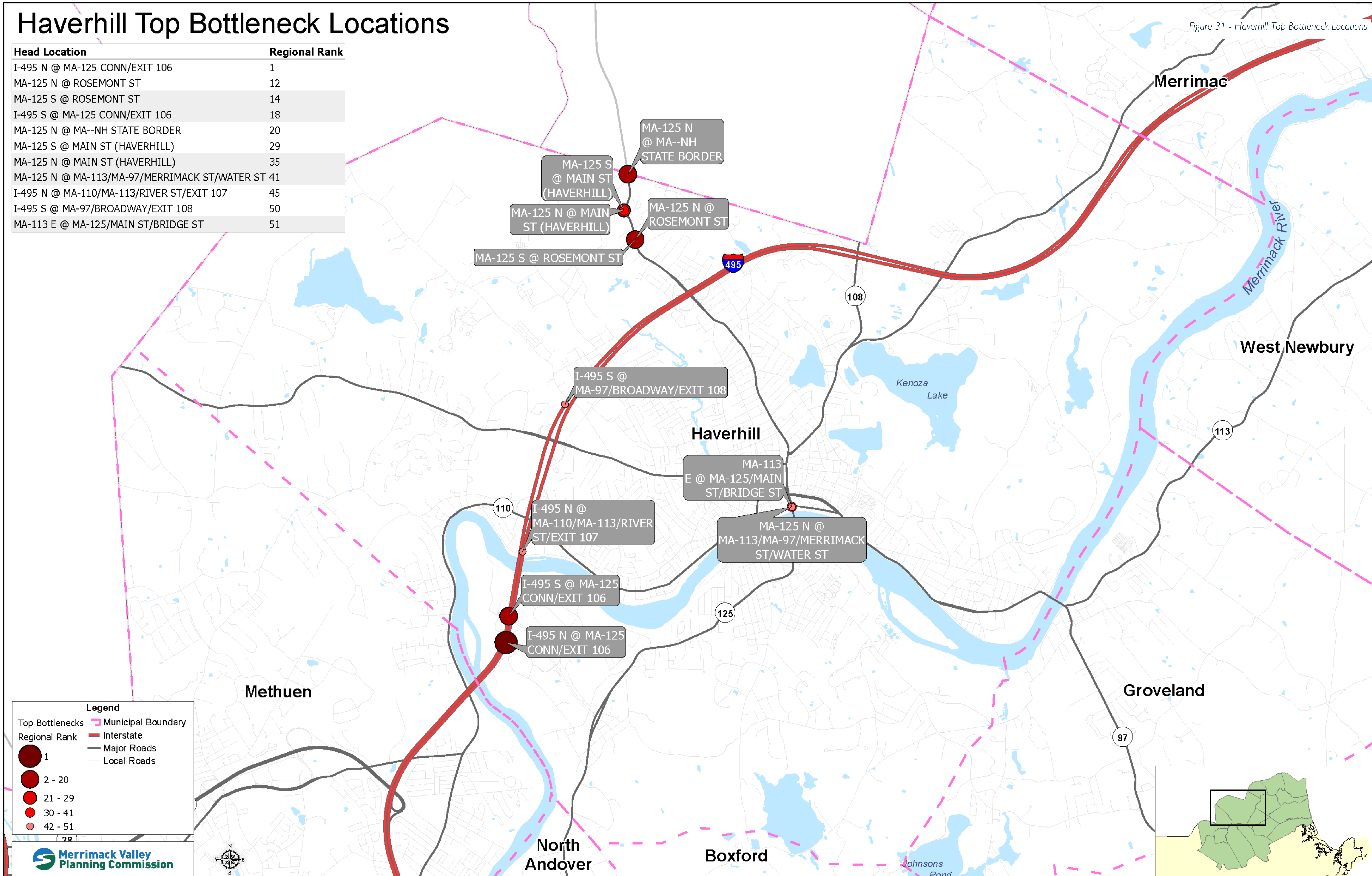
Head Location	Regional Rank
MA-97 N @ MA-113/MAIN ST	147
MA-97 S @ MA-113/MAIN ST	234
MA-113 E @ MA-97/ELM PARK	438
MA-113 E @ 7 STAR RD	534
MA-113 W @ 7 STAR RD	569



Haverhill Top Bottleneck Locations

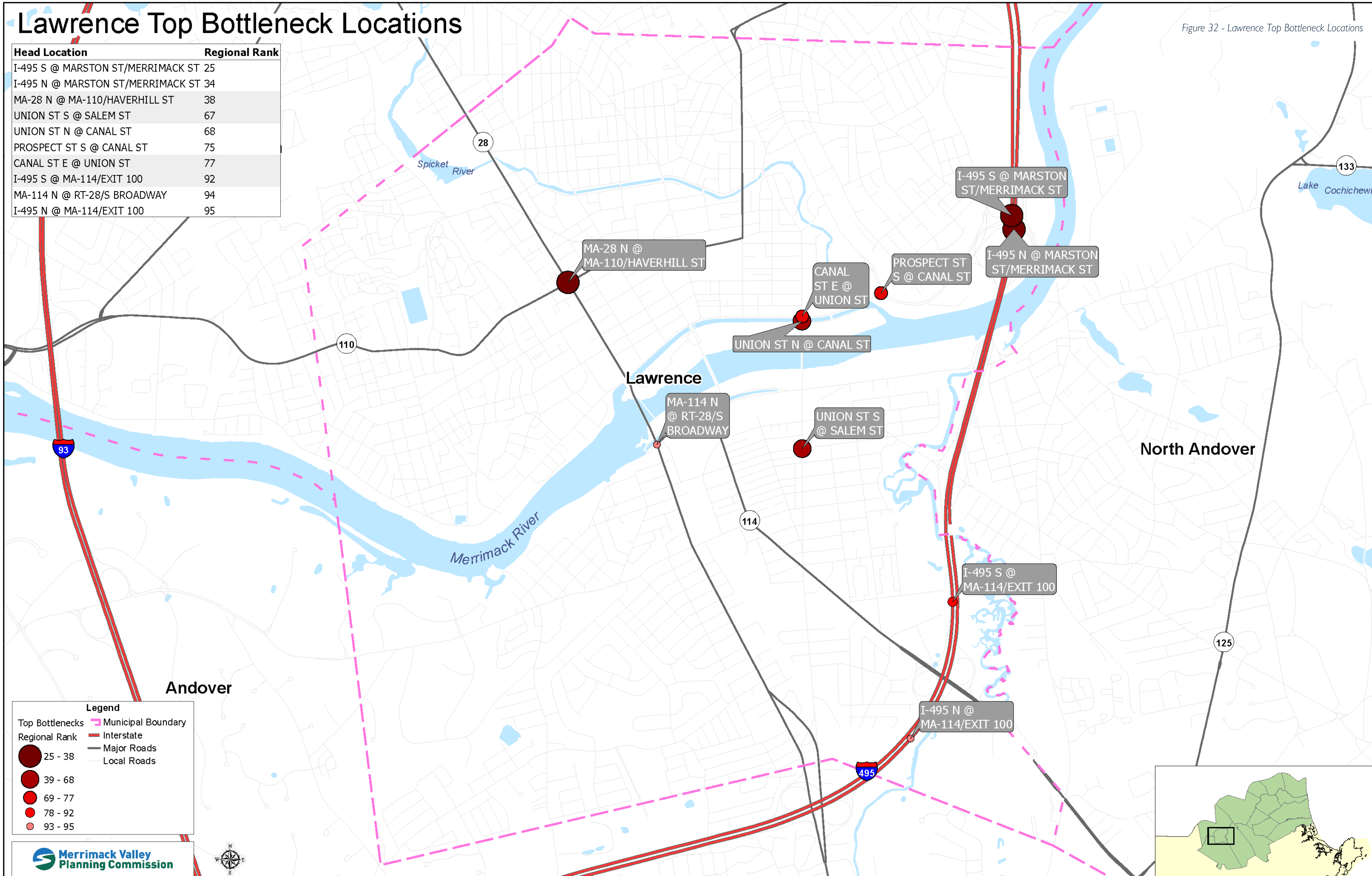
Figure 31 - Haverhill Top Bottleneck Locations

Head Location	Regional Rank
I-495 N @ MA-125 CONN/EXIT 106	1
MA-125 N @ ROSEMONT ST	12
MA-125 S @ ROSEMONT ST	14
I-495 S @ MA-125 CONN/EXIT 106	18
MA-125 N @ MA--NH STATE BORDER	20
MA-125 S @ MAIN ST (HAVERHILL)	29
MA-125 N @ MAIN ST (HAVERHILL)	35
MA-125 N @ MA-113/MA-97/MERRIMACK ST/WATER ST	41
I-495 N @ MA-110/MA-113/RIVER ST/EXIT 107	45
I-495 S @ MA-97/BROADWAY/EXIT 108	50
MA-113 E @ MA-125/MAIN ST/BRIDGE ST	51



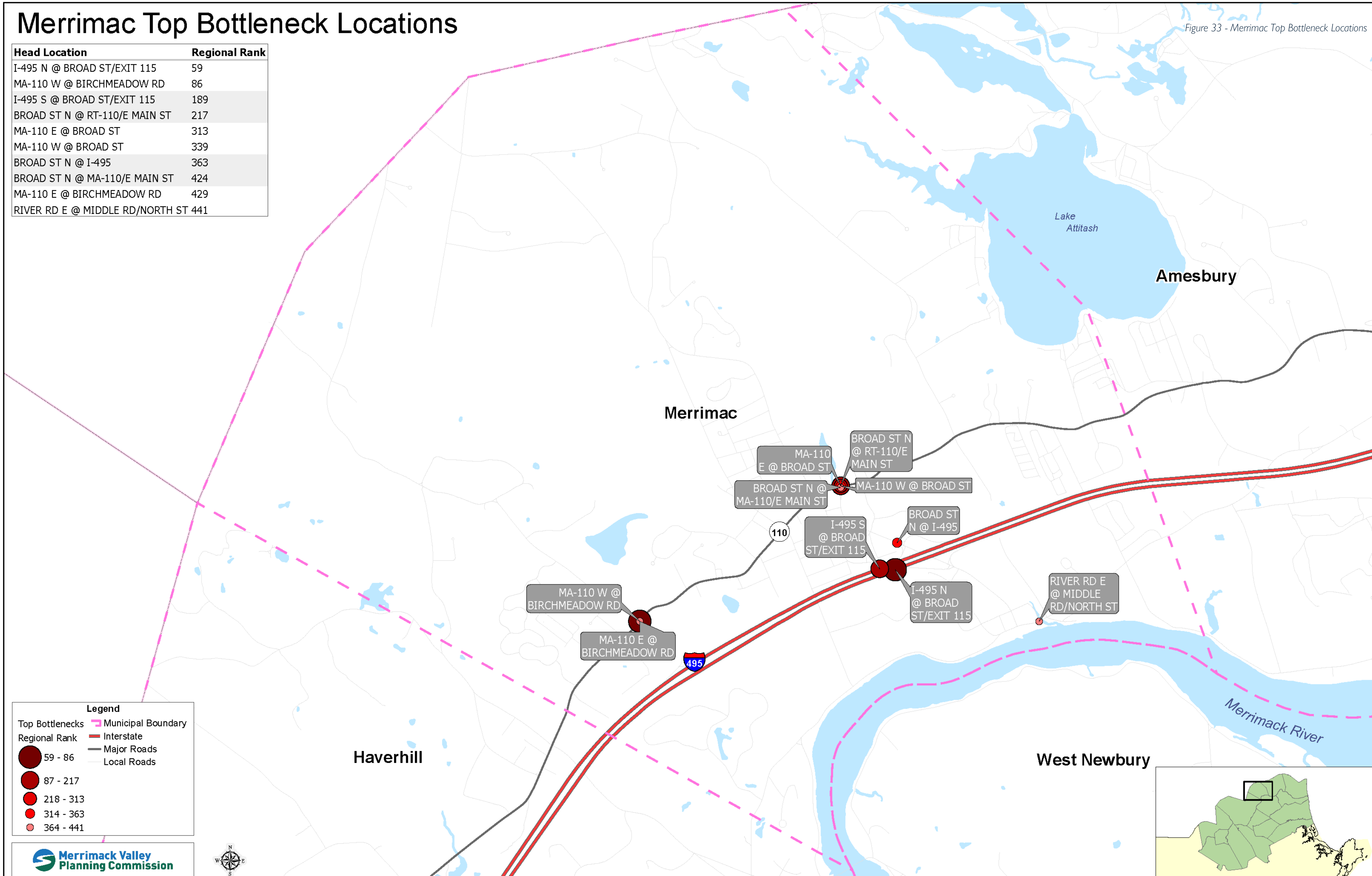
Lawrence Top Bottleneck Locations

Head Location	Regional Rank
I-495 S @ MARSTON ST/MERRIMACK ST	25
I-495 N @ MARSTON ST/MERRIMACK ST	34
MA-28 N @ MA-110/HAVERHILL ST	38
UNION ST S @ SALEM ST	67
UNION ST N @ CANAL ST	68
PROSPECT ST S @ CANAL ST	75
CANAL ST E @ UNION ST	77
I-495 S @ MA-114/EXIT 100	92
MA-114 N @ RT-28/S BROADWAY	94
I-495 N @ MA-114/EXIT 100	95



