

# Appendix

## Merrimack Valley Metropolitan Planning

## Organization

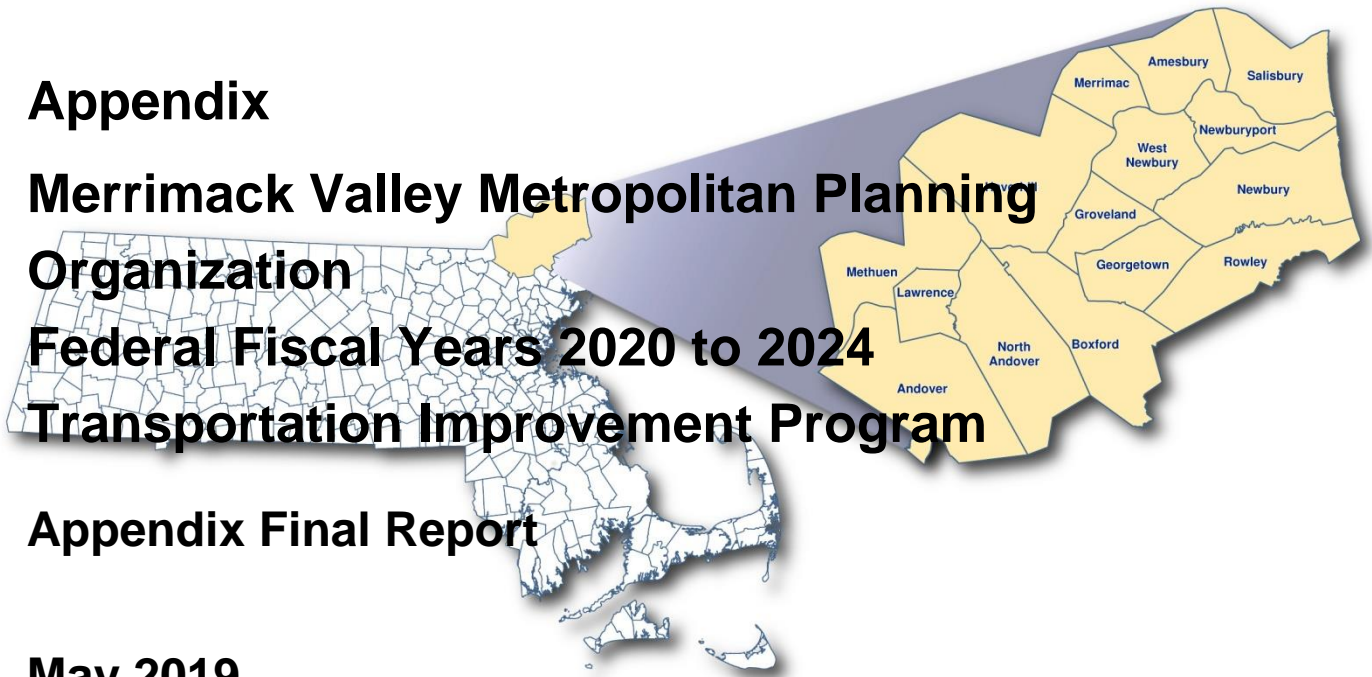
## Federal Fiscal Years 2020 to 2024

## Transportation Improvement Program

## Appendix Final Report

May 2019

Prepared by the Merrimack Valley Planning Commission



This document was prepared in cooperation with the Massachusetts Department of Transportation and the U.S. Department of Transportation. (under Contracts #95416, #MA-80-012 and #MA-80-013 with MassDOT) The views and opinions of the Merrimack Valley Planning Commission expressed herein do not necessarily state or reflect those of the Massachusetts Department of Transportation or the U.S. Department of Transportation.

Page intentionally left blank.

## Table of Contents

Appendices .....	1
Appendix A Other Regional Priority Bridge Projects .....	2
Appendix B Other Regional Priority Roadway Projects .....	3
Appendix C Transportation Evaluation Criteria Summary .....	7
Appendix D Sample Project Evaluation Worksheet .....	13
Appendix E Greenhouse Gas (GHG) Tracking .....	19
FFYs 2020 to 2024 Projects GHG Tracking Summary .....	24
Appendix F Completed Highway and Transit Projects GHG Summary .....	75
Appendix G List of Acronyms .....	81
Appendix H Key to Maps Showing Locations of Transportation Projects .....	89
Appendix I Comments Received on Draft 2020-2024 TIP .....	93

Page intentionally left blank.

## **Appendices**

### **Appendix A and B: Other Regional Priorities**

## Appendix A Other Regional Priority Bridge Projects

### (No Funding Available)

Bridges That Do Not Fit into Fiscally Constrained Targets,  
and therefore have No Funding Available in Any Year (By Town):

<u>ID</u>	<u>Location</u>	<u>Project Description</u>	<u>Estimated Total Project Cost</u>
602322	Ames.	Amesbury - Bridge Replacement, A-07-008, Oak Street Over the B&M Railroad (Abandoned Line)	\$1,000,000
	And.	Andover - Rehab. Bridge (A-09-001) Route 28 (North Main Street) Over the Shawsheen River	
605418	And.	Andover - Bridge Preservation, A-09-028, Chandler Road over I-93	\$3,450,000
604839	Law.	Lawrence – Bridge Replacement, L-04-027, Lowell Street over B&M Railroad	\$4,473,000
	Law.	Lawrence - Bridge Rehabilitation, L-04-042, South Union Connector over South Street	
	Nbypt.	Newburyport - Bridge (N-11-002) State Route 113 (High Street) Over Railroad	
	Nbypt.	Newburyport - Bridge (N-11-014) State Route 1A (High Street) over US 1	
607115	Nbypt.	Newburyport - Bridge Repairs, N-11-015, Washington St. over US 1	\$1,400,000

## Appendix B Other Regional Priority Roadway Projects

(No Funding Available)

Roadway Projects That Do Not Fit into Fiscally Constrained Targets,  
and therefore have No Funding Available in Any Year (By Town)

<u>ID</u>	<u>Location</u>	<u>Project Description</u>	<u>Estimated Total Project Cost</u>
608336	Andover	Andover – Reconstruction on Route 133 (Lowell Street), from Lovejoy Road to Route 28 (North Main Street) TEC = 11.00	\$7,245,000
607708	Andover	Andover - Resurfacing and related work on Route 28 TEC = 5.22	\$1,062,600
606721	Boxford	Boxford - Reconstruction of Route 133 (Washington Street) from North Andover town line to Main Street TEC = 5.60	\$5,172,164
	Boxford	Boxford Reconstruction of Route 97 from Georgetown to Topsfield (2 miles)	\$3,785,000
607540	Boxford	Boxford - Border to Boston Trail TEC = 3.32	\$4,174,500
602843	Georgetown	Georgetown – Reconstruction on Route 97 (W. Main Street) from Moulton Street to Groveland T.L. TEC = 6.63	\$7,239,453
	Haverhill	Haverhill -Intersection Improvements Route 110 and Elliott Street	
	Haverhill	Haverhill – Widen Route 97 (Broadway) from Computer Drive to Research Drive	

## Appendix B Other Regional Priority Roadway Projects (Continued)

### (No Funding Available)

Roadway Projects That Do Not Fit into Fiscally Constrained Targets, and therefore have No Funding Available in Any Year (By Town):

<u>ID</u>	<u>Location</u>	<u>Project Description</u>	<u>Estimated Total Project Cost</u>
608721	Haverhill	Haverhill – Corridor Improvements on Water Street (Route 97/113), from Ginty Boulevard/Mill Street to Lincoln Boulevard/Riverside Avenue TEC = 8.18	\$8,050,000
602339	Haverhill	Haverhill-Historic Waterfront Walkway Phase II (Construction)	\$3,110,184
	Lawrence/ North Andover	Lawrence - North Andover - Reconstruction of Route 114 from I-495 in Lawrence to Rt. 125 (Andover St.) in North Andover TEC = 13.05	
	Methuen	Methuen – Reconstruction of Route 110 from Burnham Road to Woodland Street	
	Newbury- port	Newburyport -Route 1 Rotary Reconfiguration	
608029	Newbury- port	Newburyport - Intersection Improvements Route 1 at Merrimac Street TEC = 7.67	\$2,400,000



## Appendix B Other Regional Priority Roadway Projects (Continued)

### (No Funding Available)

Roadway Projects That Do Not Fit into Fiscally Constrained Targets,  
and therefore have No Funding Available in Any Year (By Town):

<u>ID</u>	<u>Location</u>	<u>Project Description</u>	<u>Estimated Total Project Cost</u>
	North Andover	North Andover – Reconstruction of Mass. Ave. and Sidewalks (from Osgood St. to I-495)	
605694	North Andover	North Andover - Resurfacing and related work Route 125 TEC = 7.45	\$7,910,592
	North Andover	North Andover - Signals and turn lanes at Mass Ave. and I-495 NB and SB Ramps	
607710	Salisbury	Salisbury – Resurfacing and related work Route 1A	\$2,300,000

Page intentionally left blank.

## **Appendix C Transportation Evaluation Criteria Summary**

## Appendix C Transportation Evaluation Criteria Summary

Programmed for Funding in Draft TIP	ID#	Project Description	Project Cost in 1000s	AADT	Linear Lane Miles	Condition	Mobility	Safety & Security	Community Effects & Support	Land Use & Economic Development	Environmental Effects	Total TEC Score (2020-2024)
No		Lawrence –North Andover - Reconstruction of Rt. 114 from I-495 to Rt. 125 (Andover St.)		30,000	5.6	3.00	3.00	3.00	1.80	1.75	0.50	<b>13.05</b>
Yes	608095	North Andover – Reconstruction of Rt. 114 from Rt. 125 (Andover St.) to Stop & Shop	\$16,730	30,000	4.8	2.00	2.75	2.67	1.40	1.75	0.75	<b>11.32</b>
Yes	608930	Lawrence – LMRC Rail Trail	\$14,895	NA	NA	1.00	1.75	2.00	3.00	2.50	1.00	<b>11.25</b>
No	608336	Andover – Rt. 133 reconst. Lovejoy Road to Shawsheen Square (inc. Shawsheen Square)	\$7,245	12,773	4.4	2.00	2.75	2.00	1.00	1.75	1.50	<b>11.00</b>

### Appendix C Transportation Evaluation Criteria Summary (Cont.)

Programmed for Funding in Draft TIP	ID#	Project Description	Project Cost in 1000s	AADT	Linear Lane Miles	Condition	Mobility	Safety & Security	Community Effects & Support	Land Use & Economic Development	Environmental Effects	Total TEC Score (2020-2024)
Yes	608761	Haverhill - Intersection Improvements at Rt. 110 / Rt. 108	\$1,944	NA	NA	1.50	1.75	1.67	1.20	1.75	1.00	<b>8.87</b>
Yes	602202	Salisbury – Reconstruction of Route 1 (Lafayette Road)	\$6,331	12,147	4.8	2.00	2.00	2.00	0.60	1.5	0.5	<b>8.60</b>
No	608721	Haverhill - Corridor Improvements on Water St. from Ginty Blvd / Mill St. to Lincoln Ave./ Riverside Ave.	\$8,050	20,200	2	1.50	1.75	1.33	1.60	1.25	0.75	<b>8.18</b>
Yes	608788	Haverhill - Reconstruction of North Ave. from Main St. to NH stateline	\$12,213	13,172	4	2.50	1.75	1.00	2.00	0.00	0.75	<b>8.00</b>

### Appendix C Transportation Evaluation Criteria Summary (Cont.)

Programmed for Funding in Draft TIP	ID#	Project Description	Project Cost in 1000s	AADT	Linear Lane Miles	Condition	Mobility	Safety & Security	Community Effects & Support	Land Use & Economic Development	Environmental Effects	Total TEC Score (2020-2024)
No	608029	Newburyport – Intersection Improvements Rt. 1 at Merrimac St.	\$2,400	24,850	NA	2.00	0.50	2.67	1.00	1.25	0.25	<b>7.67</b>
No	605694	North Andover – Route 125 Resurfacing and related work	\$7,911	20,400	9.4	2.50	1.00	1.00	1.20	1.25	0.50	<b>7.45</b>
Yes	608027	Haverhill – Bradford Rail Trail extension	\$1,088	NA	NA	0.50	1.50	1.00	2.40	1.25	0.50	<b>7.15</b>
No	609251	Lawrence – Intersection Improvements at South Broadway (Route 28) and Mount Vernon St.	\$1,110	NA	NA	2.00	1.00	2.00	2.00	1.00	0.00	<b>7.02</b>

