

TOBIN BRIDGE MANAGED LANE

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9/29/22

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massDOT
Massachusetts Department of Transportation

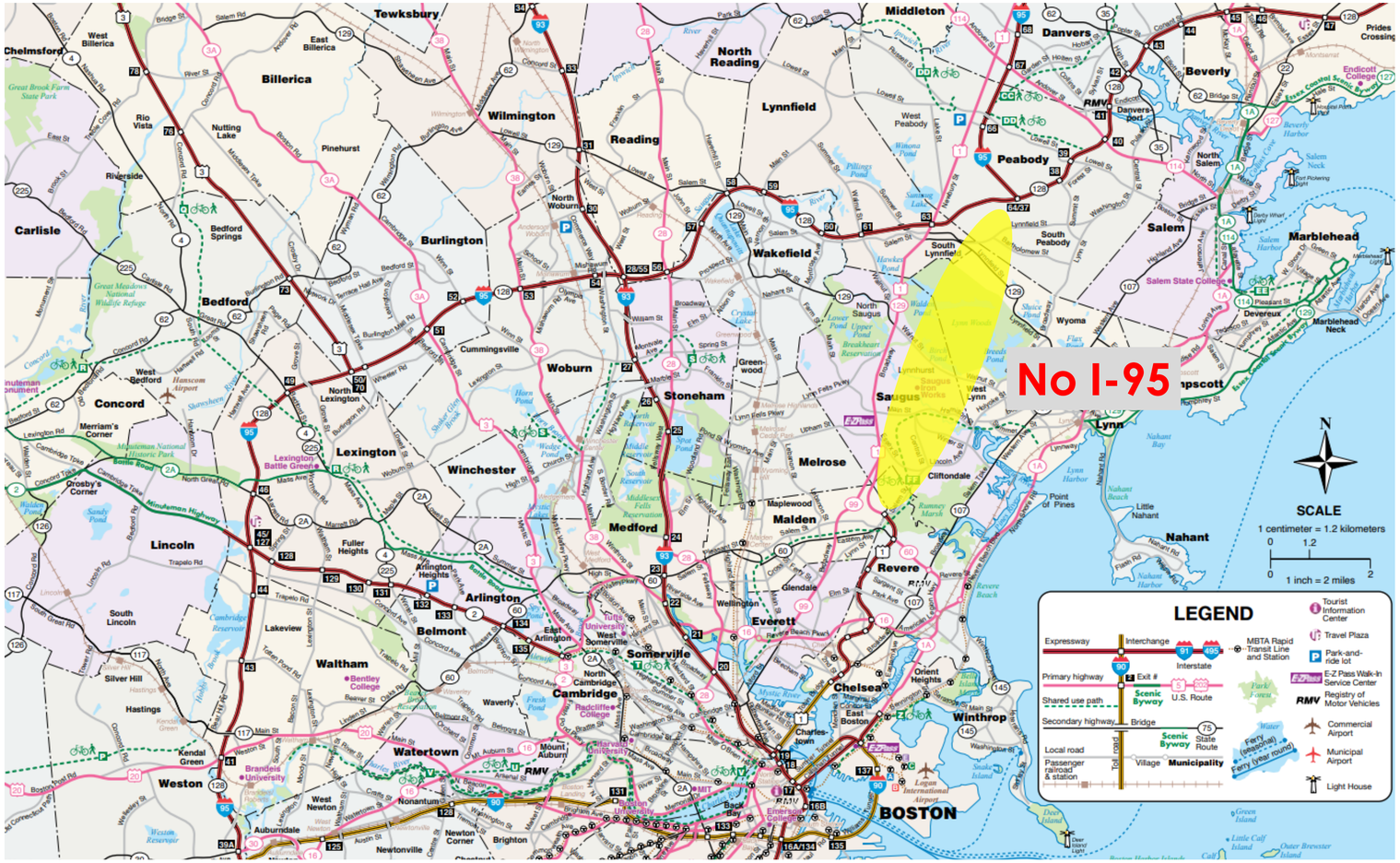
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BACKGROUND