Merrimac Top Bottleneck Locations

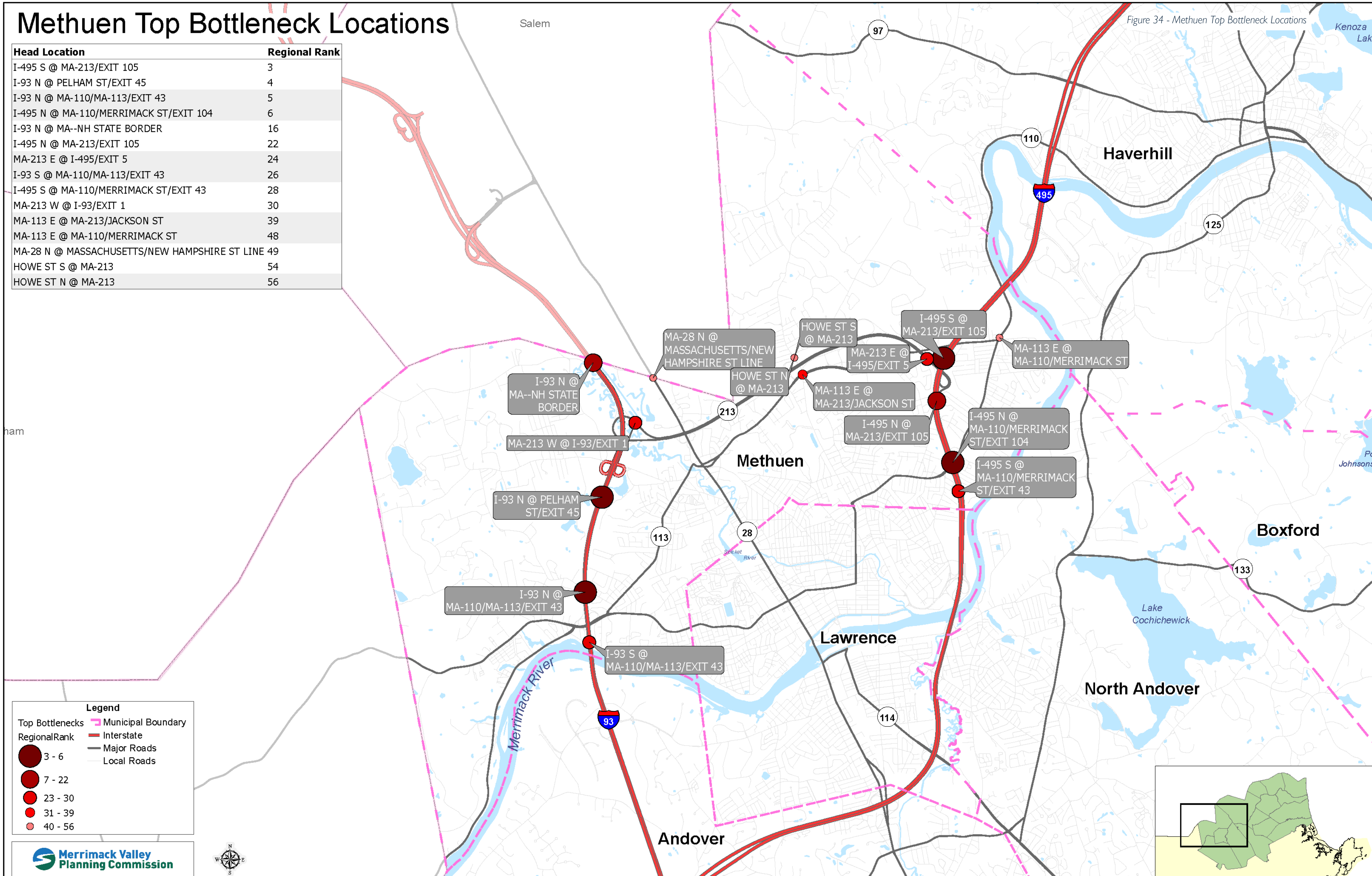
Head Location	Regional Rank
I-495 N @ BROAD ST/EXIT 115	59
MA-110 W @ BIRCHMEADOW RD	86
I-495 S @ BROAD ST/EXIT 115	189
BROAD ST N @ RT-110/E MAIN ST	217
MA-110 E @ BROAD ST	313
MA-110 W @ BROAD ST	339
BROAD ST N @ I-495	363
BROAD ST N @ MA-110/E MAIN ST	424
MA-110 E @ BIRCHMEADOW RD	429
RIVER RD E @ MIDDLE RD/NORTH ST	441



Merrimack Valley Planning Commission

Methuen Top Bottleneck Locations

Head Location	Regional Rank
I-495 S @ MA-213/EXIT 105	3
I-93 N @ PELHAM ST/EXIT 45	4
I-93 N @ MA-110/MA-113/EXIT 43	5
I-495 N @ MA-110/MERRIMACK ST/EXIT 104	6
I-93 N @ MA--NH STATE BORDER	16
I-495 N @ MA-213/EXIT 105	22
MA-213 E @ I-495/EXIT 5	24
I-93 S @ MA-110/MA-113/EXIT 43	26
I-495 S @ MA-110/MERRIMACK ST/EXIT 43	28
MA-213 W @ I-93/EXIT 1	30
MA-113 E @ MA-213/JACKSON ST	39
MA-113 E @ MA-110/MERRIMACK ST	48
MA-28 N @ MASSACHUSETTS/NEW HAMPSHIRE ST LINE	49
HOWE ST S @ MA-213	54
HOWE ST N @ MA-213	56



Newbury Top Bottleneck Locations

Head Location	Regional Rank
I-95 S @ SCOTLAND RD/EXIT 83	90
I-95 N @ CENTRAL ST/EXIT 81	107
US-1 S @ BOSTON RD	151
I-95 S @ CENTRAL ST/EXIT 81	169
CENTRAL ST N @ ORCHARD ST	178
PARKER ST E @ RT-1A/HIGH RD	286
CENTRAL ST N @ MAIN ST	311
US-1 N @ BOSTON RD	333
MA-1A S @ PARKER ST	342
MA-1A N @ PARKER ST	386

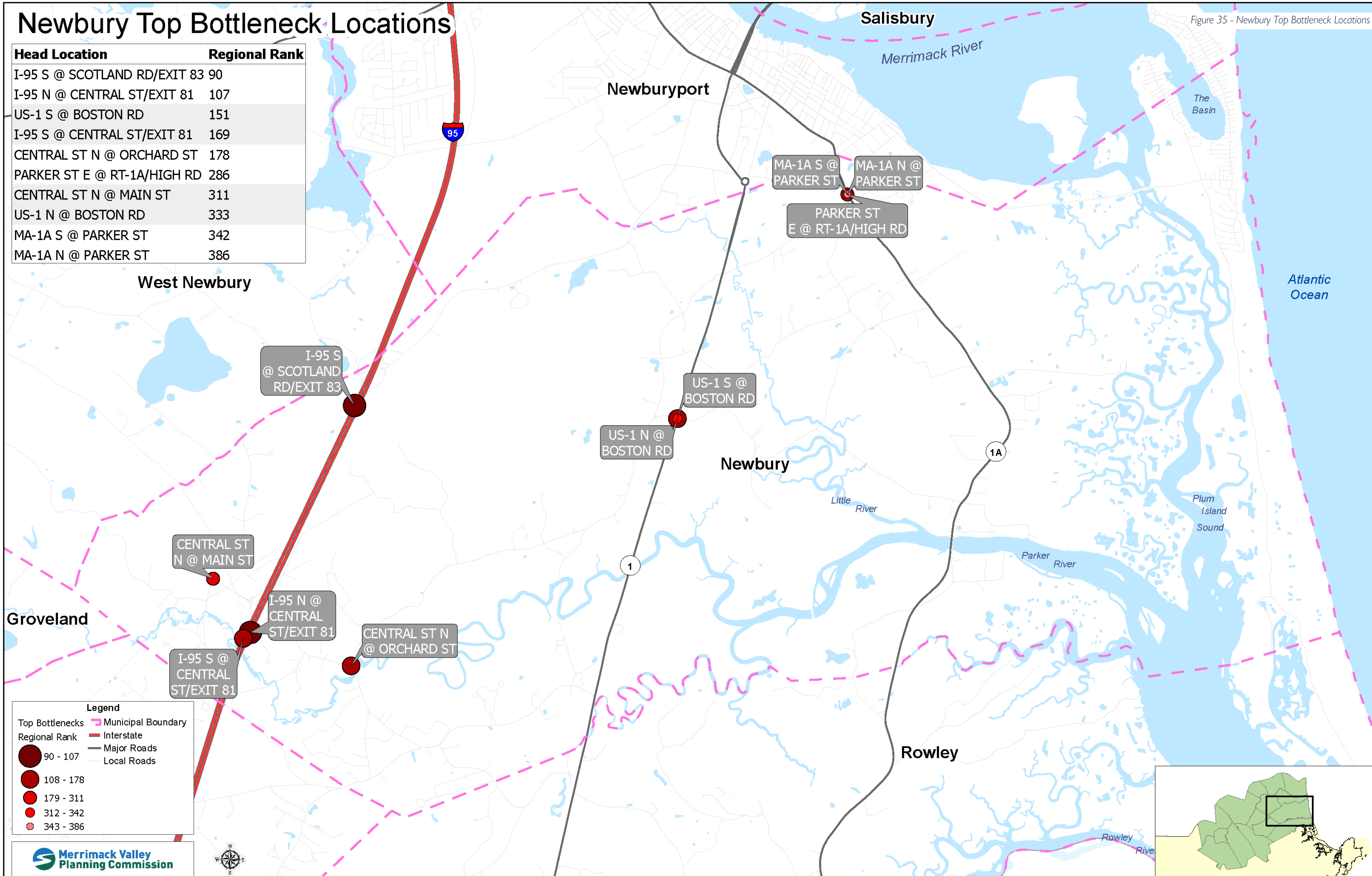


Figure 35 - Newbury Top Bottleneck Locations

Newburyport Top Bottleneck Locations

Head Location	Regional Rank
MA-113 W @ FERRY RD	72
STATE ST N @ RT-1A/HIGH ST	83
I-95 N @ MA-113/STOREY AVE/EXIT 86	89
MOSELEY AVE S @ RT-113/HIGH ST	113
FERRY RD E @ RT-113/STOREY AVE	132
I-95 S @ MA-113/STOREY AVE/EXIT 86	138
MA-113 E @ US-1/WINTER ST	171
SPOFFORD ST S @ MERRIMAC ST/MOSELEY AVE	179
MA-113 W @ I-95	185
US-1 N @ SUMMER ST/WINTER ST	188

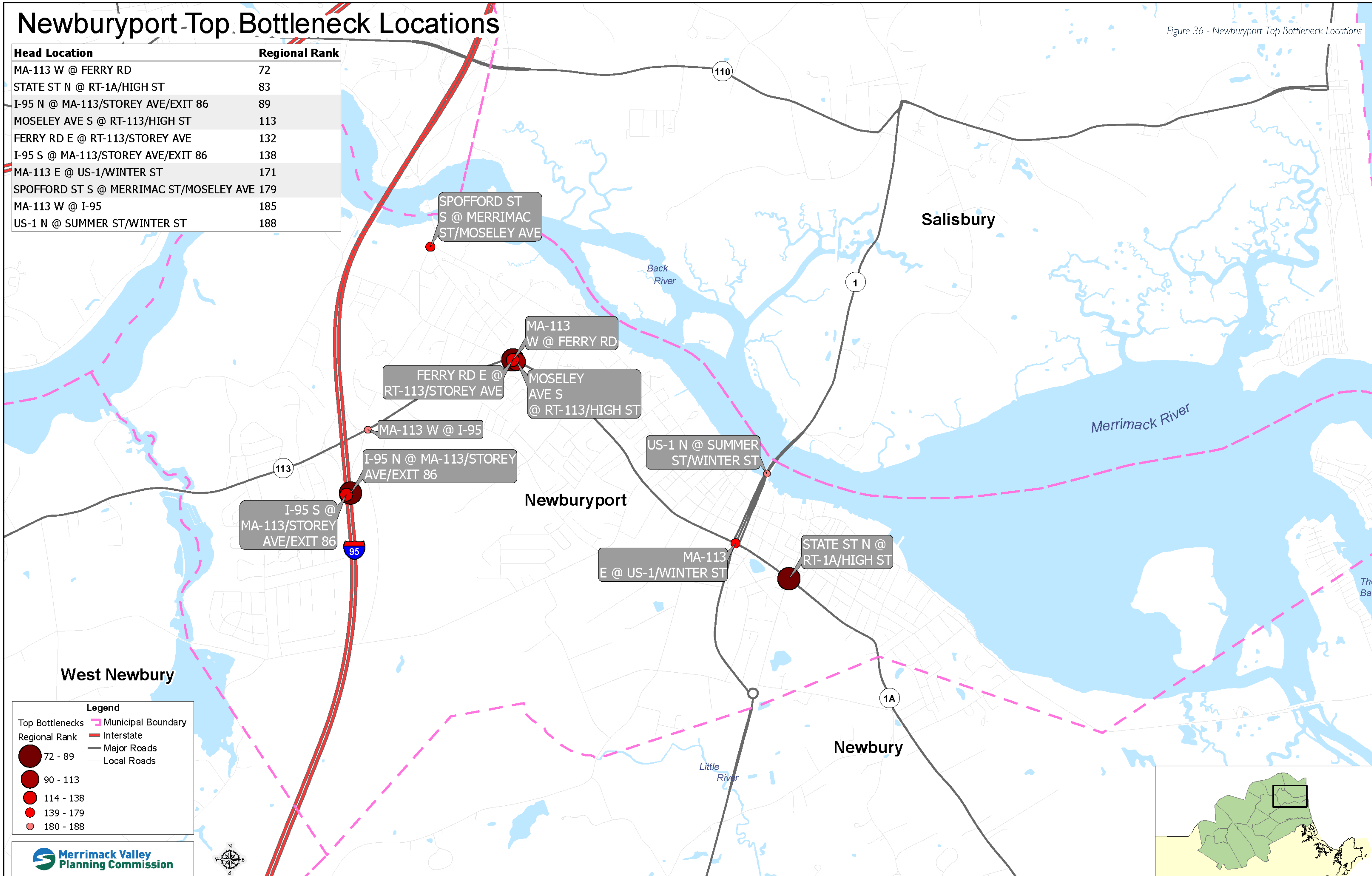
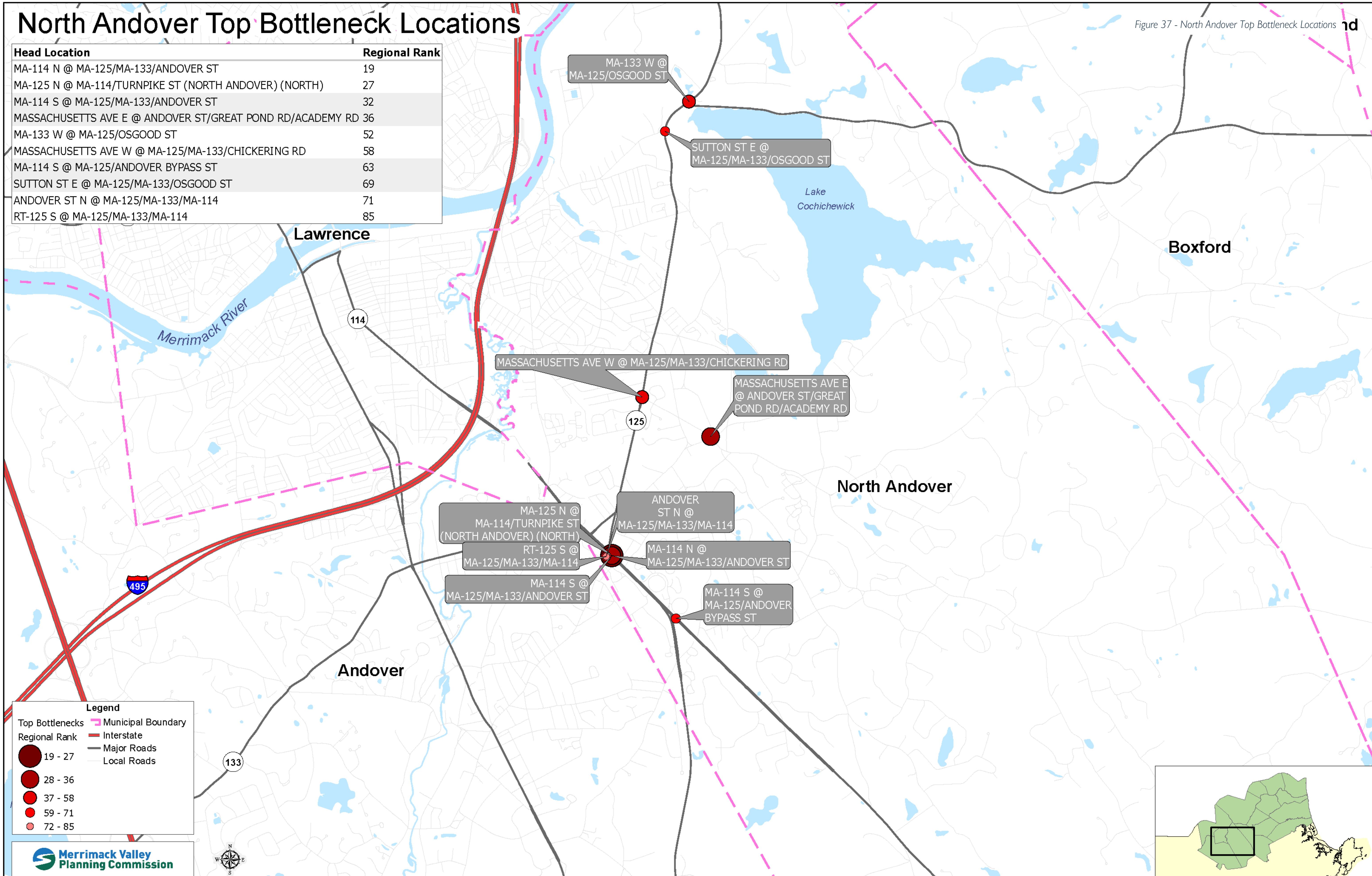