### Appendix C Transportation Evaluation Criteria Summary (Cont.)

Programmed for Funding in Draft TIP	ID#	Project Description	Project Cost in 1000s	AADT	Linear Lane Miles	Condition	Mobility	Safety & Security	Community Effects & Support	Land Use & Economic Development	Environmental Effects	Total TEC Score (2020-2024)
No	602843	Georgetown – Route 97 from Moulton St. to Groveland TL	\$7,239	15,486	2.2	1.50	0.75	1.33	0.80	1.50	0.75	<b>6.63</b>
No	606721	Boxford - Route 133 (North Andover TL to Main St.)	\$5,172	6,149	2.9	1.50	1.00	1.00	0.60	0.50	1.00	<b>5.60</b>
No	607708	Andover – Route 28 resurfacing and related work	\$1,063	19,728	4.0	2.50	0.25	0.67	0.80	0.50	0.50	<b>5.22</b>
Yes	607542	Georgetown – Square to Byfield (Northern) section of Border to Boston Trail	\$3,876	NA	NA	0.50	1.25	0.67	0.80	1.50	0.50	<b>5.22</b>
Yes	607541	Georgetown- Boxford– south of Square to Georgetown Road (Southern) section of Border to Boston Trail	\$1,735	NA	NA	0.50	1.25	0.67	0.80	1.25	0.75	<b>5.22</b>

### Appendix C Transportation Evaluation Criteria Summary (Cont.)

Programmed for Funding in Draft TIP	ID#	Project Description	Project Cost in 1000s	AADT	Linear Lane Miles	Condition	Mobility	Safety & Security	Community Effects & Support	Land Use & Economic Development	Environmental Effects	Total TEC Score (2020-2024)
Yes	608298	Groveland - Community Trail	\$1,985	NA	NA	0.50	1.25	0.67	1.20	1.00	0.25	4.87
No	607540	Boxford – section of Border to Boston Trail	\$4,175	NA	NA	0.50	1.00	0.67	0.40	0.50	0.25	3.32



**Appendix D Sample Project Evaluation Worksheet**

**Sample Project Evaluation Worksheet**

**Merrimack Valley Planning Commission and MassDOT Evaluation Criteria**

**Project: Andover - Reconstruct Rt. 133 from Lovejoy Rd to Rt. 28      Project #: 608336**

**Project Cost: \$7,245,000    AADT: 12,773      Distance: 2.2    Linear Lane Miles: 4.4**

<b>Condition</b>	<b>Score</b>	<b>Additional Comments</b>
A. Magnitude of pavement condition improvement.	2	PNF indicates longitudinal & lateral pavement cracking, utility patch failure, shoving and rutting of pavement along route.
B. Magnitude of improvement of other infrastructure.	2	Current shoulder width 0' to 2', project to increase shoulder width to 4' or 5' for bikes and > safety for pedestrians, upgrade signals, drainage improvements
<b>Condition Average</b>	<b>2.0</b>	

<b>Mobility</b>	<b>Score</b>	<b>Additional Comments</b>
A. Effect on magnitude and duration of congestion.	3	Adding left turn lanes at intersection at MA-133/ Lovejoy /Greenwood. Also Rt 133/ Rt 28 improvements
B. Effect on travel time and connectivity / access.	2	Widening shoulder, realigning Rt 133/ Lovejoy and adding left turn lanes.
C. Effect on other modes using the facility.	3	Widening shoulder for bicycles, sidewalks on both sides.
D. Effect on regional and local traffic.	3	Widening shoulder, adding left turn lanes. Additional connector I-495 to I-93. NHS roadway.
<b>Mobility Average</b>	<b>2.75</b>	

**Sample Project Evaluation Worksheet (Cont.)**

**Project: Andover - Reconstruct Rt. 133 from Lovejoy Rd to Rt. 28**

**Project #: 608336**

<b>Safety and Security</b>	<b>Score</b>	<b>Additional Comments</b>
A. Effect on crash rate compared to State average.	3	PNF Rt 133/ Lovejoy / Greenwood has a crash rate of .94, District 4 average is .78 and the arterial between two signalized intersections is 3.8, Avg. is 2.12. Have had 1 pedestrian with injuries and 1 bicycle crash.
B. Effect on bicycle and pedestrian safety.	2	Widening shoulder for bicycles and provides greater safety for pedestrians.
C. Effect on transportation security and evacuation routes/	1	Is an NHS roadway. Is an evacuation route.
<b>Safety and Security Average</b>	<b>2.00</b>	

<b>Community Effects and Support</b>	<b>Score</b>	<b>Additional Comments</b>
A. Residential effects: ROW, noise, aesthetics, cut through traffic, and other.	2	For the most part all within ROW. General appearance and less noise from better pavement conditions.
B. Public, local government, legislative, and regional support.	2	
C. Effect on service to minority or low-income neighborhoods. (Title VI and EJ)	0	Not Title VI or EJ area.
D. Other impacts / benefits to minority or low-income neighborhoods. (Title VI and EJ).	0	Not Title VI or EJ area.
E. Effect on development and redevelopment of housing	1	
<b>Community Effects and Support Average</b>	<b>1.00</b>	

**Sample Project Evaluation Worksheet (Cont.)**

**Project: Andover - Reconstruct Rt. 133 from Lovejoy Rd to Rt. 28**

**Project #: 608336**

<b>Land Use and Economic Development</b>	<b>Score</b>	<b>Additional Comments</b>
A. Business effects; ROW, noise, traffic, parking, freight access, other.	2	Improve access to existing businesses.
B. Sustainable development effects. Consistent with MVPGS.	2	Access to MVPGS Rolling Green Regional PDA. Improves transportation choice (walk/bike) for area residents.
C. Consistent with regional land-use and economic development plans and PGS.	2	Access to MVPGS Rolling Green Regional PDA. Improves transportation choice (walk/bike) for area residents.
D. Effect on job creation.	1	Should provide better access to Brickstone Square State PDA.
<b>Land Use and Economic Development Average</b>	<b>1.75</b>	

**Sample Project Evaluation Worksheet (Cont.)**

**Project: Andover - Reconstruct Rt. 133 from Lovejoy Rd to Rt. 28**

**Project #: 608336**

<b>Environmental Effects</b>	<b>Score</b>	<b>Additional Comments</b>
A. Air quality / Climate effects. GHG Impact Description – Assumed Nominal Decrease in Emissions from Other Improvements	2	Adding bike lanes and sidewalks. Reducing delays at intersections.
B. Water quality/supply effects; wetlands effects.	1	There will be deep sump catch basins
C. Historic and cultural resources effects.	3	Shawsheen Village Historic District
D. Effect on wildlife habitat and endangered species.	0	Not endangered species habitat area.
<b>Environmental Effects Average</b>	<b>1.5</b>	
<b>Overall Project TEC score</b>	<b>11.00</b>	

Page intentionally left blank.

## **Appendix E Greenhouse Gas (GHG) Tracking**

## **2020 - 2024**

# **Transportation Improvement Program Greenhouse Gas Tracking**

This section summarizes the greenhouse gas (GHG) impacts that are anticipated to result from the projects that are included in this FFY 2020 – 2024 Transportation Improvement Program (TIP). It includes a summary of the state laws and policies that call for reducing greenhouse gas in order to mitigate global climate change, actions that respond to these state laws and policies, the role of regional planning and TIP development in reducing GHG emission and tracking these reductions, and the projected GHG emission impacts from the projects programmed in the TIP.

### **State Policy Context**

The Global Warming Solutions Act (GWSA), which was signed into law in August 2008, makes Massachusetts a leader in setting aggressive and enforceable GHG reduction targets, and implementing policies and initiatives to achieve these targets. In keeping with the law, on December 29, 2010 the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA), in consultation with other state agencies and the public, released the Massachusetts *Clean Energy and Climate Plan for 2020*. In December 2014 the Department of Environmental Protection (DEP) issued new regulations that require Metropolitan Planning Organizations to quantify impacts from project investments, track progress towards reductions, and consider impacts in the prioritization of project investments. The targets for overall statewide GHG emissions are:

- By 2020: 25 percent reduction below statewide 1990 GHG emission levels, and
- By 2050: 80 percent reduction below statewide 1990 GHG emission levels

### **The Role of Metropolitan Planning Organizations**

The Commonwealth's MPOs are integrally involved in supporting the GHG reductions mandated under the GWSA. The MPOs are most directly involved in helping to achieve the GHG emissions reductions through the promotion of healthy transportation modes through prioritizing and programming an appropriate balance of roadway, transit, bicycle and pedestrian investments – and assisting smart growth development patterns through the creation of a balanced multi-modal transportation system. This is realized through the transportation goals and policies espoused in the Regional Transportation Plans (RTPs), the major projects planned in the RTPs, and the mix of new transportation projects that are programmed and implemented through the TIPs. GHG tracking and evaluation processes



enable the MPOs to identify the anticipated GHG impacts of planned and programmed projects, and also to use GHG impacts as a criterion in prioritizing transportation projects.

## **Project-Level GHG Tracking and Evaluation in TIPs**

It is also important to monitor and evaluate the GHG impacts of the transportation projects that are programmed in the MPOs' TIPs. The TIPs include both the larger, regionally-significant projects from the RTPs, which are reported in the Statewide GHG report, as well as smaller projects that are not included in the RTP but that may nevertheless have impacts on GHG emissions. The primary objective of this tracking is to enable the MPOs to evaluate expected GHG impacts of different projects and to use this information as a criterion for prioritizing and programming projects.

## **Calculation of GHG Impacts for TIP Projects**

MassDOT has adopted spreadsheets used by MPOs to determine CMAQ eligibility and that also include CO<sub>2</sub> impacts. The data and analysis required for these calculations is available from functional design reports that are submitted for projects that would produce a measurable GHG impact.

## **Projects with Quantified Impacts**

### **RTP Projects**

Major capacity expansion projects are expected to have a significant impact on GHG emissions. These projects are included in each MPO's RTP and analyzed using either the statewide model or Boston MPO's regional model, which reflect GHG impacts. As a result, no independent TIP calculations are required.

### **Quantified Decrease in Emissions**

For those projects that are expected to produce a measurable decrease in emissions, the approach for calculating these impacts is described below. These projects are categorized in the following manner:

- **Quantified Decrease in Emissions from Traffic Operational Improvement** - An intersection reconstruction or signalization project that is projected to reduce delay and congestion.
- **Quantified Decrease in Emissions from Pedestrian and Bicycle Infrastructure** - A shared-use path that enables increased walking and biking and decreased vehicle-miles traveled (VMT).

- **Quantified Decrease in Emissions from New/Additional Transit Service** - A bus or shuttle service that enables increased transit ridership and decreased VMT.
- **Quantified Decrease in Emissions from a Park and Ride Lot** - A park-and-ride lot that enables increased transit ridership/ increased ridesharing and decreased VMT.
- **Quantified Decrease in Emissions from Bus Replacement**  
A bus replacement that directly reduces GHG emissions generated by service.
- **Quantified Decrease in Emissions from Complete Streets Improvements** - Improvements to roadway networks that include the addition of bicycle and pedestrian accommodations where none were present before.
- **Quantified Decrease in Emissions from Alternative Fuel Vehicle Procurements** – A vehicle procurement where alternative fuel/ advanced technology vehicles replace traditional gas or diesel vehicles.
- **Quantified Decrease in Emissions from Anti-idling Strategies** – Implementation of policies such as limiting idling allowed, incorporating anti-idling technology into fleets and using LED lights on trucks for the purpose of illuminating worksites.
- **Quantified Decrease in Emissions from Bike Share Projects** – A new bike share project or capacity added to existing project.
- **Quantified Decrease in Emissions from Induced Travel Projects** – A project that changes roadway capacity.
- **Quantified Decrease in Emissions from Speed Reduction Programs** – Programs that reduce speed to no less than 55 miles per hour.
- **Quantified Decrease in Emissions from Transit Signal Priority Projects** – A project that applies this technology to a signal intersection or along a corridor that impacts bus service.
- **Quantified Decrease in Emissions from Truck Stop Electrification Projects** – A new truck stop electrification project or capacity added to an existing project.
- **Quantified Decrease in Emissions from Other Improvement**

### **Quantified Increase in Emissions**

Projects expected to produce a measurable increase in emissions.

### **Projects with No Assumed Impacts**

**No Assumed Impact/Negligible Impact on Emissions** - Projects that do not change the capacity or use of a facility (e.g. roadway median barrier or retaining wall replacement, or

bridge rehabilitation/replacement that restores the bridge to its previous condition) are assumed to have no/negligible GHG impact.