Figure 36 - Newburyport Top Bottleneck Locations

North Andover Top Bottleneck Locations

Head Location	Regional Rank
MA-114 N @ MA-125/MA-133/ANDOVER ST	19
MA-125 N @ MA-114/TURNPIKE ST (NORTH ANDOVER) (NORTH)	27
MA-114 S @ MA-125/MA-133/ANDOVER ST	32
MASSACHUSETTS AVE E @ ANDOVER ST/GREAT POND RD/ACADEMY RD	36
MA-133 W @ MA-125/OSGOOD ST	52
MASSACHUSETTS AVE W @ MA-125/MA-133/CHICKERING RD	58
MA-114 S @ MA-125/ANDOVER BYPASS ST	63
SUTTON ST E @ MA-125/MA-133/OSGOOD ST	69
ANDOVER ST N @ MA-125/MA-133/MA-114	71
RT-125 S @ MA-125/MA-133/MA-114	85



Rowley Top Bottleneck Locations

Head Location	Regional Rank
US-1 N @ MA-133/HAVERHILL ST	40
MA-133 E @ US-1/NEWBURYPORT TPKE	44
US-1 S @ MA-133/HAVERHILL ST	55
MA-133 W @ US-1/NEWBURYPORT TPKE	66
US-1 S @ WETHERSFIELD ST	137
MA-1A N @ MA-133/HAVERHILL ST	222
MA-133 W @ MA-1A/MAIN ST	266
CENTRAL ST N @ US-1/NEWBURYPORT TPKE	347
CENTRAL ST N @ MA-1A/MAIN ST	381
US-1 N @ WETHERSFIELD ST	412

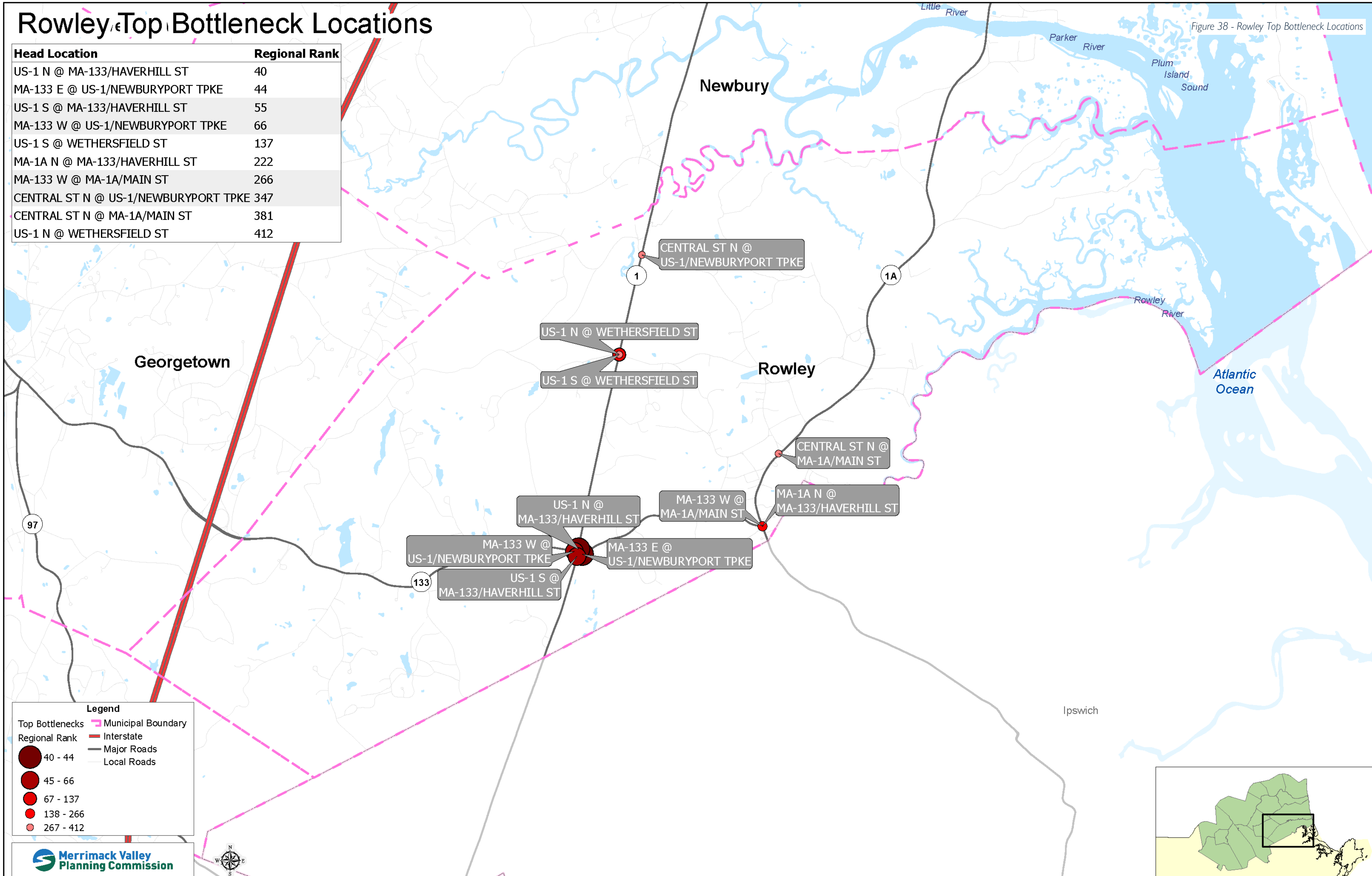


Figure 38 - Rowley Top Bottleneck Locations

Salisbury Top Bottleneck Locations

Head Location	Regional Rank
US-1 N @ MA-110/PLEASANT ST/SCHOOL ST/ELM ST	37
I-495 N @ I-95	43
US-1 S @ MA-110/PLEASANT ST/SCHOOL ST/ELM ST	47
MERRILL ST S @ MA-110/ELM ST	93
MERRILL ST N @ MA-110/ELM ST	97
TOLL RD N @ US-1/LAFAYETTE RD	104
MAIN ST W @ TOLL RD EXT/TOLL RD	118
MA-110 E @ US-1/BRIDGE RD/SALISBURY SQ	123
I-495 S @ I-95	126
I-95 S @ MA-286/EXIT 90	141

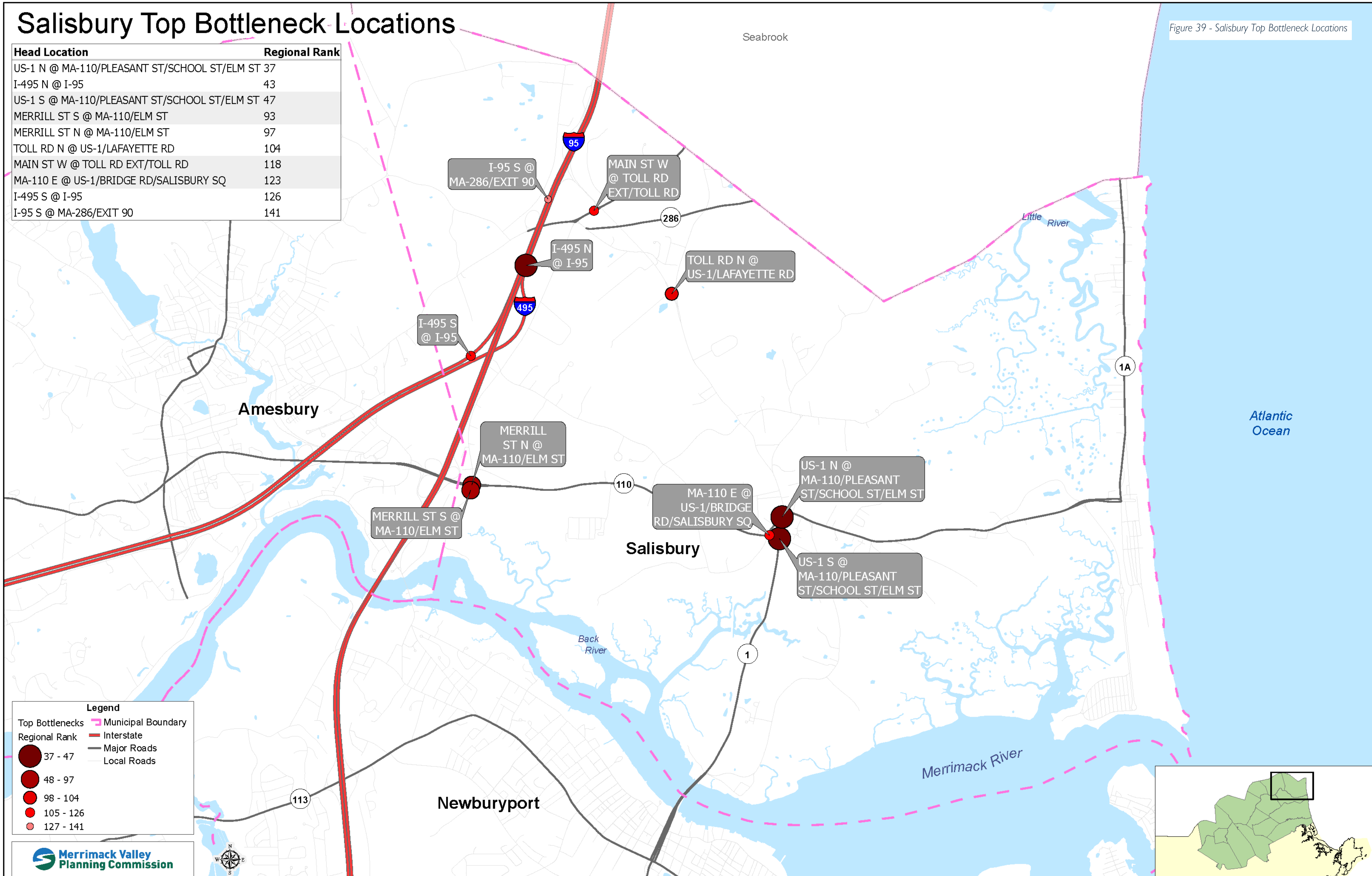


Figure 39 - Salisbury Top Bottleneck Locations

West Newbury Top Bottleneck Locations

Head Location	Regional Rank
I-95 N @ SCOTLAND RD/EXIT 83	135
MA-113 W @ BACHELLOR ST	442
SOUTH ST E @ MAIN ST	511
MA-113 W @ GARDEN ST	540
MA-113 E @ BACHELLOR ST	560
SOUTH ST W @ MAIN ST	643

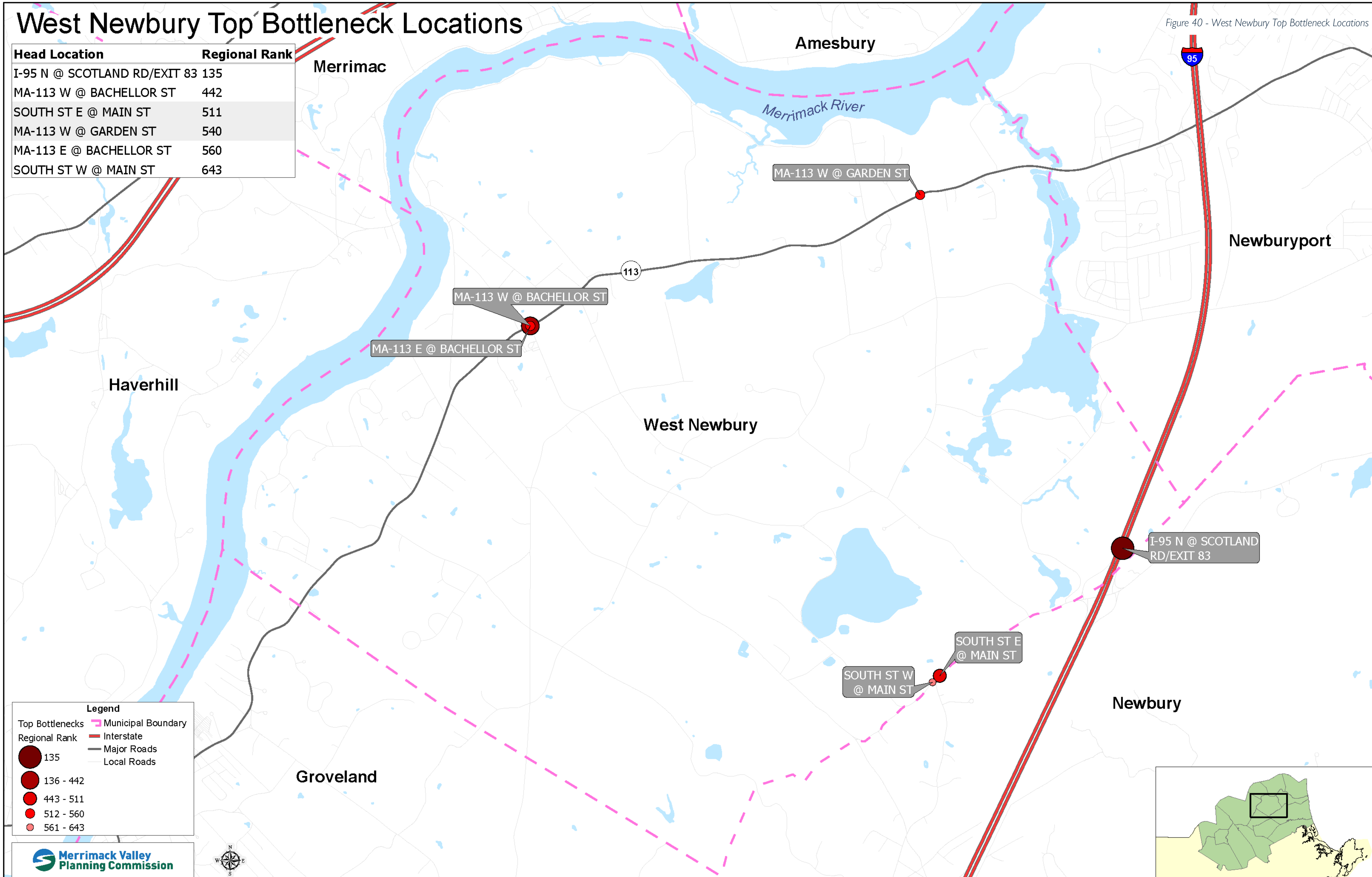


Figure 40 - West Newbury Top Bottleneck Locations

Appendix D: Commute Mode by Community

This data is sourced from American Community Survey 5-year Estimates Table B08301. Non-Single Occupancy Vehicle (non-SOV) travel to work is measured by the percentage of travel to work that is done by a mode other than driving alone. This includes transit, active modes, carpooling, and working from home.

Amesbury

Table 16 - Amesbury Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	87.40%	87.00%	87.79%	85.11%	82.12%	80.44%
Drove Alone	77.20%	78.41%	79.31%	78.30%	75.65%	74.10%
Carpooled	10.20%	8.60%	8.48%	6.82%	6.47%	6.35%
Public Transportation	1.89%	1.90%	1.77%	1.62%	1.78%	1.25%
Bicycle	0.25%	0.23%	0.24%	0.24%	0.15%	0.30%
Walked	1.37%	1.24%	1.31%	1.96%	2.59%	2.02%
Worked from Home	7.54%	7.74%	7.93%	10.23%	12.77%	15.40%
Taxicab	0.09%	0.11%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.08%	0.25%	0.15%	0.16%	0.21%	0.13%
Other means	1.37%	1.53%	0.81%	0.68%	0.38%	0.45%
Non-SOV	22.80%	21.59%	20.69%	21.70%	24.35%	25.90%

Andover

Table 17 - Andover Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	81.16%	81.82%	75.69%	69.41%	66.73%	65.84%
Drove Alone	74.76%	75.94%	69.80%	65.23%	62.60%	61.53%
Carpooled	6.40%	5.87%	5.88%	4.18%	4.13%	4.31%
Public Transportation	5.07%	5.14%	4.30%	4.05%	3.39%	2.67%
Bicycle	0.31%	0.23%	0.10%	0.01%	0.02%	0.00%
Walked	3.34%	3.03%	3.53%	3.28%	2.77%	3.20%
Worked from Home	8.91%	8.59%	14.94%	21.71%	25.82%	27.20%
Taxicab	0.16%	0.30%	0.43%	0.26%	0.28%	0.27%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	1.04%	0.89%	1.02%	1.29%	0.98%	0.82%
Non-SOV	25.24%	24.06%	30.20%	34.77%	37.40%	38.47%

Boxford

Table 18 - Boxford Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	86.74%	84.48%	81.08%	77.07%	75.15%	72.01%
Drove Alone	77.18%	76.06%	75.53%	72.76%	69.63%	68.29%
Carpooled	9.57%	8.42%	5.55%	4.32%	5.52%	3.73%
Public Transportation	1.71%	3.18%	2.96%	1.79%	1.42%	1.41%
Bicycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walked	0.00%	0.00%	2.40%	2.60%	2.98%	3.00%
Worked from Home	10.57%	9.73%	12.28%	14.32%	15.68%	19.03%
Taxicab	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	0.98%	2.61%	1.27%	4.22%	4.77%	4.56%
Non-SOV	22.82%	23.94%	24.47%	27.24%	30.37%	31.71%

Georgetown

Table 19 - Georgetown Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	93.16%	92.26%	91.28%	86.24%	86.27%	82.84%
Drove Alone	87.48%	85.65%	82.08%	78.53%	78.39%	73.97%
Carpooled	5.68%	6.60%	9.20%	7.71%	7.88%	8.87%
Public Transportation	1.19%	1.46%	1.57%	1.36%	1.26%	1.02%
Bicycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walked	0.19%	0.53%	0.46%	0.20%	0.38%	0.35%
Worked from Home	5.41%	5.68%	6.32%	11.79%	11.82%	15.53%
Taxicab	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	0.06%	0.08%	0.37%	0.41%	0.27%	0.26%
Non-SOV	12.52%	14.35%	17.92%	21.47%	21.61%	26.03%

Groveland

Table 20 - Groveland Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	88.43%	89.88%	87.40%	88.82%	86.57%	82.36%
Drove Alone	80.36%	80.72%	77.12%	77.83%	77.84%	75.25%
Carpooled	8.07%	9.17%	10.29%	10.98%	8.73%	7.11%
Public Transportation	1.88%	1.71%	0.84%	0.86%	1.05%	0.48%
Bicycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walked	1.05%	1.00%	1.36%	0.00%	0.00%	0.00%
Worked from Home	7.68%	6.53%	10.39%	10.33%	12.38%	16.71%
Taxicab	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	0.97%	0.87%	0.00%	0.00%	0.00%	0.45%
Non-SOV	19.64%	19.28%	22.88%	22.17%	22.16%	24.75%

Haverhill

Table 21 - Haverhill Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	88.70%	90.01%	89.22%	87.73%	86.33%	83.55%
Drove Alone	77.47%	79.95%	80.21%	79.57%	79.31%	76.96%
Carpooled	11.23%	10.06%	9.01%	8.16%	7.02%	6.59%
Public Transportation	4.23%	3.42%	3.54%	2.87%	1.91%	1.70%
Bicycle	0.10%	0.18%	0.07%	0.08%	0.09%	0.18%
Walked	2.24%	2.06%	1.93%	1.89%	1.68%	1.57%
Worked from Home	3.39%	2.86%	3.76%	6.10%	8.73%	11.64%
Taxicab	0.26%	0.37%	0.36%	0.38%	0.47%	0.36%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%
Other means	1.07%	1.10%	1.12%	0.95%	0.80%	0.97%
Non-SOV	22.53%	20.05%	19.79%	20.43%	20.69%	23.04%

Lawrence

Table 22 - Lawrence Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	82.12%	84.17%	85.92%	84.66%	82.62%	80.76%
Drove Alone	66.09%	68.36%	70.29%	69.40%	68.98%	67.20%
Carpooled	16.03%	15.81%	15.64%	15.26%	13.63%	13.56%
Public Transportation	4.21%	4.06%	3.73%	3.24%	3.42%	3.59%
Bicycle	0.36%	0.31%	0.18%	0.29%	0.43%	0.43%
Walked	5.14%	4.44%	3.56%	4.17%	3.55%	3.02%
Worked from Home	2.89%	2.04%	2.36%	3.30%	4.34%	5.74%
Taxicab	3.08%	2.51%	2.46%	2.56%	2.90%	3.26%
Motorcycle	0.02%	0.02%	0.03%	0.03%	0.00%	0.00%
Other means	2.19%	2.44%	1.75%	1.77%	2.74%	3.20%
Non-SOV	33.91%	31.64%	29.71%	30.60%	31.02%	32.80%

Merrimac

Table 23 - Merrimac Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	85.55%	85.49%	86.39%	85.17%	85.02%	86.01%
Drove Alone	79.33%	75.46%	76.20%	78.22%	78.05%	82.25%
Carpooled	6.22%	10.03%	10.19%	6.94%	6.97%	3.77%
Public Transportation	2.92%	2.73%	0.59%	0.28%	0.31%	0.00%
Bicycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walked	0.61%	0.48%	0.48%	1.11%	1.27%	1.31%
Worked from Home	9.63%	10.16%	10.55%	10.39%	10.35%	9.83%
Taxicab	0.00%	0.48%	0.70%	2.44%	2.43%	2.24%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	1.29%	0.66%	1.29%	0.61%	0.62%	0.60%
Non-SOV	20.67%	24.54%	23.80%	21.78%	21.95%	17.75%

Methuen

Table 24 - Methuen Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	92.65%	92.29%	89.80%	86.60%	85.65%	84.69%
Drove Alone	84.20%	83.52%	81.57%	77.80%	76.98%	75.92%
Carpooled	8.45%	8.76%	8.23%	8.80%	8.68%	8.77%
Public Transportation	1.52%	1.45%	1.30%	1.31%	1.07%	1.06%
Bicycle	0.07%	0.07%	0.05%	0.08%	0.00%	0.00%
Walked	1.01%	1.14%	1.44%	1.85%	1.52%	1.33%
Worked from Home	3.26%	3.21%	6.00%	8.79%	10.00%	10.77%
Taxicab	0.13%	0.14%	0.18%	0.20%	0.17%	0.56%
Motorcycle	0.04%	0.04%	0.05%	0.03%	0.03%	0.00%
Other means	1.31%	1.68%	1.18%	1.15%	1.55%	1.60%
Non-SOV	15.80%	16.48%	18.43%	22.20%	23.02%	24.08%

Newbury

Table 25 - Newbury Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	76.38%	79.10%	77.07%	75.18%	75.91%	75.98%
Drove Alone	72.88%	74.39%	73.66%	72.30%	75.01%	70.41%
Carpooled	3.50%	4.71%	3.40%	2.88%	0.91%	5.57%
Public Transportation	5.65%	2.83%	1.72%	0.80%	0.72%	0.00%
Bicycle	0.47%	0.42%	0.40%	0.39%	0.31%	0.00%
Walked	2.29%	2.71%	2.85%	4.46%	2.82%	3.85%
Worked from Home	13.53%	13.98%	16.28%	18.52%	20.23%	20.16%
Taxicab	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	1.68%	0.95%	1.69%	0.64%	0.00%	0.00%
Non-SOV	27.12%	25.61%	26.34%	27.70%	24.99%	29.59%

Newburyport

Table 26 - Newburyport Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	76.47%	78.20%	78.70%	74.62%	69.96%	67.02%
Drove Alone	70.75%	70.35%	70.77%	66.13%	61.72%	63.14%
Carpooled	5.72%	7.86%	7.93%	8.48%	8.23%	3.88%
Public Transportation	4.08%	3.39%	3.05%	3.58%	3.51%	3.04%
Bicycle	0.55%	0.52%	0.24%	0.15%	0.32%	0.51%
Walked	6.07%	5.11%	5.72%	4.55%	5.74%	4.58%
Worked from Home	11.19%	10.99%	10.50%	15.87%	18.82%	23.59%
Taxicab	0.61%	0.79%	0.65%	0.16%	0.30%	0.23%
Motorcycle	0.29%	0.05%	0.06%	0.07%	0.00%	0.00%
Other means	0.74%	0.95%	1.08%	1.01%	1.34%	1.04%
Non-SOV	29.25%	29.65%	29.23%	33.87%	38.28%	36.86%

North Andover

Table 27 - North Andover Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	86.29%	85.18%	82.52%	78.66%	75.30%	73.97%
Drove Alone	79.20%	78.59%	77.52%	74.43%	70.66%	68.88%
Carpooled	7.09%	6.59%	5.00%	4.23%	4.64%	5.09%
Public Transportation	3.70%	4.38%	3.49%	2.84%	2.46%	2.55%
Bicycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walked	1.66%	1.61%	1.47%	1.71%	1.86%	2.32%
Worked from Home	7.47%	7.27%	10.41%	14.22%	17.44%	18.60%
Taxicab	0.15%	0.23%	0.74%	0.69%	0.81%	0.86%
Motorcycle	0.05%	0.11%	0.10%	0.08%	0.11%	0.11%
Other means	0.69%	1.23%	1.26%	1.80%	2.01%	1.59%
Non-SOV	20.80%	21.41%	22.48%	25.57%	29.34%	31.12%

Rowley

Table 28 - Rowley Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	87.28%	87.23%	91.32%	87.45%	87.01%	89.14%
Drove Alone	79.85%	82.08%	86.79%	82.95%	84.31%	86.68%
Carpooled	7.43%	5.15%	4.54%	4.50%	2.69%	2.45%
Public Transportation	3.41%	2.48%	1.64%	1.47%	0.88%	0.36%
Bicycle	0.56%	0.48%	0.40%	0.00%	0.00%	0.00%
Walked	0.56%	0.62%	0.50%	0.86%	1.24%	1.32%
Worked from Home	7.75%	8.30%	5.31%	9.69%	10.38%	8.66%
Taxicab	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	0.44%	0.90%	0.82%	0.53%	0.49%	0.52%
Non-SOV	20.15%	17.92%	13.21%	17.05%	15.69%	13.32%

Salisbury

Table 29 - Salisbury Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	84.03%	85.56%	83.94%	82.10%	80.28%	82.37%
Drove Alone	76.48%	79.35%	79.08%	78.41%	78.21%	78.37%
Carpooled	7.55%	6.21%	4.86%	3.69%	2.07%	4.00%
Public Transportation	3.22%	2.59%	1.56%	1.59%	1.52%	0.50%
Bicycle	0.20%	0.25%	0.20%	0.16%	0.18%	0.00%
Walked	4.48%	4.26%	2.00%	1.36%	1.77%	0.12%
Worked from Home	7.13%	6.62%	11.70%	14.46%	15.75%	16.64%
Taxicab	0.44%	0.16%	0.14%	0.12%	0.10%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	0.50%	0.56%	0.45%	0.21%	0.39%	0.38%
Non-SOV	23.52%	20.65%	20.92%	21.59%	21.79%	21.63%

West Newbury

Table 30 - West Newbury Commute Mode Percentages

Commute Mode	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022	2019-2023
Car, truck, or van	85.63%	87.26%	83.13%	77.15%	78.15%	75.14%
Drove Alone	76.27%	79.14%	75.83%	73.70%	74.82%	67.88%
Carpooled	9.36%	8.12%	7.30%	3.45%	3.32%	7.27%
Public Transportation	2.57%	2.38%	1.84%	1.96%	0.87%	1.76%
Bicycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walked	0.00%	0.00%	0.04%	0.04%	0.04%	0.04%
Worked from Home	9.11%	8.03%	12.38%	18.04%	18.61%	20.90%
Taxicab	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motorcycle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other means	2.69%	2.33%	2.60%	2.81%	2.33%	2.16%
Non-SOV	23.73%	20.86%	24.17%	26.30%	25.18%	32.12%

Appendix E: Top Job Destinations by Community

The maps in this appendix show the top job destinations for workers living in each Merrimack Valley region municipality per 2022 LODES data. This data is based on cities and Census Designated Places (CDPs). In cases where CDPs are not coterminous with municipal boundaries, the number of people employed in a CDP represented on the map may be lower than the total number of people employed in the municipality.