**Qualitative Decrease in Emissions**

Projects expected to produce a minor decrease in emissions that cannot be calculated with any precision. Examples of such projects include roadway repaving, signage improvement, ITS improvement, or transit marketing/customer experience improvement.

**Qualitative Increase in Emissions**

Projects expected to produce a minor increase in emissions that cannot be calculated with any precision.

**Regional Greenhouse Gas Impact Summary Tables for FFYs 2020 – 2024 TIP**

The following tables summarize the calculated quantitative and assumed qualitative impacts of the projects included in the regional FFYs 2020 – 2024 TIP by year.

## **FFYs 2020 to 2024 Projects GHG Tracking Summary**

## 2020 Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
602418	AMESBURY- RECONSTRUCTION OF ELM STREET	\$7,223,053	Quantified	1,336	Quantified Decrease in Emissions from Complete Streets Project	\$11,178,124	AC yr 2 of 2.
608027	HVERHILL- BRADFORD RAIL TRAIL EXTENSION, FROM ROUTE 125 TO RAILROAD STREET	\$848,345	Quantified	422	Quantified Decrease in Emissions from Bicycle and Pedestrian Infrastructure	\$848,345	
605306	HVERHILL- BRIDGE REPLACEMENT, H-12-039, I-495 (NB & SB) OVER MERRIMACK RIVER	\$15,305,880	Qualitative		No assumed impact/ negligible impact on emissions	\$118,786,388	AC yr 3 of 6.

## 2021 Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
608298	GROVELAND-COMMUNITY TRAIL FROM MAIN STREET TO KING STREET	\$2,064,255	Quantified	2,710	Quantified Decrease in Emissions from Bicycle and Pedestrian Infra-structure	\$2,064,255	
608095	NORTH ANDOVER-CORRIDOR IMPROVEMENTS ON ROUTE 114, BETWEEN ROUTE 125 (ANDOVER STREET) & STOP & SHOP DRIVEWAY	\$6,813,052	Qualitative		Qualitative Decrease in Emissions	\$17,399,023	AC Yr 1 of 2

## 2021 (Cont.) Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
607541	GEORGETOWN-BOXFORD- BORDER TO BOSTON TRAIL, FROM GEORGETOWN ROAD TO WEST MAIN STREET (ROUTE 97)	\$1,812,628	Quantified	2,667	Quantified Decrease in Emissions from Bicycle and Pedestrian Infrastructure	\$1,812,628	
605306	HAVERHILL- BRIDGE REPLACEMENT, H-12-039, I-495 (NB & SB) OVER MERRIMACK RIVER	\$15,305,880	Qualitative		No assumed impact/ negligible impact on emissions	\$118,786,388	AC Yr 4 of 6.
608494	NEWBURY-NEWBURYPORT-SALISBURY- RESURFACING AND RELATED WORK ON ROUTE 1	\$9,807,200	Qualitative		Qualitative Decrease in Emissions	\$9,807,200	

## 2022 Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
608761	HAVERTHILL- INTERSECTION RECONSTRUCTION ON ROUTE 108 (NEWTON ROAD) AT ROUTE 110 (KENOZA AVENUE AND AMESBURY ROAD)	\$2,099,520	Quantified	8,307	Quantified Decrease in Emissions from Traffic Operational Improve-ment	\$2,099,520	
608095	NORTH ANDOVER- CORRIDOR IMPROVEMENTS ON ROUTE 114, BETWEEN ROUTE 125 (ANDOVER STREET) & STOP & SHOP DRIVEWAY	\$8,684,626	Qualitative		Qualitative Decrease in Emissions	\$17,399,023	AC Yr 2 of 2



## 2022 (Cont.) Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
605306	HAVERHILL- BRIDGE REPLACEMENT, H-12-039, I-495 (NB & SB) OVER MERRIMACK RIVER	\$18,203,683	Qualitative		No assumed impact/ negligible impact on emissions	\$118,786,388	AC Yr 5 of 6.

## 2023 Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
608788	HAYERHILL-ROADWAY RECONSTRUCTION ON NORTH AVENUE, FROM MAIN STREET (ROUTE 125) TO PLAISTOW NH	\$4,147,823	Qualitative		Qualitative Decrease in Emissions	\$13,678,560	AC Yr 1 of 2
602202	SALISBURY-RECONSTRUCTION OF ROUTE 1 (LAFAYETTE ROAD)	\$7,090,517	Qualitative		Qualitative Decrease in Emissions	\$7,090,517	
608930	LAWRENCE-LAWRENCE MANCHESTER RAIL CORRIDOR (LMRC) RAIL TRAIL	\$15,950,704	Quantified	175,927	Quantified Decrease in Emissions from Bicycle and Pedestrian Infrastructure	\$15,950,704	

## 2023 (Cont.) Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
607542	GEORGETOWN-NEWBURY- BORDER TO BOSTON TRAIL, (NORTHERN GEORGETOWN TO BYFIELD SECTION)	\$4,341,120	Quantified	15,682	Quantified Decrease in Emissions from Bicycle and Pedestrian Infrastructure	\$4,341,120	
605306	HAVERHILL- BRIDGE REPLACEMENT, H-12-039, I-495 (NB & SB) OVER MERRIMACK RIVER	\$15,305,880	Qualitative		No assumed impact/ negligible impact on emissions	\$118,786,388	AC Yr 6 of 6.
TBD	HAVERHILL- BRIDGE REPLACEMENT, H-12-040, I-495 (NB & SB) OVER MERRIMACK RIVER	\$25,198,768	Qualitative		No assumed impact/ negligible impact on emissions	\$96,000,000	AC Yr 1 of 3.

## 2023 (Cont.) Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
608494	NEWBURY-NEWBURYPORT-SALISBURY-RESURFACING AND RELATED WORK ON ROUTE 1	\$9,807,200	Qualitative		Qualitative Decrease in Emissions	\$9,807,200	

## 2024 Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-programmed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
608788	HAVERHILL- ROADWAY RECONSTRUCTION ON NORTH AVENUE, FROM MAIN STREET (ROUTE 125) TO PLAISTOW NH	\$9,530,737	Qualitative		Qualitative Decrease in Emissions	\$13,678,560	AC Yr 2 of 2
606522	ANDOVER- BRIDGE REHABILITATION, A-09-036, I-495 OVER ST 28 (SB), A-09-037, I-495 OVER B&M AND MBTA, A-09-041, I-495 OVER ST 28 (NB)	\$17,204,394	Qualitative		No assumed impact/ negligible impact on emissions	\$113,386,056	AC Yr 1 of 5

## 2024 (Cont.) Merrimack Valley Region MPO TIP Highway Projects GHG Tracking Summary

Mass DOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro-grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Total Cost	Additional Information
605304	HAVERHILL- BRIDGE REPLACEMENT, H-12-007 & H-12-025, BRIDGE STREET (SR 125) OVER MERRIMACK RIVER AND THE ABANDONED B&M RR (PROPOSED BIKEWAY)	\$13,142,589	Qualitative		No assumed impact/ negligible impact on emissions	\$124,938,960	AC Yr 1 of 5.
TBD	HAVERHILL- BRIDGE REPLACEMENT, H-12-040, I-495 (NB & SB) OVER MERRIMACK RIVER	\$43,180,558	Qualitative		No assumed impact/ negligible impact on emissions	\$96,000,000	AC Yr 2 of 3.

## 2020 Merrimack Valley Region Transit Projects GHGs

MassDOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro- grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Total Cost
RTD0007680	Preventive Maintenance	\$3,323,160	Qualitative		No assumed impact/ negligible impact on emissions	\$3,323,160
RTD0007681	Non-Fixed Route ADA Pa- ra Serv	\$1,653,255	Qualitative		No assumed impact/ negligible impact on emissions	\$1,653,255
RTD0007682	Short Range Transit Plan- ning	\$100,000	Qualitative		No assumed impact/ negligible impact on emissions	\$100,000
RTD0007683	Operating Assistance	\$861,550	Qualitative		No assumed impact/ negligible impact on emissions	\$861,550
RTD0007687	Replace 3 Model Yr 2007 buses delivery 2020	\$1,377,150	Quantified	8,166	Quantified Decrease in Emissions from Bus Replacement	\$1,377,150

<b>2020 Merrimack Valley Region Transit Projects GHGs (Cont.)</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
RTD0007695	SGR Riverbank stabilization Construction	\$1,750,330	Qualitative		No assumed impact/ negligible impact on emissions	\$1,750,330
RDT0007696	SGR Replace 1 model year 2013 supervisory vehicle	\$46,530	Qualitative		No assumed impact/ negligible impact on emissions	\$46,530



## 2021 Merrimack Valley Region Transit Projects GHGs

MassDOT/ FTA Project ID	MassDOT/ FTA Project Description	Total Pro- grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Total Cost
RTD0007684	Preventive Maintenance	\$3,495,970	Qualitative		No assumed impact/ negligible impact on emissions	\$3,495,970
RTD0007685	Non-Fixed Route ADA Para Serv	\$1,741,065	Qualitative		No assumed impact/ negligible impact on emissions	\$1,741,065
RTD0007686	Short Range Transit Plan- ning	\$100,000	Qualitative		No assumed impact/ negligible impact on emissions	\$100,000
RTD0007688	Operating Assistance	\$906,350	Qualitative		No assumed impact/ negligible impact on emissions	\$906,350
RTD0007689	Replace 16 Model Yr 2015 vans with new	\$1,180,480	Quantified	32,764	Quantified Decrease in Emissions from Bus Replacement	\$1,180,480

<b>2021 Merrimack Valley Region Transit Projects GHGs (Cont.)</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
RTD0007697	SGR Replace 1 model yr 2014 supervisory vehicle	\$47,900	Qualitative		No assumed impact/ negligible impact on emissions	\$47,900

<b>2022 Merrimack Valley Region Transit Projects GHGs</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
RTD0007690	Preventive Maintenance	\$3,611,335	Qualitative		No assumed impact/ negligible impact on emissions	\$3,611,335
RTD0007691	Non-Fixed Route ADA Para Serv	\$1,801,630	Qualitative		No assumed impact/ negligible impact on emissions	\$1,801,630
RTD0007692	Short Range Transit Plan- ning	\$100,000	Qualitative		No assumed impact/ negligible impact on emissions	\$100,000
RTD0007693	Operating Assistance	\$936,260	Qualitative		No assumed impact/ negligible impact on emissions	\$936,260
RTD0007694	Replace Model Yr 2009 buses delivery 2022 7 of 9	\$3,417,680	Quantified	19,755	Quantified Decrease in Emissions from Bus Replacement	\$3,417,680

<b>2022 Merrimack Valley Region Transit Projects GHGs (Cont.)</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
RTD0008061	SGR Replace 2 model year 2016 supervisory vehicles	\$97,740	Qualitative		No assumed impact/ negligible impact on emissions	\$97,740

<b>2023 Merrimack Valley Region Transit Projects GHGs</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
RTD0007698	Preventive Maintenance	\$3,730,510	Qualitative		No assumed impact/ negligible impact on emissions	\$3,730,510
RTD0007699	Operating Assistance	\$967,150	Qualitative		No assumed impact/ negligible impact on emissions	\$967,150
RTD0007700	Non-Fixed Route ADA Para Serv	\$1,861,090	Qualitative		No assumed impact/ negligible impact on emissions	\$1,861,090
RTD0007701	Replace 2 Model Yr 2009 buses delivery 2023	\$1,005,780	Quantified	5,644	Quantified Decrease in Emissions from Bus Replacement	\$1,005,780
RTD0007702	Replace 6 model yr 2017 vans delivery 2023	\$469,620	Qualitative		Not yet enough infor- mation to calculate	\$469,620

<b>2023 Merrimack Valley Region Transit Projects GHGs (Cont.)</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
RTD0007703	Short Range Transit Plan- ning	\$100,000	Qualitative		No assumed impact/ negligible impact on emissions	\$100,000

<b>2024 Merrimack Valley Region Transit Projects GHGs</b>						
<b>MassDOT/ FTA Project ID</b>	<b>MassDOT/ FTA Project Description</b>	<b>Total Pro- grammed Funds</b>	<b>GHG Analysis Type</b>	<b>GHG CO<sub>2</sub> Impact (kg/yr)</b>	<b>GHG Impact Description</b>	<b>Total Cost</b>
	Preventive Maintenance	\$3,853,620	Qualitative		No assumed impact/ negligible impact on emissions	\$3,853,620
	Non-Fixed Route ADA Para Serv	\$1,922,630	Qualitative		No assumed impact/ negligible impact on emissions	\$1,922,630
	Operating Assistance	\$865,320	Qualitative		No assumed impact/ negligible impact on emissions	\$865,320
	Short Range Transit Plan- ning	\$100,000	Qualitative		No assumed impact/ negligible impact on emissions	\$100,000
	SGR Replace 2 model year 2011 buses delivery 2024 2 of 8	\$1,035,940	Qualitative		Not yet enough infor- mation to calculate	\$1,035,940

**CMAQ Air Quality Analysis Worksheet for Complete Streets Project**

**FILL IN SHADED BOXES ONLY**

**TIP YEAR:** 2019

**MPO:** Merrimack Valley **Municipality:** Amesbury

**Project:** Project #602418 Reconstruction of Elm Street (New sidewalks from Rt 110 to Rocky Hill Road and bike lanes)

**Step 1: Calculate New Walk and Bike Miles Traveled:**

If VMT reduction per year is known then go to Step 2B, if not proceed with Step 1 :

			User Input (blank for default <u>Default</u> )
<b>A Facility Length (L):</b>	1.1	Miles	
<b>B Types of Improvements Implemented:</b>	Both	(select Pedestrian, Bicycle, or Bot	
<b>B Service Area Radius for Bicycling (RB):</b>	0.5	Miles	0.5
<b>C Service Area Radius for Walking (RW):</b>	0.25	Miles	0.25
<b>D Service Area of Community(ies) for Bicycling (SAB):</b> $L * 2RB = SAB$	1.13	Sq. Miles	
<b>E. Service Area of Community(ies) for Walking (SAW):</b> $L * 2RW = SAW$	0.565	Sq. Miles	
<b>F. Land Area of Neighborhoods Served (AN):</b>	11.2	Sq. Miles	
<b>G Population of Neighborhoods Served (PN):</b>	7,137	Persons	
<b>H Population Density of Neighborhoods Served (PD):</b>	637	Persons/Sq. Mile	
<b>I. Population Served by Facility for Bicycling (PB):</b> $PD * SAB = PB$	720	Persons	
<b>J. Population Served by Facility for Walking (PW):</b> $PD * SAW = PW$	360	Persons	
<b>K Trips per Person per Day in Service Area (T):</b>	4.7	Trips	4.7



<b>L. Baseline Bicycle Mode Share in Service Area (MSB):</b>	0.6%	Percent	<input type="text"/>	
<b>M Baseline Walk Mode Share in Service Area (MSW):</b>	4.7%	Percent	<input type="text"/>	
<b>N Relative Increase in Service Area Bicycle Mode Share from Improvements (BI):</b>	30.0%	Percent	<input type="text"/>	30.0%
<b>O Relative Increase in Service Area Walk Mode Share from Improvements (WI):</b>	7.5%	Percent	<input type="text"/>	7.5%
<b>P. New Bike Trips (BT):</b> $PB * T * MSB * BI = BT$	6	1-Way Trips/Day		
<b>Q New Walk Trips (WT):</b> $PW * T * MSW * WI = WT$	6	1-Way Trips/Day		
<b>R Average Bike Trip Length (LB):</b>	2.3	Miles	<input type="text"/>	2.3
<b>S. Average Walk Trip Length (LW):</b>	0.7	Miles	<input type="text"/>	0.7
<b>T. New Bike and Walk Miles of Travel (BWM):</b>	18	Miles per Day		

**Step 2: Calculate the VMT Reduction:**

<b>U Prior Drive Mode Share of New Bike and Walk Trips (MSD):</b>	59.0%	Percent	<input type="text" value="59%"/>
<b>V. VMT Reduced per Day (VMTR):</b> $BWM * MSD = VMTR$	11	Miles per Day	
<b>W VMTR * Operating Days Per Year</b>	$11 * 365 =$	3,942	VMTR Per Year
If the Vehicle Miles Traveled Reduction is known enter in the box to the right.	<input type="text"/>		VMTR Per Year

**Note:** A manual entry of the VMTR will override the calculated cell.

**Step 3: MOVES 2014a Emission Factors for Unrestricted PM:**

Note: Use 35 MPH as a default if average speed is not known. Speed Used:  Eastern or Western

2020 Passenger Summer VOC Factor grams/mile	2020 Passenger Summer NOx Factor grams/mile	2020 Passenger Summer CO Factor grams/mile	2020 Passenger Summer CO2 Factor grams/mile
<input type="text" value="0.030"/>	<input type="text" value="0.081"/>	<input type="text" value="2.095"/>	<input type="text" value="338.769"/>

---

**Step 4: Calculate emissions reductions in kilograms per year (Seasonally Adjusted):**

Summer VOC	Summer NOx	Summer CO	Summer CO2
<b>0.1</b>	<b>0.3</b>	<b>8.4</b>	<b>1,335.5</b>

---

**Step 5: Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost		Emission Reduction in kg per year	First year cost per kilogram
Summer VOC	<b>\$1,000,000</b>	/	0.1 =	<b>\$8,355,241</b>
Summer NOx	\$1,000,000	/	0.3 =	<b>\$3,058,798</b>
Summer CO	\$1,000,000	/	8.4 =	<b>\$118,866</b>
Summer CO2	\$1,000,000	/	1,335.5 =	<b>\$749</b>

**Georgetown - Boxford Border-to-Boston Trail**

**CMAQ Air Quality Worksheet**

**CMAQ Air Quality Analysis Worksheet for Bicycle and Pedestrian Project**

**FILL IN SHADED BOXES ONLY**

**TIP YEAR:** 2019  
**MPO:** Merrimack Valley **Municipality:** Georgetown, Boxford  
**Project:** # 607541 Georgetown-Boxford Border to Boston Trail

**Step 1: Calculate Estimated Reduction in Vehicle Miles Traveled (VMT):**

If VMT reduction per year is known then go to Step 2B, if not proceed with Step 1 :

<b>A. Facility Length (L):</b>	2.0	Miles	
<b>B. Service Area Radius (R):</b>	1.0	Miles	(Default = 1)
<b>C. Service Area of Community(ies) (SA):</b> $L * 2R = SA$	4	Sq. Miles	
<b>D. Total Land Area of Community(ies) (T):</b>	36.5	Sq. Miles	
<b>E. Service Area % of Community(ies) Land Area (LA):</b> $SA / T = LA$	11.0%		
<b>F. Total Population of Community(ies) (TP):</b>	16,579	Persons	
<b>G. Population Served by Facility (P):</b> $LA * TP = P$	1,817	Persons	
<b>H. Total Number of Households in Community(ies) (HH):</b>	5,828	HH	
<b>I. Number of Households Served by Facility (HS):</b> $LA * HH = HS$	639	HH	
<b>J. Total Number of Workers Residing in Community(ies) (W):</b>	8,647	Persons	
<b>K. Workers Per household (WPHH):</b> $W / HH = WPHH$	1.48	Persons	
<b>L. Workers in Service Area (WSA):</b> $HS * WPHH = WSA$	948	Persons	
<b>M. Population Density of the Service area (PD):</b> $P / SA = PD$	454	Persons Per Sq. Mile	

**Georgetown - Boxford Border-to-Boston Trail**

**CMAQ Air Quality Worksheet (Cont.)**

N. If the bicycle and pedestrian commuter mode share is known, enter the percentage at the right. **(BMS)**

If not, use US Census - American Community Survey data to determine the mode share and enter the percentage.

<http://www.census.gov/programs-surveys/acs/guidance/estimates.html>

O. Bike and Ped. Work Utilitarian Trips **(BWT)**:  $WSA * BMS = BWT$  7 One-Way Trips

P. Bike and Ped. Non-Work Utilitarian Trips **(BNWT)**:  $BWT * 1.7 = BNWT$  12 One-Way Trips

(Latest planning assumptions estimate non-work utilitarian trips to be 1.7 times the work utilitarian.)

**Step 2: Calculate the VMT Reduction Per Day:**

A.  $((2 * BWT) + (2 * BNWT)) * (0.5 * L) = VMTR$  39.4 VMTR Per Day

B.  $VMTR * \text{Operating Days Per Year} = 39.4 * 200 = 7,872 \text{ VMTR Per Year}$

If the Vehicle Miles Traveled Reduction is known enter in the box to the right.  VMTR Per Year

**Note:** A manual entry of the VMTR will override the calculated cell.

**Step 3: MOVES 2014a Emission Factors for Unrestricted PM:**

Note: Use 35 MPH as a default if average speed is not known. Speed Used:

2020 Passenger Summer VOC Factor grams/mile	2020 Passenger Summer NOx Factor grams/mile	2020 Passenger Summer CO Factor grams/mile	2020 Passenger Summer CO2 Factor grams/mile
<input type="text" value="0.030"/>	<input type="text" value="0.081"/>	<input type="text" value="2.095"/>	<input type="text" value="338.769"/>

**Step 4: Calculate emissions reductions in kilograms per year (Seasonally Adjusted):**

Summer VOC	Summer NOx	Summer CO	Summer CO2
<b>0.2</b>	<b>0.7</b>	<b>16.8</b>	<b>2,666.9</b>

**Step 5: Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost	Emission Reduction in kg per year	First year cost per kilogram
Summer VOC	\$1,874,028	/ 0.2 =	<b>\$7,840,800</b>
Summer NOx	\$1,874,028	/ 0.7 =	<b>\$2,870,465</b>
Summer CO	\$1,874,028	/ 16.8 =	<b>\$111,547</b>
Summer CO2	\$1,874,028	/ 2,666.9 =	<b>\$703</b>

Spreadsheet Template Prepared by Office of Transportation Planning

Updated March 2016

CMAQ Air Quality Analysis Worksheet for Bicycle and Pedestrian Project

**FILL IN SHADED BOXES ONLY**

TIP YEAR: 2020  
 MPO: Merrimack Valley Municipality: Georgetown, Newbury  
 Project: # 607542 Georgetown-Newbury Border to Boston Trail

**Step 1: Calculate Estimated Reduction in Vehicle Miles Traveled (VMT):**

If VMT reduction per year is known then go to Step 2B, if not proceed with Step 1 :

<b>A. Facility Length (L):</b>	3.6	Miles	
<b>B. Service Area Radius (R):</b>	1.0	Miles	(Default = 1)
<b>C. Service Area of Community(ies) (SA):</b> $L * 2R = SA$	7.2	Sq. Miles	
<b>D. Total Land Area of Community(ies) (T):</b>	36.3	Sq. Miles	
<b>E. Service Area % of Community(ies) Land Area (LA):</b> $SA / T = LA$	19.8%		
<b>F. Total Population of Community(ies) (TP):</b>	15,088	Persons	
<b>G. Population Served by Facility (P):</b> $LA * TP = P$	2,993	Persons	
<b>H. Total Number of Households in Community(ies) (HH):</b>	5,808	HH	
<b>I. Number of Households Served by Facility (HS):</b> $LA * HH = HS$	1,152	HH	
<b>J. Total Number of Workers Residing in Community(ies) (W):</b>	8,055	Persons	
<b>K. Workers Per household (WPHH):</b> $W / HH = WPHH$	1.39	Persons	
<b>L. Workers in Service Area (WSA):</b> $HS * WPHH = WSA$	1,598	Persons	
<b>M. Population Density of the Service area (PD):</b> $P / SA = PD$			416 Persons Per Sq. Mile

**Georgetown - Newbury Border to Boston Trail**

**CMAQ Air Quality Worksheet (Cont.)**

**N.** If the bicycle and pedestrian commuter mode share is known, enter the percentage at the ri **(BMS)**   
 If not, use US Census - American Community Survey data to determine the mode share and enter the percentage.  
<http://www.census.gov/programs-surveys/acs/guidance/estimates.html>

**O.** Bike and Ped. Work Utilitarian Trips **(BWT)**:  $WSA * BMS = BWT$  24 One-Way Trips

**P.** Bike and Ped. Non-Work Utilitarian Trips **(BNWT)**:  $BWT * 1.7 = BNWT$  40 One-Way Trips  
 (Latest planning assumptions estimate non-work utilitarian trips to be 1.7 times the work utilitarian.)