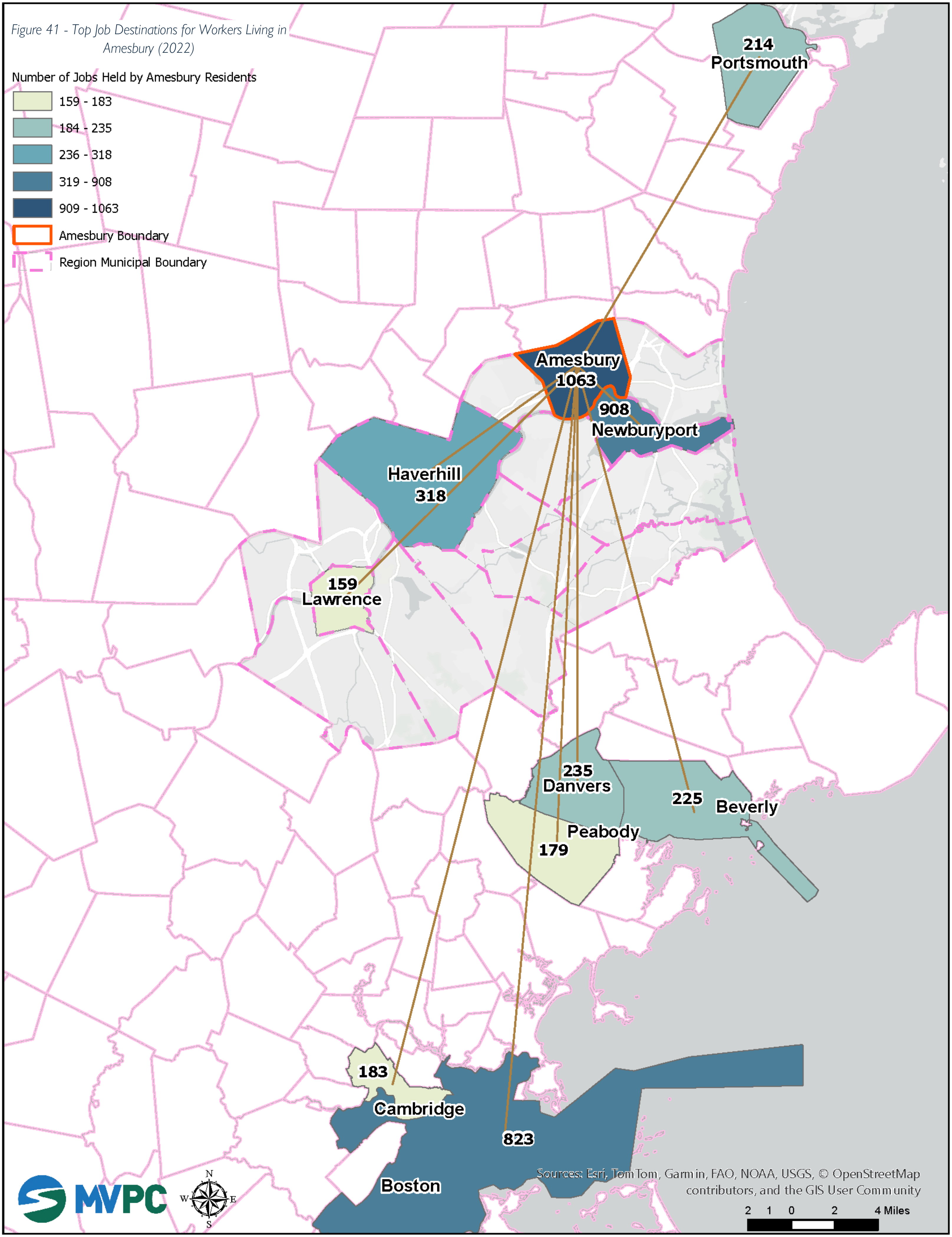


Figure 41 - Top Job Destinations for Workers Living in Amesbury (2022)
Number of Jobs Held by Amesbury Residents
159 - 183
184 - 235
236 - 318
319 - 908
909 - 1063
Amesbury Boundary
Region Municipal Boundary
214
Portsmouth
Amesbury
1063
908
Newburyport
Haverhill
318
159
Lawrence
235
Danvers
225
Beverly
Peabody
179
183
Cambridge
823
Boston
MVPC
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
2 1 0 2 4 Miles

Figure 42 - Top Job Destinations for Workers Living in Andover (2022)

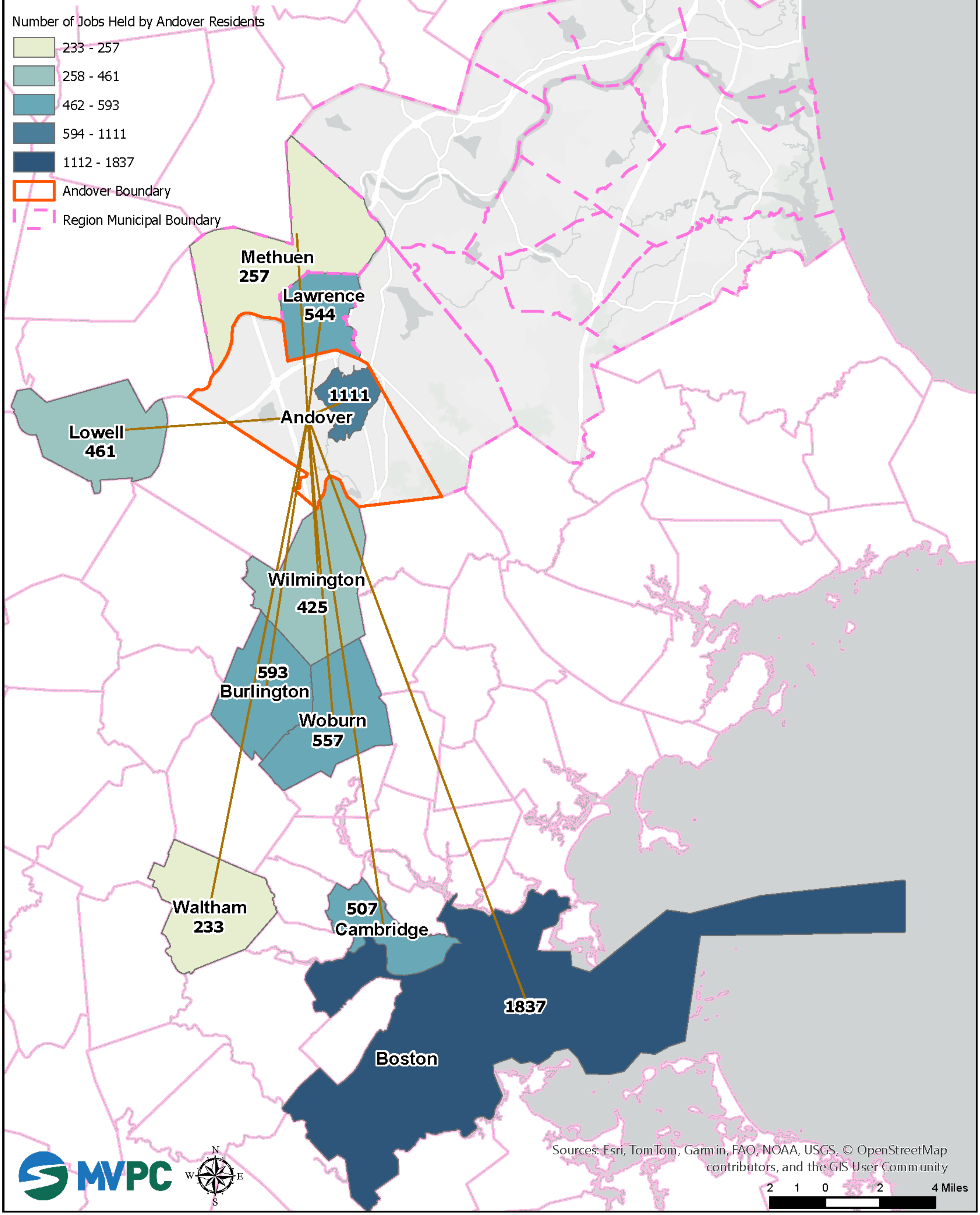


Figure 43 - Top Job Destinations for Workers Living in Boxford (2022)

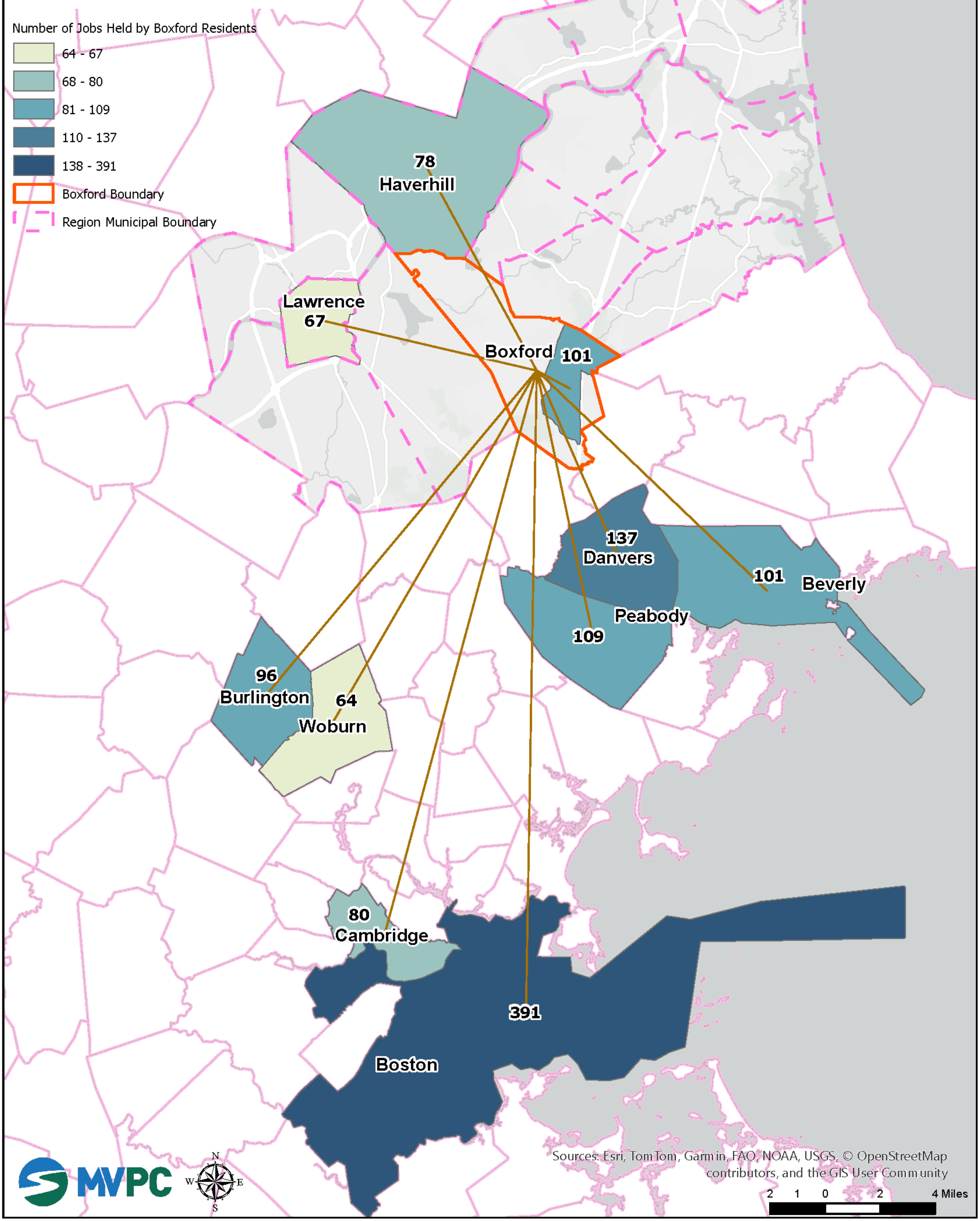


Figure 44 - Top Job Destinations for Workers Living in Georgetown (2022)