**Step 2: Calculate the VMT Reduction Per Day:**

**A.**  $((2 * BWT) + (2 * BNWT)) * (0.5 * L) = VMTR$  231.5 VMTR Per Day

**B.**  $VMTR * Operating Days Per Year$   $231.5 * 200 =$  46,290 VMTR Per Year  
 If the Vehicle Miles Traveled Reduction is known enter in the box to the right.  VMTR Per Year

**Note:** A manual entry of the VMTR will override the calculated cell.

**Step 3: MOVES 2014a Emission Factors for Unrestricted PM:**

Note: Use 35 MPH as a default if average speed is not known. Speed Used:

2020 Passenger Summer VOC Factor	2020 Passenger Summer NOx Factor	2020 Passenger Summer CO Factor	2020 Passenger Summer CO2 Factor
grams/mile	grams/mile	grams/mile	grams/mile
<input type="text" value="0.030"/>	<input type="text" value="0.081"/>	<input type="text" value="2.095"/>	<input type="text" value="338.769"/>

**Step 4: Calculate emissions reductions in kilograms per year (Seasonally Adjusted):**

Summer VOC	Summer NOx	Summer CO	Summer CO2
1.4	3.8	98.8	15,681.6

**Step 5: Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost	Emission Reduction in kg per year	First year cost per kilogram
Summer VOC	\$4,341,120	/ 1.4 =	<b>\$3,088,934</b>
Summer NOx	\$4,341,120	/ 3.8 =	<b>\$1,130,838</b>
Summer CO	\$4,341,120	/ 98.8 =	<b>\$43,945</b>
Summer CO2	\$4,341,120	/ 15,681.6 =	<b>\$277</b>

Spreadsheet Template Prepared by Office of Transportation Planning

Updated March 2016



**CMAQ Air Quality Analysis Worksheet for Bicycle and Pedestrian Project**

---

**FILL IN SHADED BOXES ONLY**

**TIP YEAR:** 2020

**MPO:** Merrimack Valley

**Municipality:** Groveland

**Project:** Groveland Community Trail Project # 608298

---

**Step 1: Calculate Estimated Reduction in Vehicle Miles Traveled (VMT):**

If VMT reduction per year is known then go to Step 2B, if not proceed with Step 1 :

<b>A. Facility Length (L):</b>	2.2	Miles	
<b>B. Service Area Radius (R):</b>	1.0	Miles	(Default = 1)
<b>C. Service Area of Community(ies) (SA):</b> $L * 2R = SA$	4.4	Sq. Miles	
<b>D. Total Land Area of Community(ies) (T):</b>	8.9	Sq. Miles	
<b>E. Service Area % of Community(ies) Land Area (LA):</b> $SA / T = LA$	49.4%		
<b>F. Total Population of Community(ies) (TP):</b>	6,646	Persons	
<b>G. Population Served by Facility (P):</b> $LA * TP = P$	3,286	Persons	
<b>H. Total Number of Households in Community(ies) (HH):</b>	2,385	HH	
<b>I. Number of Households Served by Facility (HS):</b> $LA * HH = HS$	1,179	HH	
<b>J. Total Number of Workers Residing in Community(ies) (W):</b>	3,405	Persons	
<b>K. Workers Per household (WPHH):</b> $W / HH = WPHH$	1.43	Persons	
<b>L. Workers in Service Area (WSA):</b> $HS * WPHH = WSA$	1,683	Persons	
<b>M. Population Density of the Service area (PD):</b> $P / SA = PD$	747	Persons Per Sq. Mile	

**N.** If the bicycle and pedestrian commuter mode share is known, enter the percentage at the right **(BMS)**   
 If not, use US Census - American Community Survey data to determine the mode share and enter the percentage.  
<http://www.census.gov/programs-surveys/acs/guidance/estimates.html>

**O.** Bike and Ped. Work Utilitarian Trips **(BWT)**:  $WSA * BMS = BWT$  7 One-Way Trips

**P.** Bike and Ped. Non-Work Utilitarian Trips **(BNWT)**:  $BWT * 1.7 = BNWT$  11 One-Way Trips  
 (Latest planning assumptions estimate non-work utilitarian trips to be 1.7 times the work utilitarian.)

**Step 2: Calculate the VMT Reduction Per Day:**

**A.**  $((2 * BWT) + (2 * BNWT)) * (0.5 * L) = VMTR$  40.0 VMTR Per Day

**B.**  $VMTR * Operating Days Per Year$   $40.0 * 200 =$  7,999 VMTR Per Year  
 If the Vehicle Miles Traveled Reduction is known enter in the box to the right.  VMTR Per Year

**Note:** A manual entry of the VMTR will override the calculated cell.

**Step 3: MOVES 2014a Emission Factors for Unrestricted PM:**

Note: Use 35 MPH as a default if average speed is not known. Speed Used:

2020 Passenger Summer VOC Factor	2020 Passenger Summer NOx Factor	2020 Passenger Summer CO Factor	2020 Passenger Summer CO2 Factor
grams/mile	grams/mile	grams/mile	grams/mile
<input type="text" value="0.030"/>	<input type="text" value="0.081"/>	<input type="text" value="2.095"/>	<input type="text" value="338.769"/>

**Step 4: Calculate emissions reductions in kilograms per year (Seasonally Adjusted):**

Summer VOC	Summer NOx	Summer CO	Summer CO2
<b>0.2</b>	<b>0.7</b>	<b>17.1</b>	<b>2,709.9</b>

**Step 5: Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost	Emission Reduction in kg per year	First year cost per kilogram
Summer VOC	\$2,672,677	/ 0.2 =	<b>\$11,004,874</b>
Summer NOx	\$2,672,677	/ 0.7 =	<b>\$4,028,811</b>
Summer CO	\$2,672,677	/ 17.1 =	<b>\$156,560</b>
Summer CO2	\$2,672,677	/ 2,709.9 =	<b>\$986</b>

Spreadsheet Template Prepared by Office of Transportation Planning

Updated March 2016

**Haverhill Bradford Rail Trail Extension from Route 125 to Railroad St.**

**CMAQ Air Quality Analysis**

**CMAQ Air Quality Analysis Worksheet for Bicycle and Pedestrian Project**

**FILL IN SHADED BOXES ONLY**

<b>TIP YEAR:</b>	2019		
<b>MPO:</b>	Merrimack Valley	<b>Municipality:</b>	Haverhill
<b>Project:</b>	# 608027 Bradford Rail Trail Extension from Route 125 to Railroad Street		

**Step 1: Calculate Estimated Reduction in Vehicle Miles Traveled (VMT):**

If VMT reduction per year is known then go to Step 2B, if not proceed with Step 1 :

<b>A. Facility Length (L):</b>	0.2	Miles	
<b>B. Service Area Radius (R):</b>	1.0	Miles	(Default = 1)
<b>C. Service Area of Community(ies) (SA):</b> $L * 2R = SA$	0.4	Sq. Miles	
<b>D. Total Land Area of Community(ies) (T):</b>	33	Sq. Miles	
<b>E. Service Area % of Community(ies) Land Area (LA):</b> $SA / T = LA$	1.2%		
<b>F. Total Population of Community(ies) (TP):</b>	62,079	Persons	
<b>G. Population Served by Facility (P):</b> $LA * TP = P$	752	Persons	
<b>H. Total Number of Households in Community(ies) (HH):</b>	23,781	HH	
<b>I. Number of Households Served by Facility (HS):</b> $LA * HH = HS$	288	HH	
<b>J. Total Number of Workers Residing in Community(ies) (W):</b>	30,696	Persons	
<b>K. Workers Per household (WPHH):</b> $W / HH = WPHH$	1.29	Persons	
<b>L. Workers in Service Area (WSA):</b> $HS * WPHH = WSA$	372	Persons	
<b>M. Population Density of the Service area (PD):</b> $P / SA = PD$	1,881	Persons Per Sq. Mile	

**Haverhill Bradford Rail Trail Extension from Route 125 to Railroad St.**

**CMAQ Air Quality Analysis (Cont.)**

**N.** If the bicycle and pedestrian commuter mode share is known, enter the percentage at the right **(BMS)**

If not, use US Census - American Community Survey data to determine the mode share and enter the percentage.

<http://www.census.gov/programs-surveys/acs/guidance/estimates.html>

**O.** Bike and Ped. Work Utilitarian Trips **(BWT)**:  $WSA * BMS = BWT$  12 One-Way Trips

**P.** Bike and Ped. Non-Work Utilitarian Trips **(BNWT)**:  $BWT * 1.7 = BNWT$  20 One-Way Trips

(Latest planning assumptions estimate non-work utilitarian trips to be 1.7 times the work utilitarian.)

**Step 2: Calculate the VMT Reduction Per Day:**

**A.**  $((2 * BWT) + (2 * BNWT)) * (0.5 * L) = VMTR$  6.2 VMTR Per Day

**B.**  $VMTR * \text{Operating Days Per Year}$   $6.2 * 200 =$  1,246 VMTR Per Year

If the Vehicle Miles Traveled Reduction is known enter in the box to the right.  VMTR Per Year

**Note:** A manual entry of the VMTR will override the calculated cell.

**Step 3: MOVES 2014a Emission Factors for Unrestricted PM:**

Note: Use 35 MPH as a default if average speed is not known. Speed Used:

2020 Passenger Summer VOC Factor	2020 Passenger Summer NOx Factor	2020 Passenger Summer CO Factor	2020 Passenger Summer CO2 Factor
grams/mile <input type="text" value="0.030"/>	grams/mile <input type="text" value="0.081"/>	grams/mile <input type="text" value="2.095"/>	grams/mile <input type="text" value="338.769"/>

**Step 4: Calculate emissions reductions in kilograms per year (Seasonally Adjusted):**

Summer VOC	Summer NOx	Summer CO	Summer CO2
<b>0.0</b>	<b>0.1</b>	<b>2.7</b>	<b>422.0</b>

**Step 5: Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost		Emission Reduction in kg per year	First year cost per kilogram
Summer VOC	\$1,176,240	/	0.0 =	<b>\$31,101,222</b>
Summer NOx	\$1,176,240	/	0.1 =	<b>\$11,385,951</b>
Summer CO	\$1,176,240	/	2.7 =	<b>\$442,461</b>
Summer CO2	\$1,176,240	/	422.0 =	<b>\$2,787</b>

Spreadsheet Template Prepared by Office of Transportation Planning

Updated March 2016

**Haverhill - Intersection Reconstruction on Route 108 at Route 110**

**CMAQ Air Quality Analysis Worksheet**

**CMAQ Air Quality Analysis Worksheet for Traffic Flow and Intersection Improvements**

**FILL IN SHADED BOXES ONLY**

**TIP YEAR** 2021

**MPO:** Merrimack Valley

**Municipality:** Haverhill

**Project:** # 608761 Intersection Reconstruction on Route 108 (Newton Road) at Route 110 (Kenoza Av & Amesbury Rd)

**Step 1: Calculate Existing AM Peak Hour Total Intersection Delay in Seconds:**

Street Name	Dir	Left-Turns (Vol / PHF)	X delay per veh	=	Total move. delay	+	Thru (Vol / PHF)	X delay per veh	=	Total move. delay	+	Right-Turns (Vol / PHF)	X delay per veh	=	Total move. delay	=	Total approach delay
-------------	-----	---------------------------	--------------------	---	-------------------------	---	---------------------	--------------------	---	-------------------------	---	----------------------------	--------------------	---	-------------------------	---	----------------------------

	NB	0	1.00	=	0.0	=	0	+	350	1.00	=	0.0	=	0	+	12	1.00	=	0.0	=	0	=	0
Rt 108	SB	0	1.00	=	0.0	=	0	+	610	1.00	=	0.0	=	0	+	114	1.00	=	0.0	=	0	=	0
Rt 110	EB	0	1.00	=	0.0	=	0	+	411	1.00	=	0.0	=	0	+	185	1.00	=	0.0	=	0	=	0
Rt 110	WB	0	1.00	=	0.0	=	0	+	458	1.00	=	0.0	=	0	+	21	1.00	=	0.0	=	0	=	0
																<b>Total Intersection Delay/Seconds =</b>		<b>0</b>					

**Haverhill - Intersection Reconstruction on Route 108 at Route 110**

**CMAQ Air Quality Analysis Worksheet (Cont.)**

**Step 2: Calculate Existing PM Peak Hour Total Intersection Delay in Seconds:**

Street Name	Dir	Left-Turns			Total move. delay	+	Thru			Total move. delay	+	Right-Turns			Total move. delay	=	Total approach delay
		(Vol / PHF)	X delay per veh	=			(Vol / PHF)	X delay per veh	=			(Vol / PHF)	X delay per veh	=			
	NB		1.00	=	0	+	0	1.00	=	0	+		1.00	=	0	=	0
Rt 108	SB	40	1.00	=	1,732	+	0	1.00	=	0	+	134	1.00	=	5,802	=	7,534
Rt 110	EB	253	1.00	=	2,454	+	463	1.00	=	0.0	+	0	1.00	=	0	=	2,454
Rt 110	WB	0	1.00	=	0	+	421	1.00	=	0.0	+	145	1.00	=	0	=	0
<b>Total Intersection Delay/Seconds =</b>															<b>9,988</b>		