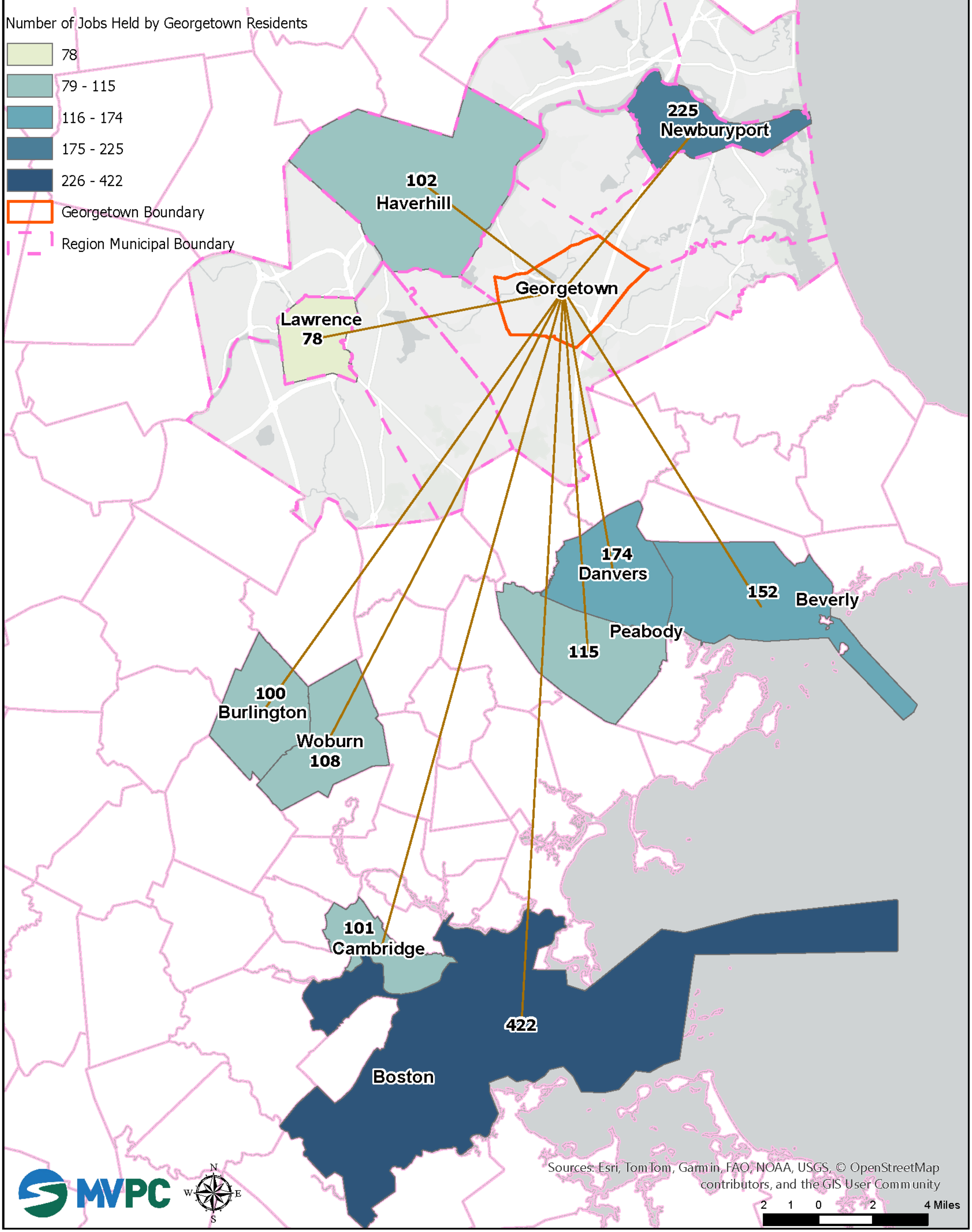
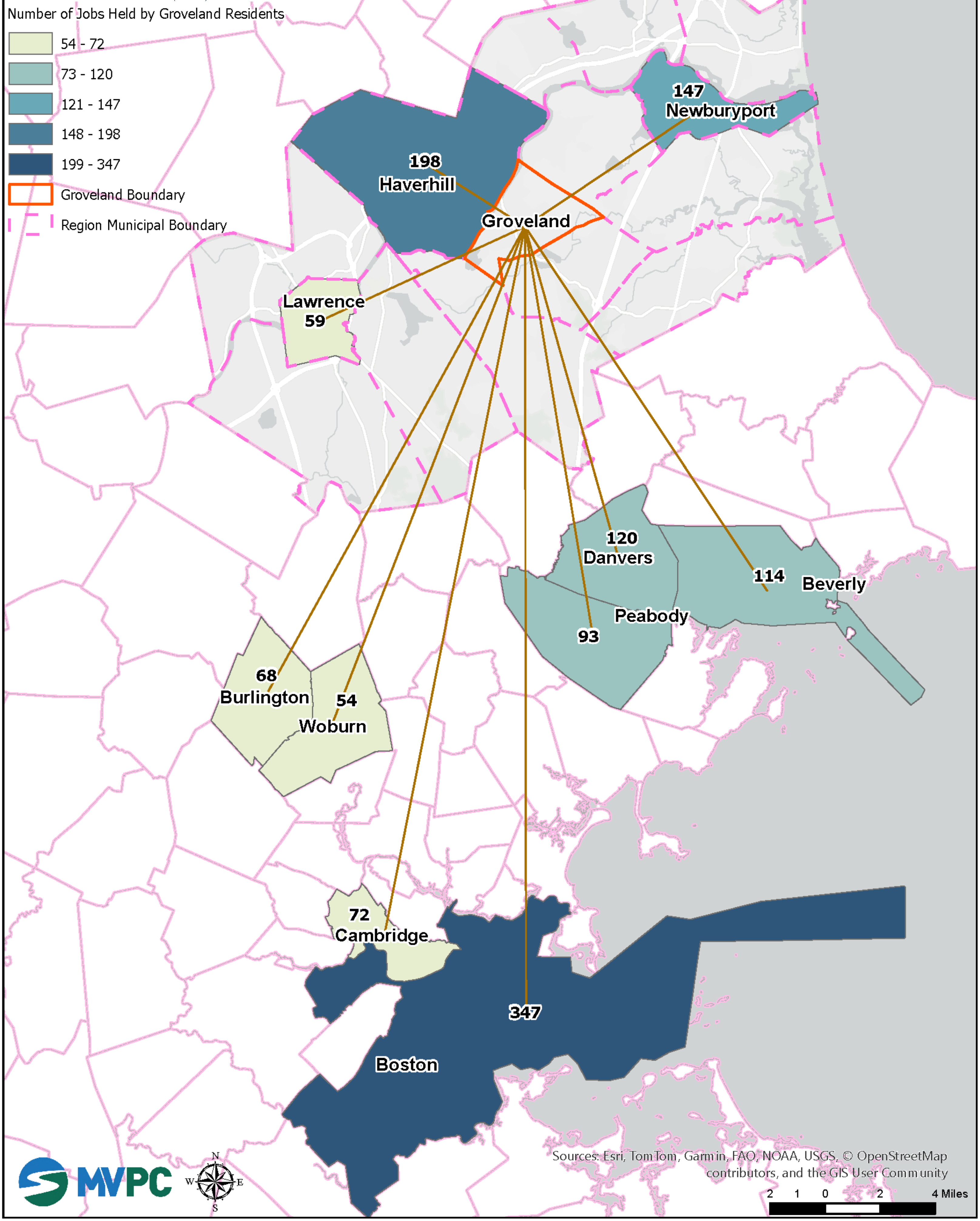


Figure 45 - Top Job Destinations for Workers Living in Groveland (2022)



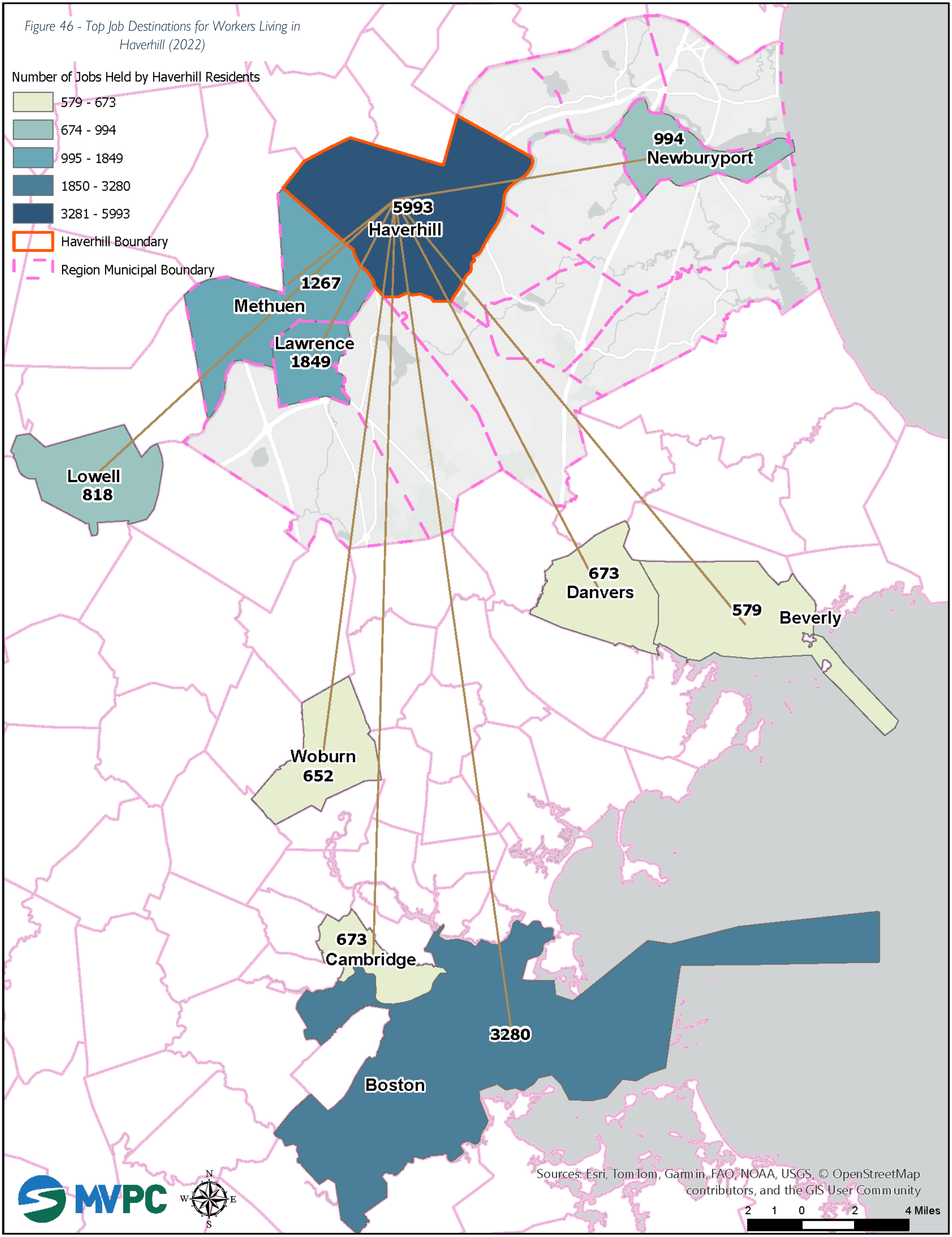


Figure 46 - Top Job Destinations for Workers Living in Haverhill (2022)
Number of Jobs Held by Haverhill Residents
579 - 673
674 - 994
995 - 1849
1850 - 3280
3281 - 5993
Haverhill Boundary
Region Municipal Boundary
5993
Haverhill
994
Newburyport
1267
Methuen
Lawrence
1849
Lowell
818
673
Danvers
579
Beverly
Woburn
652
673
Cambridge
3280
Boston
MVPC
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
2 1 0 2 4 Miles

Figure 47 - Top Job Destinations for Workers Living in Lawrence (2022)

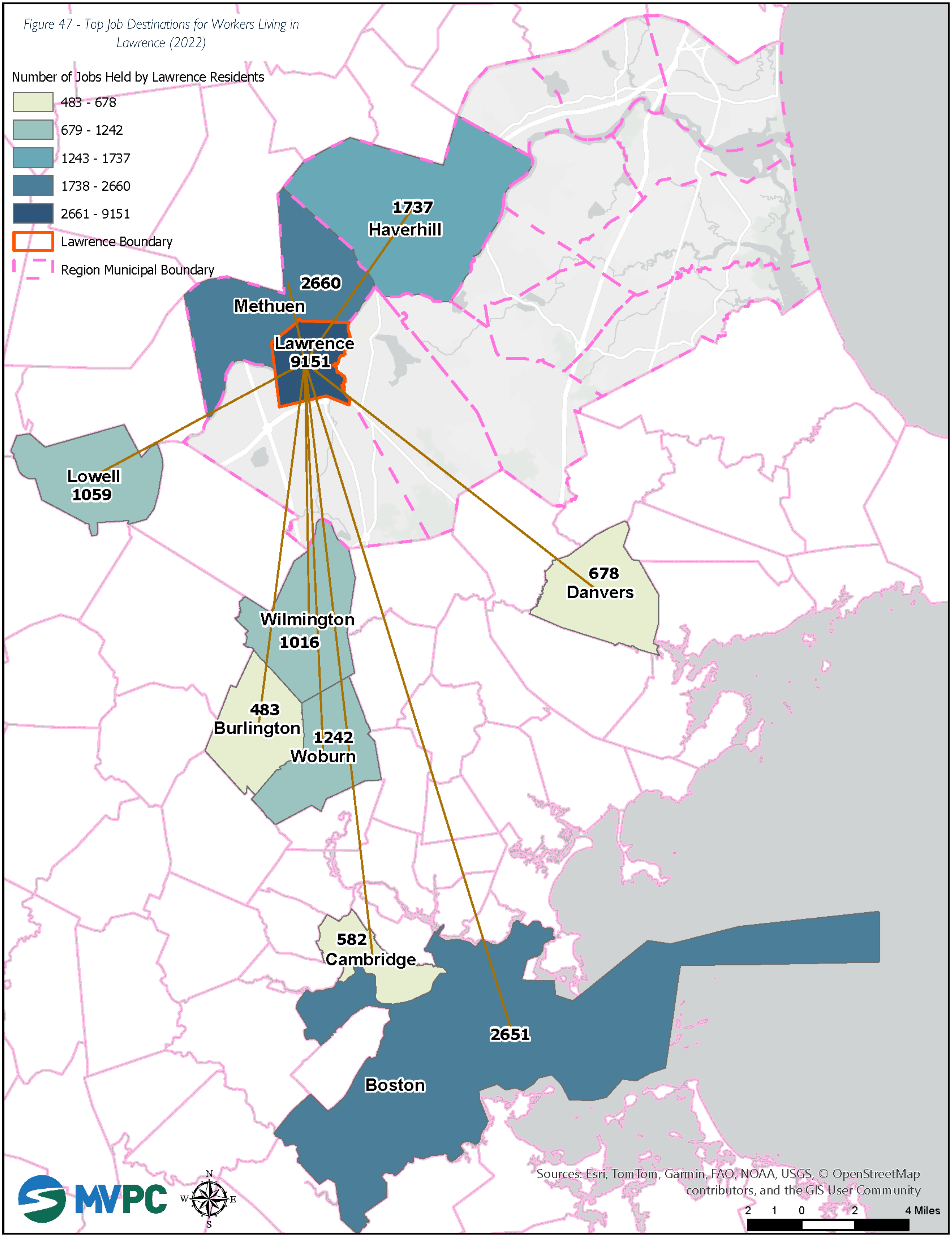


Figure 48 - Top Job Destinations for Workers Living in Merrimac (2022)

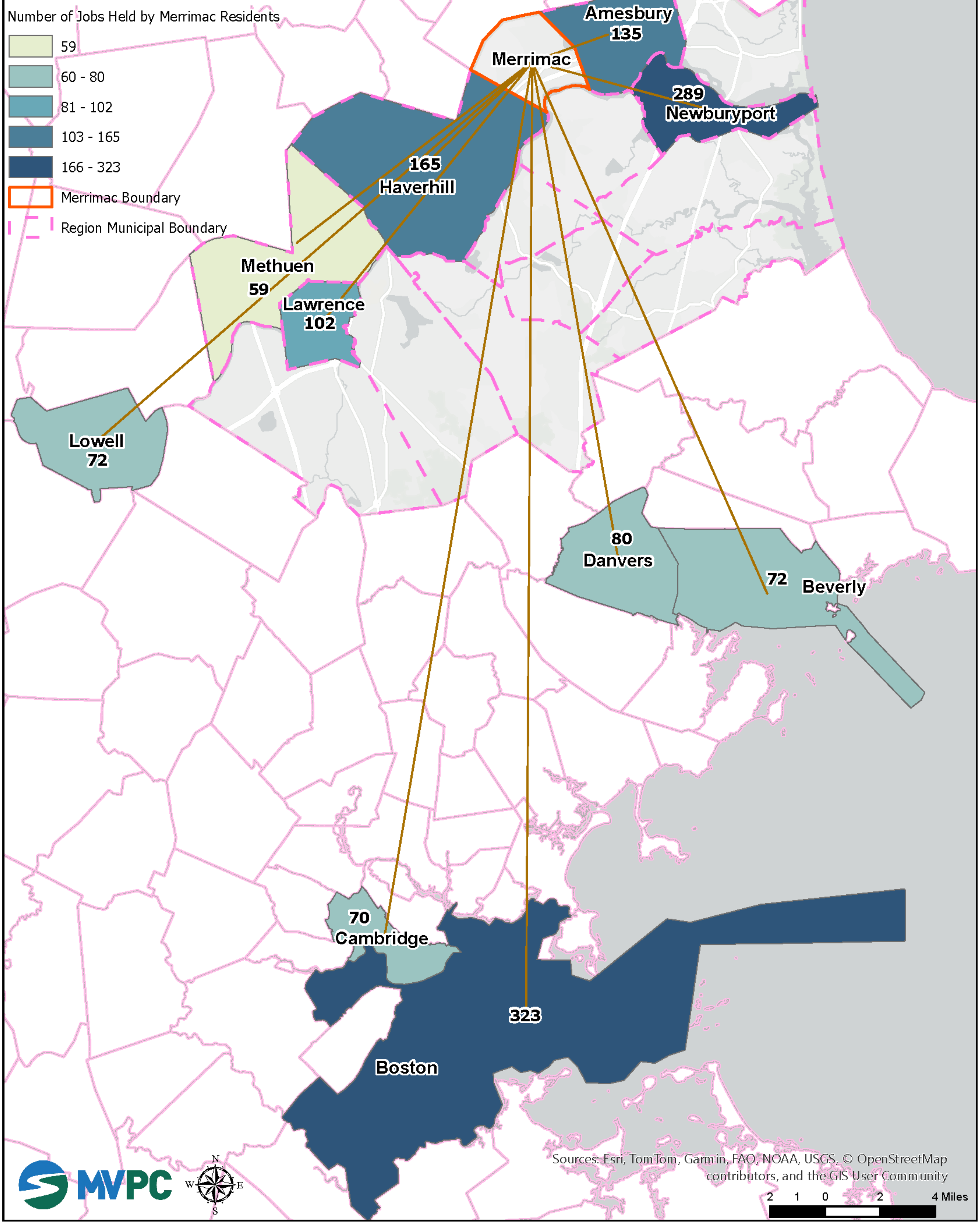


Figure 49 - Top Job Destinations for Workers Living in Methuen (2022)