**Step 3: The spreadsheet automatically chooses the peak hour with the longer total intersection delay for the next step in the analysis.**

Peak Hour:  Total Intersection Delay:

**Step 4: Calculate the existii PM Peak Hour Total Intersection Delay with Improvements:**

Street Name	Dir	Left-Turns			Total move. delay	+	Thru			Total move. delay	+	Right-Turns			Total move. delay	=	Total approach delay
		(Vol / PHF)	X delay per veh	=			(Vol / PHF)	X delay per veh	=			(Vol / PHF)	X delay per veh	=			
	NB		1.00	=	0	+		1.00	=	0	+		1.00	=	0	=	0
Rt 108	SB	40	1.00	=	2,424	+	0	1.00	=		+	134	1.00	=	1,755	=	4,179
Rt 110	EB	253	1.00	=	2,454	+	463	1.00	=		+	0	1.00	=	0	=	2,454
Rt 110	WB	0	1.00	=	0	+	421	1.00	=		+	145	1.00	=	0	=	0
<b>Total Intersection Delay/Seconds =</b>															<b>6,634</b>		



**Haverhill - Intersection Reconstruction on Route 108 at Route 110**

**CMAQ Air Quality Analysis Worksheet (Cont.)**

**Step 5: Calculate vehicle delay in hours per day:**

	(	Delay in seconds	X	Hours per day)	/	Seconds per hour	=	Delay in hours / day
Existing peak hour intersection delay	(	9,988	X	10	)	/	3600	= 27.7
Peak hour intersection delay w/ improvements	(	6,634	X	10	)	/	3600	= 18.4

**Step 6: MOVES 2014a emission factors for idling speed:**

	2020	2020	2020	2020	AM or PM
	Summer VOC Factor	Summer NOx Factor	Winter CO Factor	Summer CO2 Factor	<b>PM</b>
	grams/hour	grams/hour	grams/hour	grams/hour	
	<b>0.249</b>	<b>0.630</b>	<b>3.569</b>	<b>3565.610</b>	

**Step 7: Calculate net emissions change in kilograms per day:**

	Delay in	Summer VOC Emissions	Summer NOx Emissions	Winter CO Emissions	Summer CO2 Emissions
	Hours per Day	kilograms/day	kilograms/day	kilograms/day	kilograms/day
Existing Conditions	27.7	0.007	0.017	0.099	98.929
With Improvements	18.4	0.005	0.012	0.066	65.701
<b>Net Change</b>		<b>-0.002</b>	<b>-0.006</b>	<b>-0.033</b>	<b>-33.228</b>

**Step 8: Calculate net emissions change in kilograms per year (seasonally adjusted)**

	Net change per day (kg) X	Avg. weekdays per year	Seasonal adj. X	Seasonal adj. factor	=	Adj. net change in kg per year
Summer VOC Emissions	-0.002 X	250	X	1.0188	=	<b>-0.591</b>
Summer NOx Emissions	-0.006 X	250	X	1.0188	=	<b>-1.494</b>
Winter CO Emissions	-0.033 X	250	X	0.9812	=	<b>-8.158</b>
Summer CO2 Emissions	-33.228 X	250	X	1.000	=	<b>-8,306.881</b>

**Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost	/	Adj. net change in kg per year	=	First year cost per kilogram
Summer VOC	\$1,944,000	/	-0.591	=	<b>3,291,034</b>
Summer NOx	\$1,944,000	/	-1.494	=	<b>1,300,809</b>
Winter CO	\$1,944,000	/	-8.158	=	<b>238,286</b>
Summer CO2	\$1,944,000	/	-8,306.881	=	<b>234</b>

Spreadsheet Template Prepared by Office of Transportation Planning Updated March 2016

Lawrence Manchester Rail Corridor Rail Trail      CMAQ Air Quality Worksheet

CMAQ Air Quality Analysis Worksheet for Bicycle and Pedestrian Project

**FILL IN SHADED BOXES ONLY**

**TIP YEAR:**      2023

**MPO:**      Merrimack Valley      **Municipality:**      Lawrence

**Project:**      Lawrence Manchester Rail Corridor (LMRC) Rail Trail Project # 608930

**Step 1: Calculate Estimated Reduction in Vehicle Miles Traveled (VMT):**

If VMT reduction per year is known then go to Step 2B, if not proceed with Step 1 :

<b>A. Facility Length (L):</b>	1.5	Miles	
<b>B. Service Area Radius (R):</b>	1.0	Miles	(Default = 1)
<b>C. Service Area of Community(ies) (SA):</b> $L * 2R = SA$	2.92	Sq. Miles	
<b>D. Total Land Area of Community(ies) (T):</b>	6.93	Sq. Miles	
<b>E. Service Area % of Community(ies) Land Area (LA):</b> $SA / T = LA$	42.1%		
<b>F. Total Population of Community(ies) (TP):</b>	79,337	Persons	
<b>G. Population Served by Facility (P):</b> $LA * TP = P$	33,429	Persons	
<b>H. Total Number of Households in Community(ies) (HH):</b>	25,759	HH	
<b>I. Number of Households Served by Facility (HS):</b> $LA * HH = HS$	10,854	HH	
<b>J. Total Number of Workers Residing in Community(ies) (W):</b>	33,261	Persons	
<b>K. Workers Per household (WPHH):</b> $W / HH = WPHH$	1.29	Persons	
<b>L. Workers in Service Area (WSA):</b> $HS * WPHH = WSA$	14,015	Persons	
<b>M. Population Density of the Service area (PD):</b> $P / SA = PD$		11,448 Persons Per Sq. Mile	

**Lawrence Manchester Rail Corridor Rail Trail**

**CMAQ Air Quality Worksheet (Cont.)**

N. If the bicycle and pedestrian commuter mode share is known, enter the percentage at the right: **(BMS)**

If not, use US Census - American Community Survey data to determine the mode share and enter the percentage.

<http://www.census.gov/programs-surveys/acs/guidance/estimates.html>

O. Bike and Ped. Work Utilitarian Trips **(BWT)**:  $WSA * BMS = BWT$  659 One-Way Trips

P. Bike and Ped. Non-Work Utilitarian Trips **(BNWT)**:  $BWT * 1.7 = BNWT$  1,120 One-Way Trips

(Latest planning assumptions estimate non-work utilitarian trips to be 1.7 times the work utilitarian.)

**Step 2: Calculate the VMT Reduction Per Day:**

A.  $((2 * BWT) + (2 * BNWT)) * (0.5 * L) = VMTR$  2596.6 VMTR Per Day

B.  $VMTR * \text{Operating Days Per Year} = 2,596.6 * 200 = 519,313 \text{ VMTR Per Year}$

If the Vehicle Miles Traveled Reduction is known enter in the box to the right.  VMTR Per Year

**Note:** A manual entry of the VMTR will override the calculated cell.

**Step 3: MOVES 2014a Emission Factors for Unrestricted PM:**

Note: Use 35 MPH as a default if average speed is not known. Speed Used:

2020 Passenger Summer VOC Factor	2020 Passenger Summer NOx Factor	2020 Passenger Summer CO Factor	2020 Passenger Summer CO2 Factor
grams/mile	grams/mile	grams/mile	grams/mile
<input type="text" value="0.030"/>	<input type="text" value="0.081"/>	<input type="text" value="2.095"/>	<input type="text" value="338.769"/>

**Step 4: Calculate emissions reductions in kilograms per year (Seasonally Adjusted):**

Summer VOC	Summer NOx	Summer CO	Summer CO2
<b>15.8</b>	<b>43.1</b>	<b>1,108.2</b>	<b>175,927.3</b>

**Step 5: Calculate cost effectiveness (first year cost per kg of emissions reduced)**

Emission	Project Cost	Emission Reduction in kg per year	First year cost per kilogram
Summer VOC	\$14,895,375	/ 15.8 =	<b>\$944,750</b>
Summer NOx	\$14,895,375	/ 43.1 =	<b>\$345,867</b>
Summer CO	\$14,895,375	/ 1,108.2 =	<b>\$13,440</b>
Summer CO2	\$14,895,375	/ 175,927.3 =	<b>\$85</b>

Spreadsheet Template Prepared by Office of Transportation Planning

Updated March 2016

**Merrimack Valley RTA Replace 3 (2007) Buses with 3 (2020) Buses**  
**CMAQ Bus Replacement Air Quality Analysis Worksheet**

**FILL IN SHADED BOXES ONLY**

TIP YEAR: **2020** Bus Replacements  
MPO: **Merrimack Valley**  
RTA: **Merrimack Valley**

**Project #BCG0006781 - Replace 3 (2007) Buses with 3 (2020) Buses**

Emission Rates in grams/mile at assumed operating speed bin of : **18 MPH (Bin 5 (17.5-22.5))**

Scenario Comparison	Model Year	Summer VOC	Summer NOx	Winter CO	Summer CO2
		(grams/mile)	(grams/mile)	(grams/mile)	(grams/mile)
Existing Model*	2007	0.115	3.750	0.659	1,200.600
New Bus Purchase**	2020	0.048	0.764	0.275	1,133.23

\* Please contact OTP for assistance on Existing Model emission factors

\*\* MOVES 2014a Commercial Emission Factors - Please Specify the Following:

AM or PM: **PM**      Restricted or Unrestricted: **Unrestricted**

Change (Buy-Base)	-0.067	-2.986	-0.384	-67.370
-------------------	--------	--------	--------	---------

**Calculate fleet vehicle miles per day:**

Revenue miles per year	X	Deadhead factor	= fleet miles per year	\ operating days per year	= fleet miles per day
<b>104,490</b>		<b>1.16</b>	<b>121,208</b>	<b>354</b>	<b>342</b>

**Merrimack Valley RTA Replace 3 (2007) Buses with 3 (2020) Buses (Cont.)**

**Calculate emissions change in kilograms per summer day**

Change	rate change grams/mile	/ 1000 g/kg	X fleet miles per day	X seasonal adj factor	= change/day in kg
Change in Summer VOC	-0.067	1,000	342	1.0188	<b>-0.023</b>
Change in Summer NOx	-2.986	1,000	342	1.0188	<b>-1.042</b>
Change in Winter CO	-0.384	1,000	342	0.9812	<b>-0.129</b>
Change in Summer CO2	-67.370	1,000	342	1.0000	<b>-23.067</b>

**Calculate emissions change in kilograms per year**

Pollutant	= change/day in kg	X op.days per year	= change per year in kg
Summer VOC	-0.023	354	-8.274
Summer NOx	-1.042	354	-368.733
Winter CO	-0.129	354	-45.669
Summer CO2	-23.067	354	-8165.810

**Calculate cost effectiveness (cost per kg of emissions reduced)**

Pollutant	Total Project Cost	/ Project Life in years	/ reduction per year in kg	= annual cost per kg
Summer VOC	<b>\$1,377,150</b>	<b>12</b>	8.274	<b>\$13,871</b>
Summer NOx	<b>\$1,377,150</b>	<b>12</b>	368.733	<b>\$311</b>
Winter CO	<b>\$1,377,150</b>	<b>12</b>	45.669	<b>\$2,513</b>
Summer CO2	<b>\$1,377,150</b>	<b>12</b>	8165.810	<b>\$14</b>

Template prepared by the Office of Transportation Planning

Updated March 2016

**Merrimack Valley RTA Replace 16 (2015) Vans with 16 (2021) Vans  
CMAQ Bus Replacement Air Quality Analysis Worksheet**

**FILL IN SHADED BOXES ONLY**

TIP YEAR: **2021** Bus Replacements  
MPO: **Merrimack Valley**  
RTA: **Merrimack Valley**

**Project #BCG0006784 - Replace 16 (2015) Vans with 16 (2021) vans**

Emission Rates in grams/mile at assumed operating speed bin of : **18 MPH (Bin 5 (17.5-22.5))**

<b>Scenario Comparison</b>		<b>Summer VOC</b>	<b>Summer NOx</b>	<b>Winter CO</b>	<b>Summer CO2</b>
		(grams/mile)	(grams/mile)	(grams/mile)	(grams/mile)

		Model Year				
Existing Model*	=	2015	0.008	0.058	2.014	501.185
New Bus Purchase**	=	2021	0.003	0.025	0.593	435.854

\* Please contact OTP for assistance on Existing Model emission factors

\*\* MOVES 2014a Commercial Emission Factors - Please Specify the Following:

AM or PM: **PM**      Restricted or Unrestricted: **Unrestricted**

Change (Buy-Base)	-0.005	-0.033	-1.421	-65.331
-------------------	--------	--------	--------	---------

**Calculate fleet vehicle miles per day:**

Revenue miles per year	X	Deadhead factor	= fleet miles per year	operating days per year	= fleet miles per day
<b>436,096</b>		<b>1.15</b>	<b>501,510</b>	<b>359</b>	<b>1,397</b>



## Merrimack Valley RTA Replace 16 (2015) Vans with 16 (2021) Vans (Cont.)

### Calculate emissions change in kilograms per summer day

Change	rate change grams/mile	/ 1000 g/kg	X fleet miles per day	X seasonal adj factor	= change/day in kg
Change in Summer VOC	-0.005	1,000	1,397	1.0188	<b>-0.007</b>
Change in Summer NOx	-0.033	1,000	1,397	1.0188	<b>-0.047</b>
Change in Winter CO	-1.421	1,000	1,397	0.9812	<b>-1.948</b>
Change in Summer CO2	-65.331	1,000	1,397	1.0000	<b>-91.265</b>

### Calculate emissions change in kilograms per year

Pollutant	= change/day in kg	X op.days per year	= change per year in kg
Summer VOC	-0.007	359	-2.555
Summer NOx	-0.047	359	-16.861
Winter CO	-1.948	359	-699.249
Summer CO2	-91.265	359	-32764.176

### Calculate cost effectiveness (cost per kg of emissions reduced)

Pollutant	Total Project Cost	/ Project Life in years	/ reduction per year in kg	= annual cost per kg
Summer VOC	<b>\$1,185,310</b>	<b>4</b>	2.555	<b>\$115,993</b>
Summer NOx	<b>\$1,185,310</b>	<b>4</b>	16.861	<b>\$17,575</b>
Winter CO	<b>\$1,185,310</b>	<b>4</b>	699.249	<b>\$424</b>
Summer CO2	<b>\$1,185,310</b>	<b>4</b>	32764.176	<b>\$9</b>

Template prepared by the Office of Transportation Planning

Updated March 2016

**Merrimack Valley RTA Replace 7 (2009) Buses with 7 (2022) Buses**  
**CMAQ Bus Replacement Air Quality Analysis Worksheet**

**FILL IN SHADED BOXES ONLY**

TIP YEAR: **2022** Bus Replacements  
MPO: **Merrimack Valley**  
RTA: **Merrimack Valley**

**Project #BCG0006791 - Replace 7 (2009) Buses with 7 (2022) Buses**

Emission Rates in grams/mile at assumed operating speed bin of : **18 MPH (Bin 5 (17.5-22.5))**

Scenario Comparison		Summer	Summer	Winter	Summer	
		VOC	NOx	CO	CO2	
		(grams/mile)	(grams/mile)	(grams/mile)	(grams/mile)	
		Model Year				
Existing Model*	=	2009	0.115	3.750	0.659	1,203.080
New Bus Purchase**	=	2022	0.048	0.764	0.275	1,133.23

\* Please contact OTP for assistance on Existing Model emission factors

\*\* MOVES 2014a Commercial Emission Factors - Please Specify the Following:

AM or PM: **PM**      Restricted or Unrestricted **Unrestricted**

Change (Buy-Base)	-0.067	-2.986	-0.384	-69.850
-------------------	--------	--------	--------	---------

**Calculate fleet vehicle miles per day:**

Revenue miles per year	X	Deadhead factor	=	fleet miles per year	/	operating days per year	=	fleet miles per day
<b>243,810</b>		<b>1.16</b>		<b>282,820</b>		<b>354</b>		<b>799</b>

**Merrimack Valley RTA Replace 7 (2009) Buses with 7 (2022) Buses (Cont.)**

**Calculate emissions change in kilograms per summer day**

Change	rate change grams/mile	/ 1000 g/kg	X fleet miles per day	X seasonal adj factor	= change/day in kg
Change in Summer VOC	-0.067	1,000	799	1.0188	<b>-0.055</b>
Change in Summer NOx	-2.986	1,000	799	1.0188	<b>-2.430</b>
Change in Winter CO	-0.384	1,000	799	0.9812	<b>-0.301</b>
Change in Summer CO2	-69.850	1,000	799	1.0000	<b>-55.805</b>

**Calculate emissions change in kilograms per year**

Pollutant	= change/day in kg	X op. days per year	= change per year in kg
Summer VOC	-0.055	354	-19.305
Summer NOx	-2.430	354	-860.376
Winter CO	-0.301	354	-106.561
Summer CO2	-55.805	354	-19754.949

**Calculate cost effectiveness (cost per kg of emissions reduced)**

Pollutant	Total Project Cost	/ Project Life in years	/ reduction per year in kg	= annual cost per kg
Summer VOC	<b>\$3,309,565</b>	<b>12</b>	19.305	<b>\$14,286</b>
Summer NOx	<b>\$3,309,565</b>	<b>12</b>	860.376	<b>\$321</b>
Winter CO	<b>\$3,309,565</b>	<b>12</b>	106.561	<b>\$2,588</b>
Summer CO2	<b>\$3,309,565</b>	<b>12</b>	19754.949	<b>\$14</b>

Template prepared by the Office of Transportation Planning

Updated March 2016

**Merrimack Valley RTA Replace 2 (2009) Buses with 2 (2023) Buses**  
**CMAQ Bus Replacement Air Quality Analysis Worksheet**

**FILL IN SHADED BOXES ONLY**

TIP YEAR: **2023** Bus Replacements  
MPO: **Merrimack Valley**  
RTA: **Merrimack Valley**

**Project #RTD0007135 - Replace 2 (2009) Buses with 2 (2023) Buses**

Emission Rates in grams/mile at assumed operating speed bin of: **18 MPH (Bin 5 (17.5-22.5))**

Scenario Comparison		Summer	Summer	Winter	Summer	
		VOC	NOx	CO	CO2	
		(grams/mile)	(grams/mile)	(grams/mile)	(grams/mile)	
		Model Year				
Existing Model*	=	2009	0.115	3.750	0.659	1,203.080
New Bus Purchase**	=	2023	0.048	0.764	0.275	1,133.23

\* Please contact OTP for assistance on Existing Model emission factors

\*\* MOVES 2014a Commercial Emission Factors - Please Specify the Following:

AM or PM: **PM**      Restricted or Unrestricted: **Unrestricted**

Change (Buy-Base)	-0.067	-2.986	-0.384	-69.850
-------------------	--------	--------	--------	---------

**Calculate fleet vehicle miles per day:**

Revenue miles per year	X	Deadhead factor	=	fleet miles per year	/	operating days per year	=	fleet miles per day
<b>69,660</b>		<b>1.16</b>		<b>80,806</b>		<b>354</b>		<b>228</b>

**Merrimack Valley RTA Replace 2 (2009) Buses with 2 (2023) Buses (Cont.)**

**Calculate emissions change in kilograms per summer day**

Change	rate change grams/mile	/ 1000 g/kg	X fleet miles per day	X seasonal adj factor	= change/day in kg
Change in Summer VOC	-0.067	1,000	228	1.0188	<b>-0.016</b>
Change in Summer NOx	-2.986	1,000	228	1.0188	<b>-0.694</b>
Change in Winter CO	-0.384	1,000	228	0.9812	<b>-0.086</b>
Change in Summer CO2	-69.850	1,000	228	1.0000	<b>-15.944</b>

**Calculate emissions change in kilograms per year**

Pollutant	= change/day in kg	X op. days per year	= change per year in kg
Summer VOC	-0.016	354	-5.516
Summer NOx	-0.694	354	-245.822
Winter CO	-0.086	354	-30.446
Summer CO2	-15.944	354	-5644.271

**Calculate cost effectiveness (cost per kg of emissions reduced)**

Pollutant	Total Project Cost	/ Project Life in years	/ reduction per year in kg	= annual cost per kg
Summer VOC	<b>\$973,910</b>	<b>12</b>	5.516	<b>\$14,714</b>
Summer NOx	<b>\$973,910</b>	<b>12</b>	245.822	<b>\$330</b>
Winter CO	<b>\$973,910</b>	<b>12</b>	30.446	<b>\$2,666</b>
Summer CO2	<b>\$973,910</b>	<b>12</b>	5644.271	<b>\$14</b>

Template prepared by the Office of Transportation Planning

Updated March 2016

Page intentionally left blank.

## **Appendix F Completed Highway and Transit Projects GHG Summary**

## Merrimack Valley Region MPO TIP Completed Highway Projects GHG Tracking Summary

Mass DOT/ Project ID	MassDOT Project Description	Total Pro-grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Additional Description	Fiscal Year of Contract Award (2015 and forward)
606503	NEWBURYPORT CLIPPER CITY RAIL TRAIL ALONG THE CITY BRANCH (PHASE II)	\$4,061,158	Quantified	34,996	Quantified Decrease in Emissions from Bicycle and Pedestrian Infra-structure	Advertised 9/19/2015 Notice to Proceed 4/1/2016	2016
606161	HAVERHILL- IMPROVEMENTS ON MAIN STREET (ROUTE 125)	\$3,635,519	Quantified	16,491	Quantified Decrease in Emissions from Traffic Operational Improve-ment	Advertised 9/17/2016 Notice to Proceed 4/12/2017	2017
607573	HAVERHILL- RECONSTRUCTION ON ROUTE 97 (BROADWAY), FROM SILVER BIRCH LANE TO RESEARCH DRIVE	\$6,526,912	Quantified	41,800	Quantified Decrease in Emissions from Traffic Operational Improve-ment	Advertised 5/13/2017 Notice to Proceed 2/9/2018	



## Merrimack Valley Region MPO TIP Completed Highway Projects GHG Tracking Summary (Cont.)

Mass DOT/ Project ID	MassDOT Project Description	Total Pro-grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Im-pact (kg/yr)	GHG Impact Description	Additional Description	Fiscal Year of Contract Award (2015 and forward)
604585	FLEX TO FTA FOR MVRTA NEW BUS UPGRADE TO CLEANER FUEL BUSES	\$645,840	Quantified	26,343	Quantified Decrease in Emissions from Bus Replacement	Flexed to FTA	2017
605020	SALISBURY- MULTI-USE TRAIL EXTENSION (BORDERS TO BOSTON TRAIL), INCLUDES NEW BRIDGE S-02-004 AND BOARDWALK (S-02-012) (BYX)	\$5,918,500	Quantified	18,631	Quantified Decrease in Emissions from Bicycle and Pedestrian Infra-structure	Advertised 8/25/2018 Contract Awarded 12/12/18 Notice to Proceed 1/18/19	2018

## Merrimack Valley Region MPO TIP Completed Highway Projects GHG Tracking Summary (Cont.)

Mass DOT/ Project ID	MassDOT Project Description	Total Pro-grammed Funds	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Additional Description	Fiscal Year of Contract Award (2015 and forward)
607737	AMESBURY-SALISBURY- TRAIL CONNECTOR @ I-95	\$2,574,805	Quantified	3,972	Quantified Decrease in Emissions from Bicycle and Pedes-trian Infrastructure	Advertised 9/15/2018 Awaiting Contract Award	
606159	NORTH ANDOVER- INTERSECTION & SIGNAL IMPROVEMENTS AT ROUTE 125 & MASSACHUSETTS AVENUE	\$5,446,662	Quantified	482,727	Quantified Decrease in Emissions from Traffic Operational Improvement	Advertised 1/12/2019 Bids due 4/17/2019	

## Merrimack Valley Region MPO TIP Completed Transit Projects GHG Tracking Summary

FTA Activity Line Item	Transit Agency	Project Description	Total Cost	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Additional Description	Fiscal Year Programmed (2015 and forward)
	MVRTA	Purchase – Replacement Vans 11 Model Year 2009 Delivery 2015	\$627,000	Quantified	41,814	Quantified Decrease in Emissions from Bus Replacement		2015
111202	MVRTA	Replace 10 of 17 Model Year 2004 Transit Buses with new buses (Delivery 2016)	\$4,200,000	Quantified	12,557	Quantified Decrease in Emissions from Bus Replacement		2015
111215	MVRTA	Replace 5 Model Year 2011 Para-transit Vehicles (Delivery 2016)	\$320,000	Quantified	15,992	Quantified Decrease in Emissions from Bus Replacement		2016
111202	MVRTA	Replace 7 MY 2004 Transit Buses with new buses	\$2,989,000	Quantified	18,271	Quantified Decrease in Emissions from Bus Replacement		2017