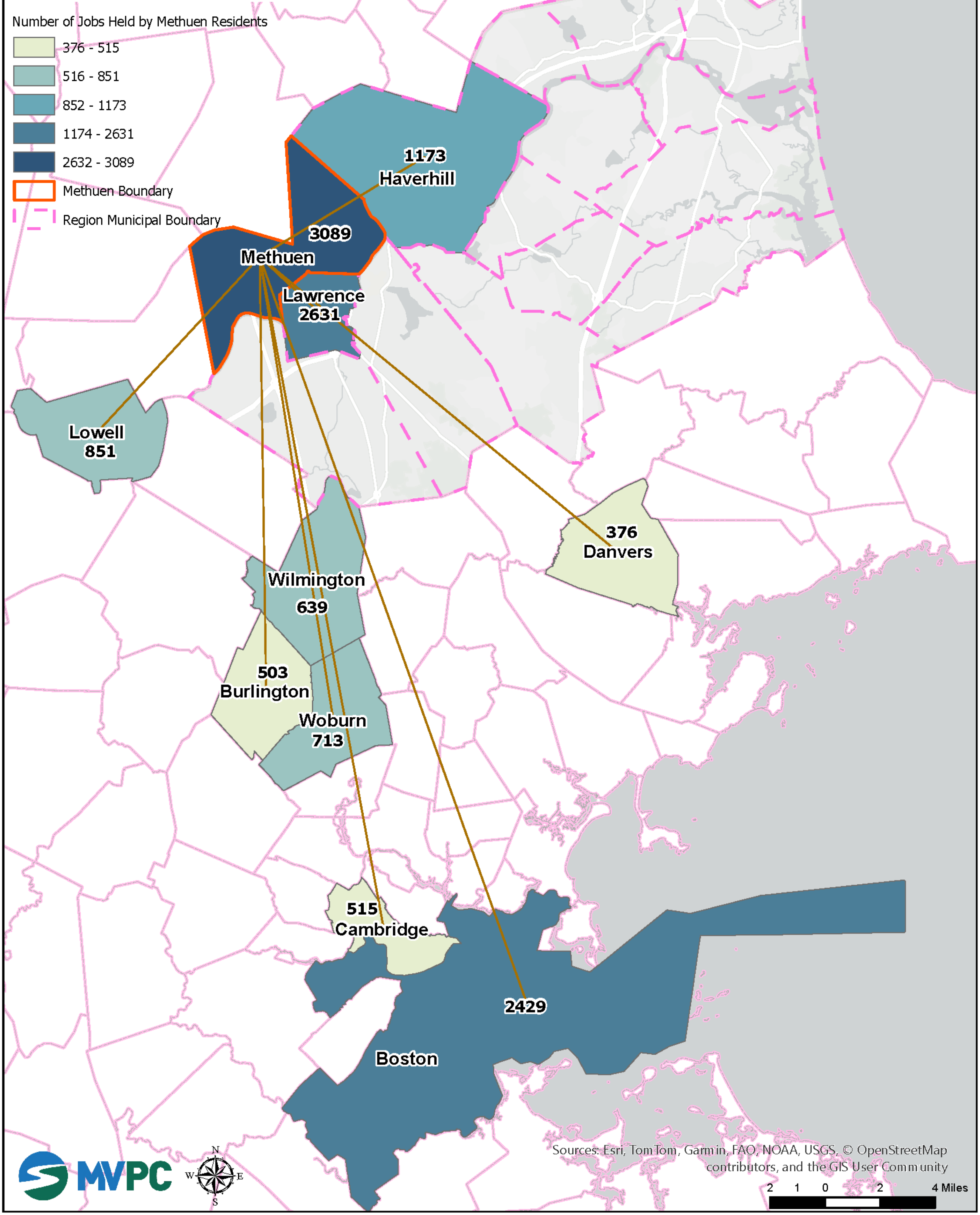
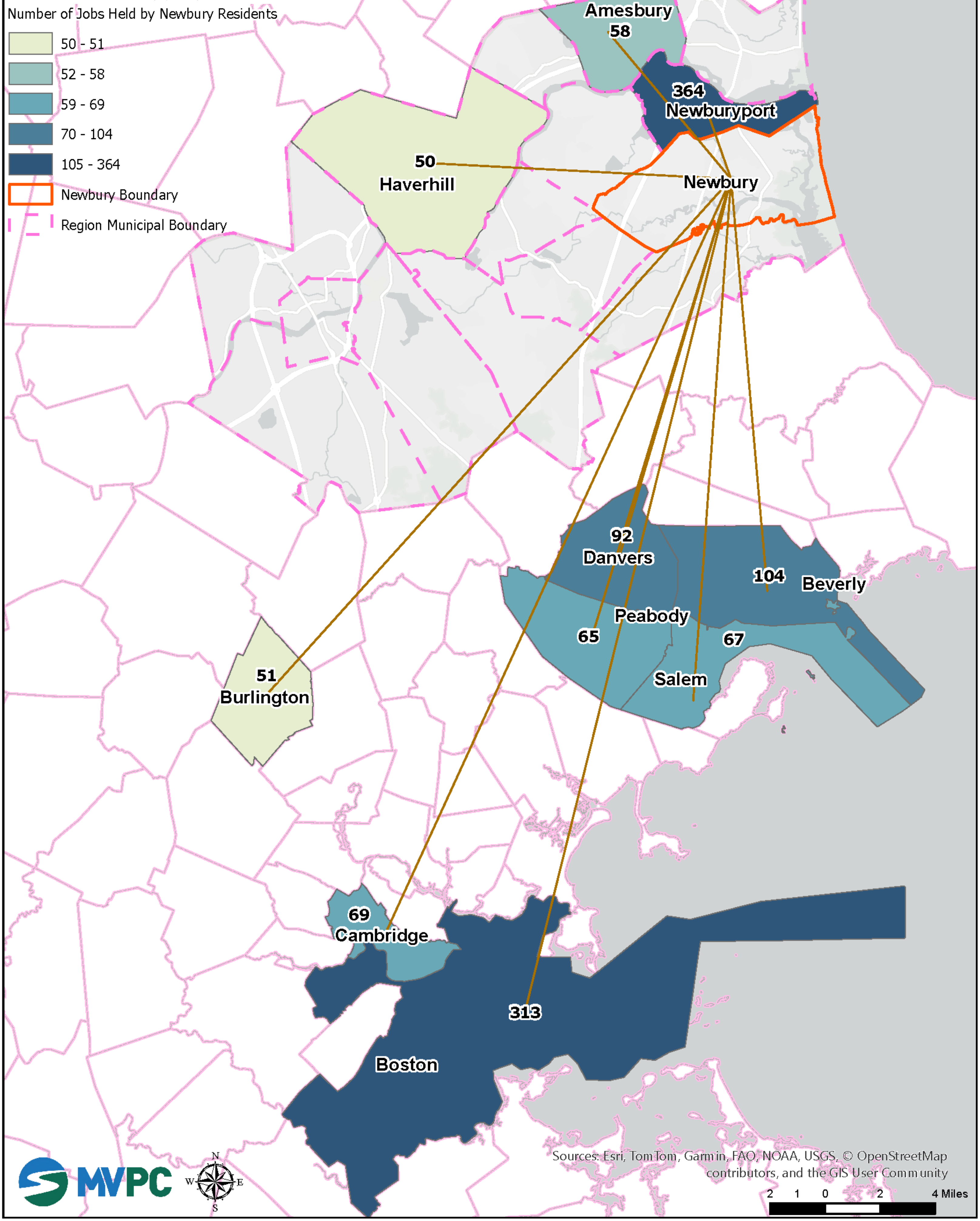


Figure 50 - Top Job Destinations for Workers Living in Newbury (2022)



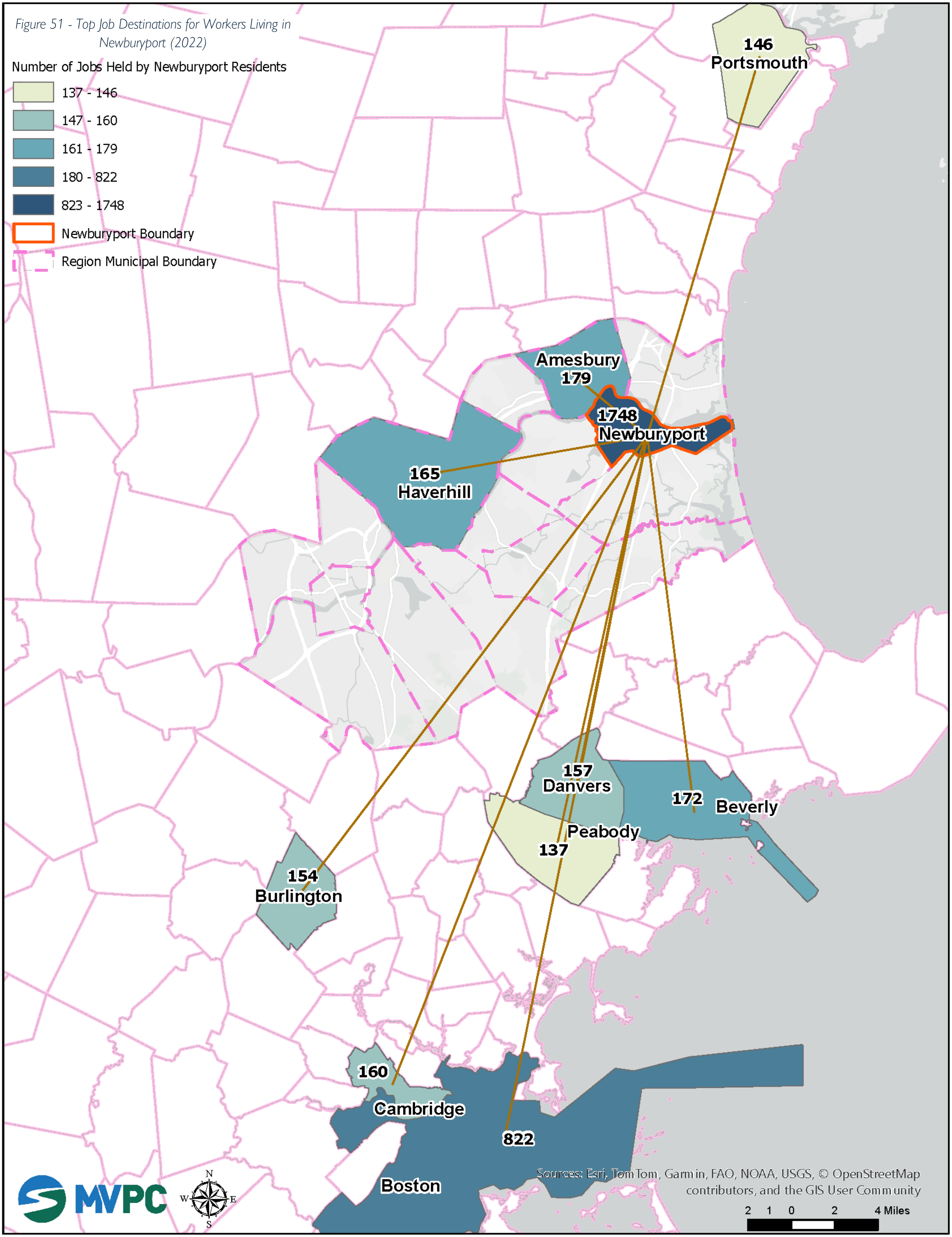


Figure 51 - Top Job Destinations for Workers Living in Newburyport (2022)
Number of Jobs Held by Newburyport Residents
137 - 146
147 - 160
161 - 179
180 - 822
823 - 1748
Newburyport Boundary
Region Municipal Boundary
146
Portsmouth
Amesbury
179
1748
Newburyport
165
Haverhill
157
Danvers
172
Beverly
Peabody
137
154
Burlington
160
Cambridge
822
Boston
MVPC
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
2 1 0 2 4 Miles