## Merrimack Valley Region MPO TIP Completed Transit Projects GHG Tracking Summary (Cont.)

FTA Activity Line Item	Transit Agency	Project Description	Total Cost	GHG Analysis Type	GHG CO <sub>2</sub> Impact (kg/yr)	GHG Impact Description	Additional Description	Fiscal Year Pro-programmed (2015 and forward)
111202	MVRTA	Replace 6 Model Year 2004 Buses (Delivery 2018)	\$2,689,500	Quantified	15,661	Quantified Decrease in Emissions from Bus Replacement		2018

## **Appendix G List of Acronyms**

<b>MVMPO List of Commonly Used Acronyms</b>		
A	AADT	Average Annual Daily Traffic
	AASHTO	American Association of State Highway Transportation Officials
	ABP	MassDOT Accelerated Bridge Program
	AC	Advance Construction
	ADA	Americans with Disabilities Act (1990)
	ADT	Average Daily Traffic
	ARRA	American Recovery and Reinvestment Act (of 2009)
	AQ	Air Quality
B	B to B	Border to Boston Rail Trail
	BR, BR-On, BR-Off	Bridge Rehabilitation or Replacement (On- or Off-National Highway System)
C	(C)	Type of Project = Capital Improvement
	3C	Continuing, Comprehensive and Coordinated (Transportation Planning)
	CAAA	Clean Air Act Amendments of 1990
	CFR	Code of Federal Regulations
	CIP	Capital Investment Plan
	CLF	Conservation Law Foundation
	CMAQ	Congestion Mitigation and Air Quality Improvement Program
	CMP	Congestion Management Process
	CMR	Code of Massachusetts Regulations
	CNG	Compressed Natural Gas
	CO	Carbon Monoxide

D	DEP	Department of Environmental Protection
	DOT	Department of Transportation
	DPW	Department of Public Works
E	EB	Eastbound
	EIR	Environmental Impact Report
	EIS	Environmental Impact Statement
	EJ	Environmental Justice
	ENF	Environmental Notification Form
	E.O.	Executive Order (of the Governor of the Commonwealth)
	EPA	U.S. Environmental Protection Agency
F	FA	Federal-Aid
	FAPRO	Federal Aid Program Reimbursement Office
	FAST Act	Fixing America's Surface Transportation Act legislation signed into law December 4, 2015
	FHWA	Federal Highway Administration
	FTA	Federal Transit Administration
	FY	(State) Fiscal Year
	FFY	Federal Fiscal Year
G	GANs	Grant Anticipation Notes
	GHG	Greenhouse Gas
H	HPP	USDOT High Priority Project
	HSIP	Highway Safety Improvement Program

I	IM	Interstate Maintenance
	ITS	Intelligent Transportation System
	ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
L	LEP	Limited English Proficiency
	LOS	Level of Service
	LTA	Local Technical Assistance
M	(M)	Type of project = Maintenance
	MAP-21	Moving Ahead for Progress in the 21 <sup>st</sup> Century legislation signed into law July 6, 2012
	MassDOT	Massachusetts Department of Transportation
	MCAD	Massachusetts Commission Against Discrimination
	MEPA	Massachusetts Environmental Policy Act
	M.G.L.	Massachusetts General Laws
	MOA	Memorandum of Agreement
	MOD	Massachusetts Office on Disabilities
	MOU	Memorandum of Understanding
	MPO	Metropolitan Planning Organization
	MVMPO	Merrimack Valley Metropolitan Planning Organization
	MVPC	Merrimack Valley Planning Commission
	MVPGS	Merrimack Valley Priority Growth Strategy
	MVRTA	Merrimack Valley Regional Transit Authority
N	(N)	Type of project = other, not capital expense, or operating expense, but other such as planning or design



	NAAQS	National Ambient Air Quality Standards
	NARC	National Association of Regional Councils
	NB	Northbound
	NEPA	National Environmental Policy Act
	NFA	Non-Federal Aid
	NHS	National Highway System
	NMCOG	Northern Middlesex Council of Governments
	NOx	Nitrogen Oxide
	NPRM	Notice of Proposed Rulemaking (Federal Register)
O	(O)	Type of Project = Operating Expense
	O&M	Operations and Maintenance
P	PCI	Pavement Condition Index
	PDA	Priority Development Area
	PL	(Metropolitan) Planning Funds
	PMS	Pavement Management System
	PPP	Public Participation Plan
	PRC	(MassDOT) Project Review Committee
	PSAC	Project Selection Advisory Council
	PS&E	The Plans, Specifications and Estimate to be used by contractors to bid on construction proposals
R	RGGI	Regional Greenhouse Gas Initiative
	ROW	Right-of-Way
	RPA	Regional Planning Agency
	RPMS	Regional Pavement Management System
	RTA	Regional Transit Authority
	RTP	Regional Transit Plan

S	SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
	SB	Southbound
	SD	Structurally Deficient
	SGR	State of Good Repair
	SIP	State (Air Quality) Implementation Plan
	SOV	Single Occupancy Vehicle
	SPR	Statewide Planning and Research Funds
	STBG	Surface Transportation Block Grant Program
	STIP	Statewide Transportation Improvement Program
	STP	Surface Transportation Program
T	TA	Transportation Alternatives
	TAM	Transit Asset Management
	TAP	Transportation Alternatives Program
	TCSP	Transportation and Community System Preservation Grant Program
	TDM	Transportation Demand Management
	TEA-21	Transportation Equity Act for the 21 <sup>st</sup> Century
	TEC	Transportation Project Evaluation Criteria
	TERM score	Transit Economic Requirements Model score used to rate transit facility conditions
	TIP	Transportation Improvement Program
	TMA	Transportation Management Area
	TMC	Turning Movement Count
	TOD	Transit-Oriented Development
	TRB	Transportation Research Board

U	ULB	Useful Life Benchmark
	UPWP	Unified Planning Work Program
	USDOT	U.S. Department of Transportation
V	V/C	Volume/Capacity Ratio
	VMT	Vehicle Miles Traveled
	VOC	Volatile Organic Compound
W	WB	Westbound

<b>Massachusetts Executive Orders</b>		
EO	526	Nondiscrimination, Diversity, Equal Employment Opportunity and Affirmative Action
EO	12898	Environmental Justice in Minority and Low-Income Populations, February 1994
EO	13166	Improving Access to Programs (and Services) for persons with limited English Proficiency

Page intentionally left blank.

## **Appendix H Key to Maps Showing Locations of Transportation Projects**

## Appendix H Key to Maps Showing Locations of Transportation Projects

Map Number	Project Number	City/Town	Project Description
<a href="#"><u>1</u></a>	602418	Amesbury	Amesbury – Reconstruction of Elm Street
<a href="#"><u>2</u></a>	606522	Andover	Andover- Bridge Rehabilitation, A-09-036, I-495 over St 28 (SB), A-09-037, I-495 over B&M and MBTA, A-09-041, I-495 over St 28 (NB)
<a href="#"><u>3</u></a>	607541	Georgetown-Boxford	Georgetown – Boxford Border to Boston Trail from Georgetown Road to West Main Street (Route 97)
<a href="#"><u>3</u></a>	607542	Georgetown-Newbury	Georgetown– Newbury Border to Boston Trail (Northern Georgetown to Byfield Section)
<a href="#"><u>4</u></a>	608298	Groveland	Groveland- Groveland Community Trail, from Main Street to King Street
<a href="#"><u>5</u></a>	608027	Haverhill	Haverhill- Bradford Rail Trail Extension, from Route 125 to Railroad Street
<a href="#"><u>5</u></a>	RTD - 7695	MVRTA	SGR Riverbank Stabilization Construction
<a href="#"><u>5</u></a>	605306	Haverhill	Haverhill – Bridge Replacement, H-12- 039, I-495 (NB & SB) over Merrimack River
<a href="#"><u>5</u></a>	605304	Haverhill	Haverhill- Bridge Replacement, H-12-007 & H-12-025, Bridge Street (SR 125) over Merrimack River and the Abandoned B&M RR (Proposed Bikeway)

## Appendix H Key to Maps Showing Locations of Transportation Projects

(Continued)

Map Number	Project Number	City/Town	Project Description
<a href="#">6</a>	608761	Haverhill	Haverhill – Intersection Reconstruction on Route 108 (Newton Road) at Route 110 (Kenoza Avenue and Amesbury Road)
<a href="#">6</a>	608788	Haverhill	Haverhill – Roadway Reconstruction on North Avenue, from Main Street (Route 125) to Plaistow NH
<a href="#">7</a>	608930	Lawrence	Lawrence - Lawrence Manchester Rail Corridor (LMRC) Rail Trail
<a href="#">8</a>	608494	Newbury / Newburyport / Salisbury	Resurfacing of Route 1
<a href="#">9</a>	608095	North Andover	North Andover- Corridor Improvements on Route 114, between Route 125 (Andover Street) & Stop & Shop driveway
<a href="#">10</a>	602202	Salisbury	Salisbury – Reconstruction of Route 1 (Lafayette Road)
<a href="#">11</a>	TBD	Haverhill	Haverhill – Bridge Replacement, H-12-040, I-495 (NB & SB) over Merrimack River

Page intentionally left blank.



## **Appendix I    Comments Received on Draft 2020-2024 TIP**



Charles D. Baker, Governor  
Karyn E. Polito, Lieutenant Governor  
Stephanie Pollack, MassDOT Secretary & CEO



May 6, 2019

Karen Sawyer Conard, Executive Director  
Merrimack Valley Planning Commission  
160 Main Street  
Haverhill, MA 01830

Dear Ms. Conard:

The Massachusetts Department of Transportation (MassDOT) Office of Transportation Planning (OTP) has reviewed the draft Federal Fiscal Year (FFY) 2020 - 2024 Transportation Improvement Program (TIP) released by the Merrimack Valley Metropolitan Planning Organization (MVMPO) on April 24, 2019. The following MassDOT comments include both general guidance and specific comments on the MPO's 3C planning process related to the content of this document as released for public review.

Please note the following comments specific to the information contained in the MPO's draft FFY 2020 - 2024 TIP.

#### General

- Please proofread the document for spelling errors and consistency with capitalization.
- For all pages containing tables and charts, please center them in the document and add a page break when appropriate to keep content from spilling to next page (when possible).

#### Narrative

- Pages 1, 3, and 5: Please remove the space in MassDOT under Secretary Pollock's signatory certification lines.
- Page 11: Please pluralize injury on line 7
- Pages 14-15: Please hyphenate 5 Year (i.e. 5-Year)
- Pages 17, 19: Please change title heading to read "Total Incapacitating Injuries and Incapacitating Injury Crash Rates" (There is a definitional difference between serious injuries and incapacitating injuries).
- Pages 18-19: Please change 'Ped' to 'Pedestrian' in title headings.
- Pages 48-52: Please remove MassRIDES from the current list. Although this list is consistent with the current Public Participation Plan (PPP), MVMPO should review this section to confirm if there are any other stakeholders it wishes to include in this process.
- Page 59: Please remove '-' between the words set aside.

John Park Plaza, Suite 4160, Boston, MA 02116  
Tel: 857 368 4635, TTY: 857 368 6655  
[www.mass.gov/massdot](http://www.mass.gov/massdot)

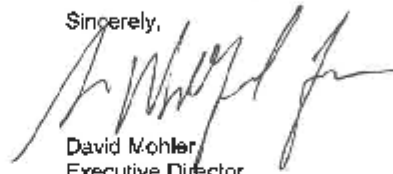
**Greenhouse Gas (GHG) Emissions Impacts**

**General**

- Please refer to the text in the most recent STIP "GHG tracking" section (available online) for updated language for use in Appendix E – Greenhouse Gas (GHG) Monitoring and Evaluation.

Please contact me at (857) 368-8865 or Derek Shooster at (857) 368-8842 if you have any questions.

Sincerely,



David Mohler  
Executive Director  
Office of Transportation Planning

Cc: Jeffrey McEwen, Division Administrator, Federal Highway Administration  
Peter Butler, Acting Regional Administrator, Federal Transit Administration  
Paul Sledman, District 4 Highway Director  
Frank Suszynski, District 4 Project Development Engineer  
Astrid Glynn, Rail and Transit Division Administrator

Response: Changes made.

The Town of Groveland sent an email confirming that the Groveland Community Trail Project was on track to be ready for FFY 2021 and they provided more details about the project's progress.