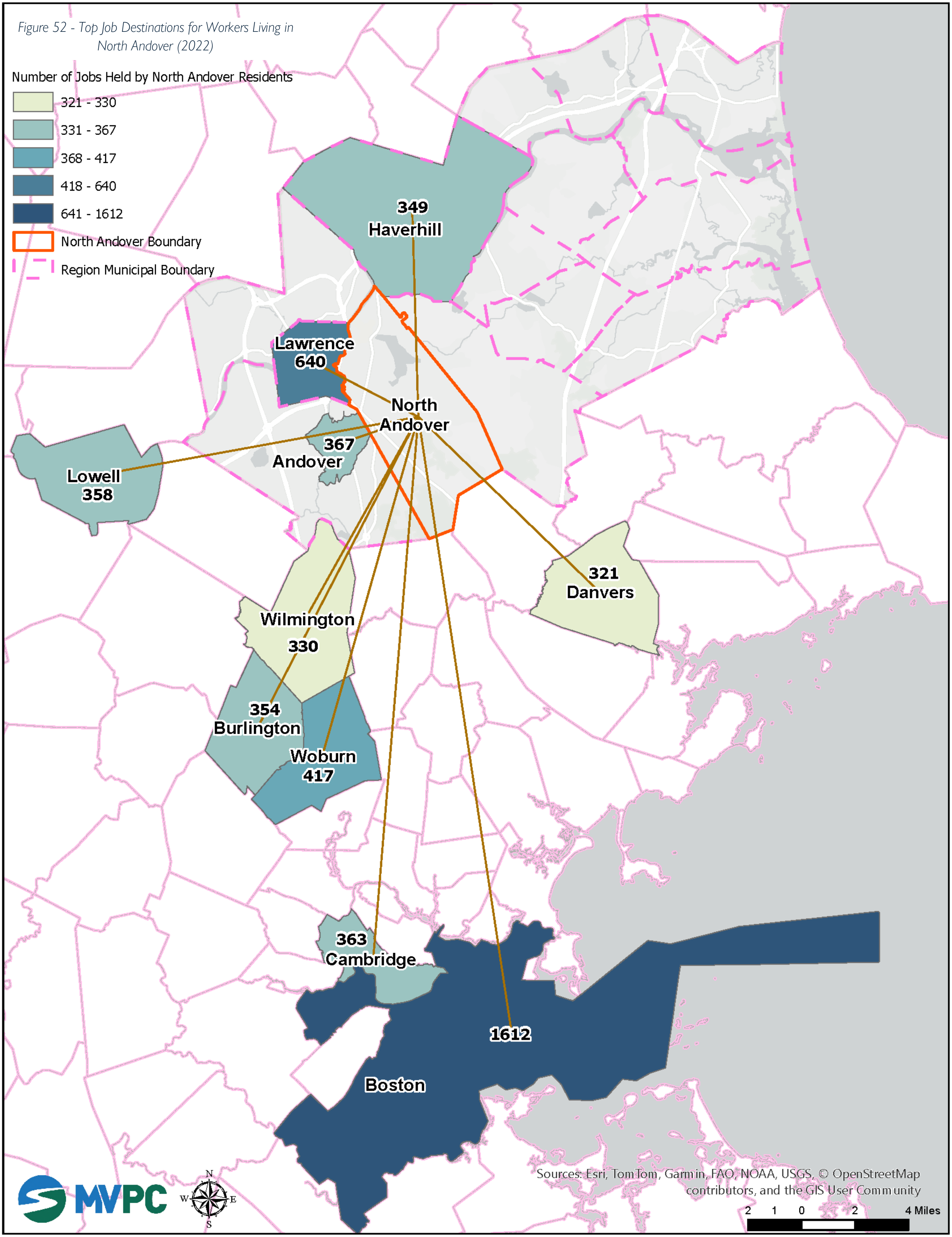


Figure 52 - Top Job Destinations for Workers Living in North Andover (2022)
Number of Jobs Held by North Andover Residents
321 - 330
331 - 367
368 - 417
418 - 640
641 - 1612
North Andover Boundary
Region Municipal Boundary
349
Haverhill
Lawrence
640
North
Andover
367
Andover
Lowell
358
321
Danvers
Wilmington
330
354
Burlington
Woburn
417
363
Cambridge
1612
Boston
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
2 1 0 2 4 Miles
MVPC

Figure 53 - Top Job Destinations for Workers Living in Rowley (2022)

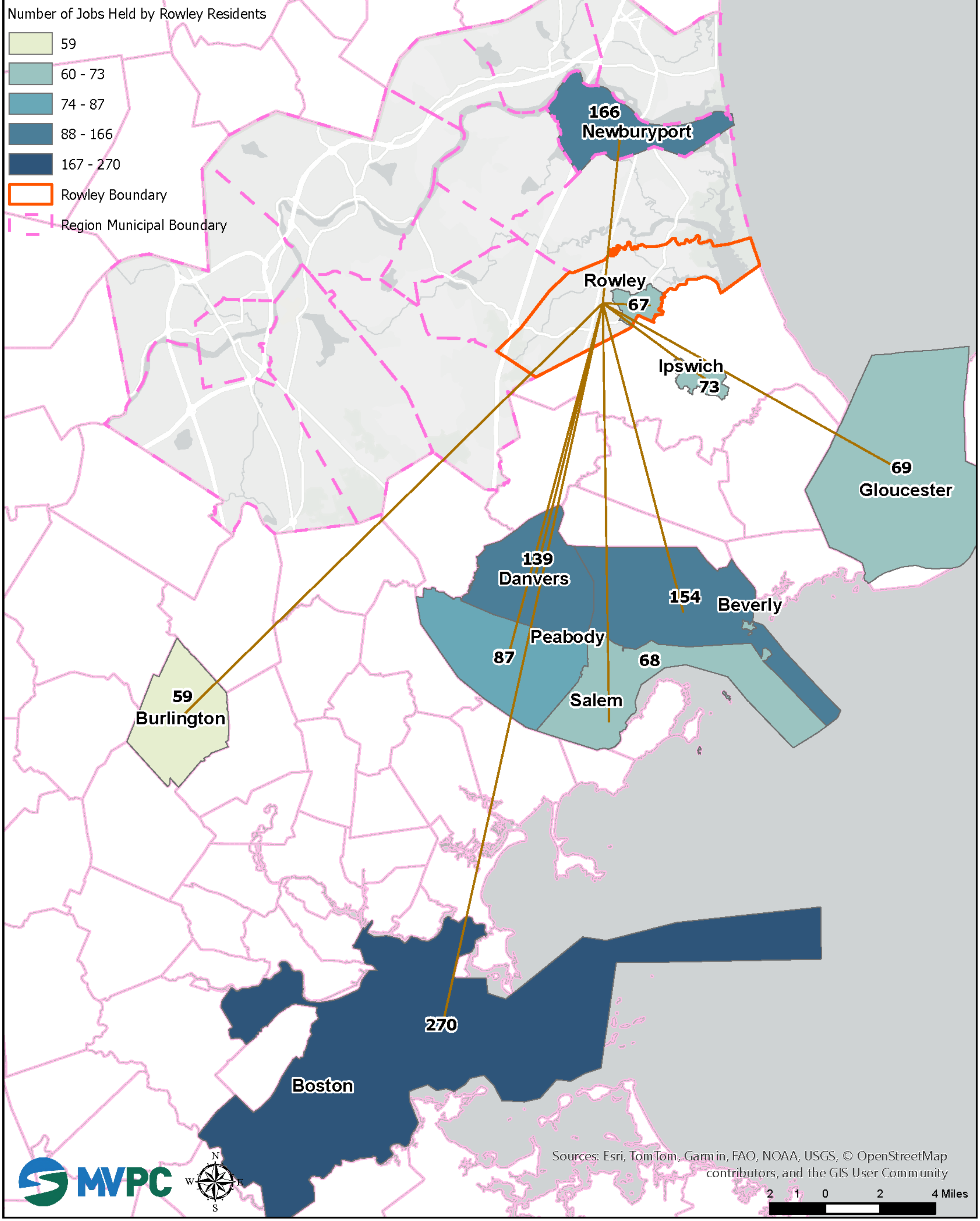
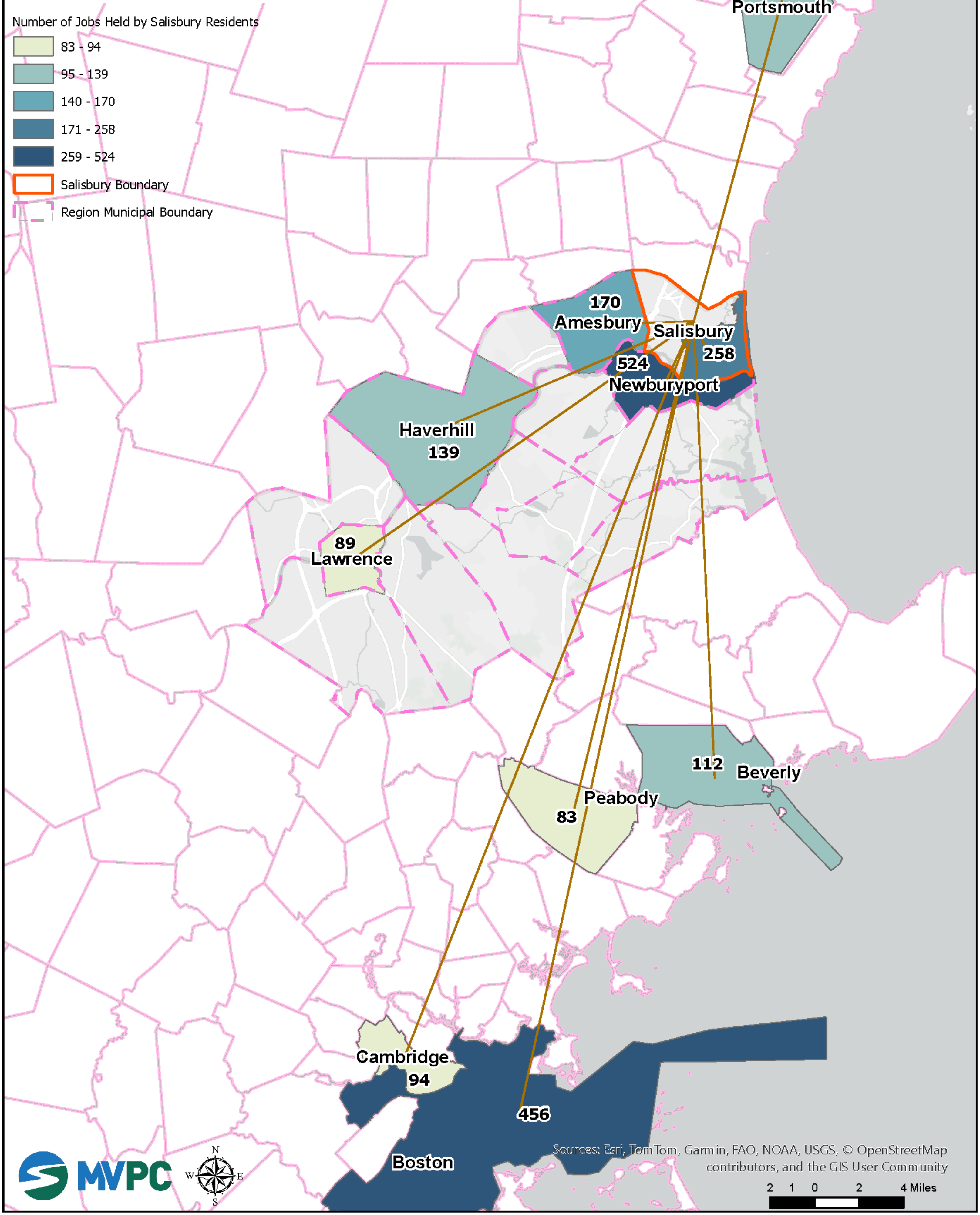


Figure 54 - Top Job Destinations for Workers Living in Salisbury (2022)



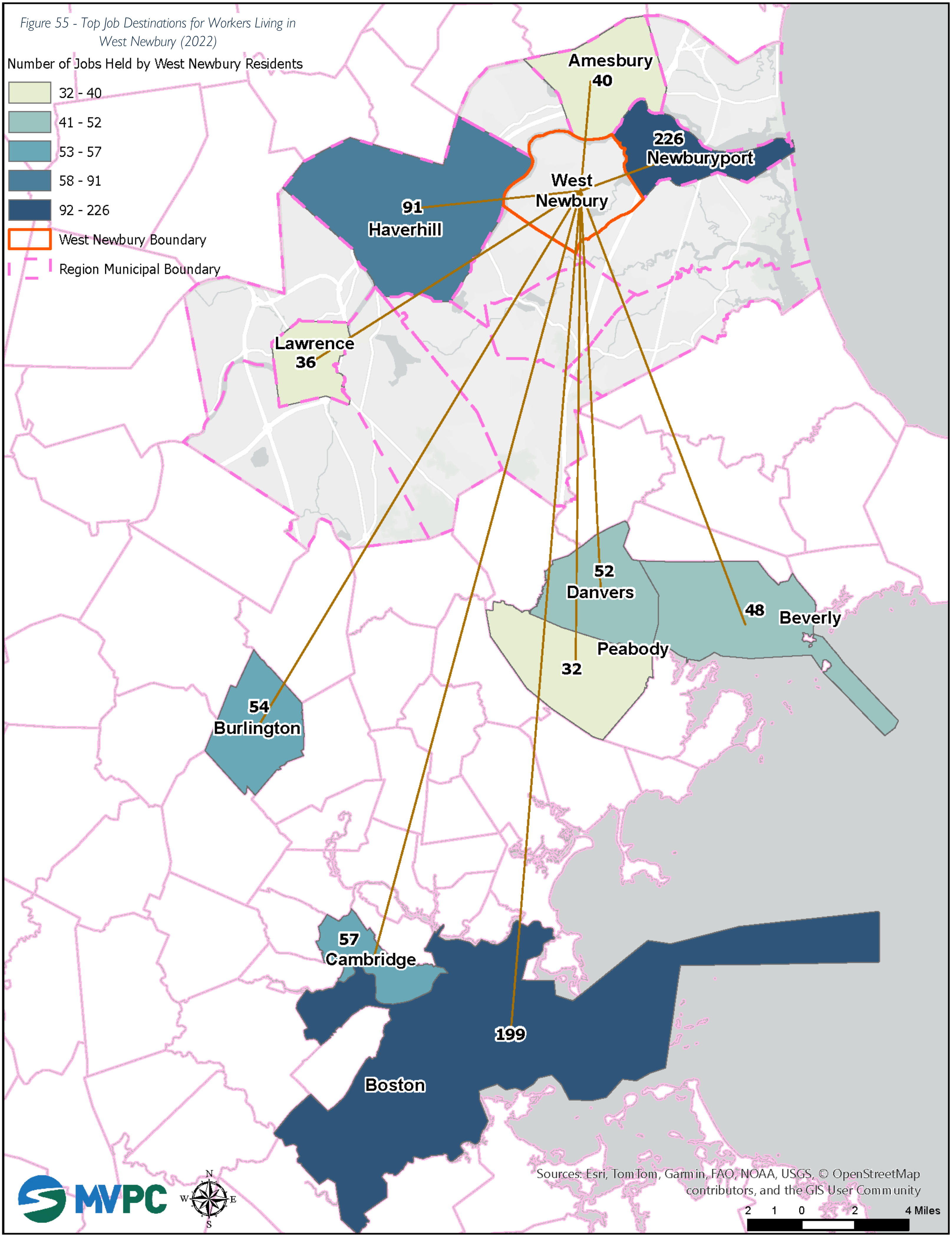


Figure 55 - Top Job Destinations for Workers Living in West Newbury (2022)
Number of Jobs Held by West Newbury Residents
32 - 40
41 - 52
53 - 57
58 - 91
92 - 226
West Newbury Boundary
Region Municipal Boundary
Amesbury
40
226
Newburyport
West
Newbury
91
Haverhill
Lawrence
36
52
Danvers
48
Beverly
Peabody
32
54
Burlington
57
Cambridge
199
Boston
MVPC
N
W
E
S
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
2 1 0 2 4 Miles