The Freeway System in Boston

- Old
- Complex
- Incomplete
- *Does an amazing job of moving traffic*

Proposed and Constructed Boston Freeway System

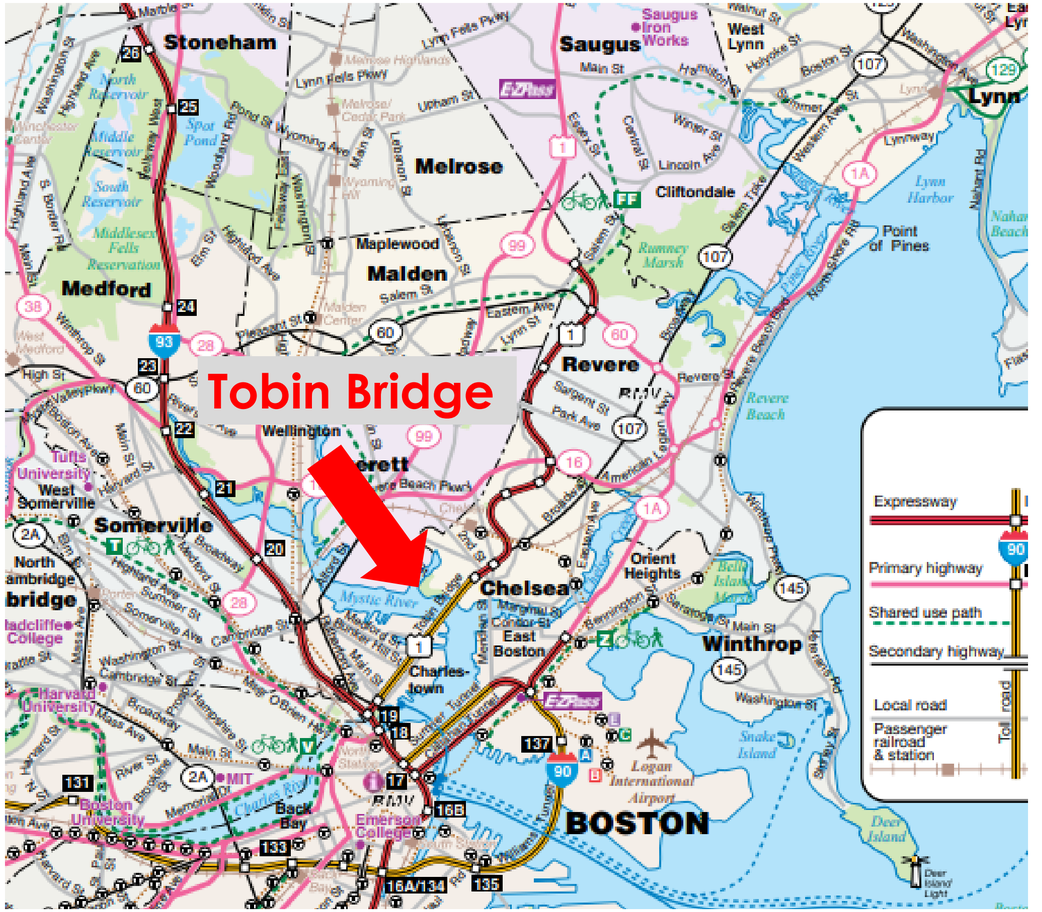


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The Tobin Bridge

- Double-deck bridge with 36 feet/3 lanes in each direction
  - Southbound on top deck
- Tolled (all-electronic)
- Opened 1950





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Upstream (travelling northbound)



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Downstream (travelling southbound)



Tobin Bridge Background

MassDOT Multimodal Initiatives

- How can highways be used to support multimodal travel?
- Statewide Bus-on-Shoulder Screening Study identified US 1 as the #2 candidate corridor, but Tobin Bridge lacks a shoulder
  - 218 southbound MBTA buses per day

Chelsea Curves Construction

- Reduced US 1 from 3 to 2 lanes in each direction north of Tobin Bridge beginning in 2019 and into COVID
- Gave drivers an opportunity to see what reduced lanes would be like



- **What if a lane stayed closed (to general purpose traffic?)**

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STUDY

Objectives, Goals, and Solution

1

Background

Support high ridership MBTA Route 111

Long-term US 1 lane closure due to Chelsea Curves reconstruction could transition to managed lane

2

Objective

Study managed lane scenarios on the Tobin Bridge

3

Goals

Maximize person-throughput across all lanes

Reduce bus travel time

Maintain reasonable level of mobility for all modes

4

Principles

Only peak direction studied

Analysis for Year 2018

Matches CTPS Travel Demand Model

Prior to COVID and Chelsea Curves project

Consistent with rapid implementation of improvements

5

Findings

Propose implementing a managed lane (managed lane restrictions TBD) in the southbound direction

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Scenarios Considered







Baseline

Baseline is existing geometry with pre-COVID volumes.

HOV 2+ Lane

HOV 3+ Lane

Bus Only Lane

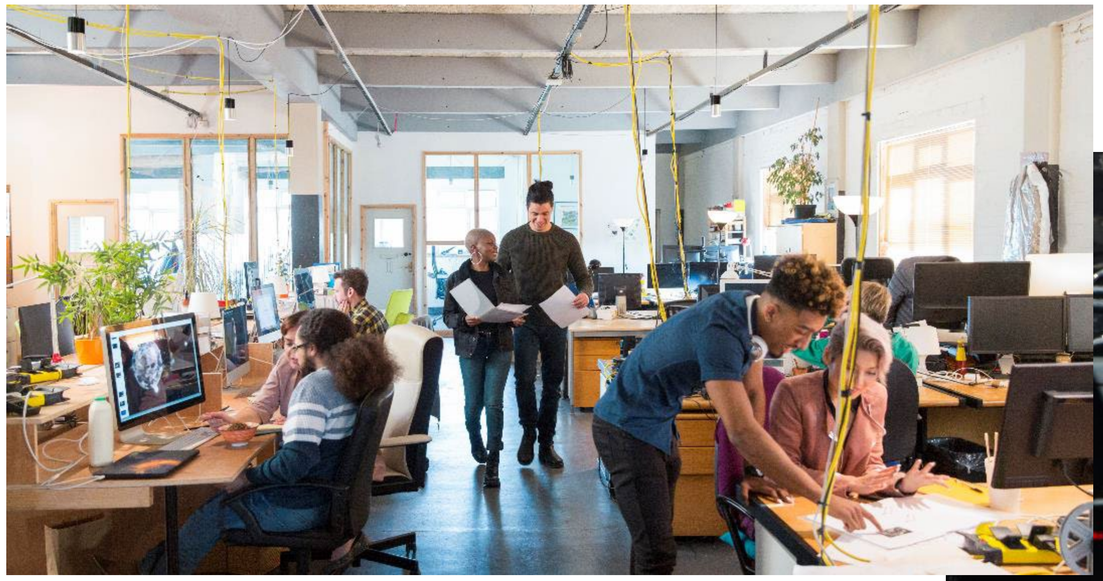
Only for Southbound

Initial northbound analysis found managed lane created acute bottleneck prior to bridge and introduced weaving for buses on bridge

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Assumption

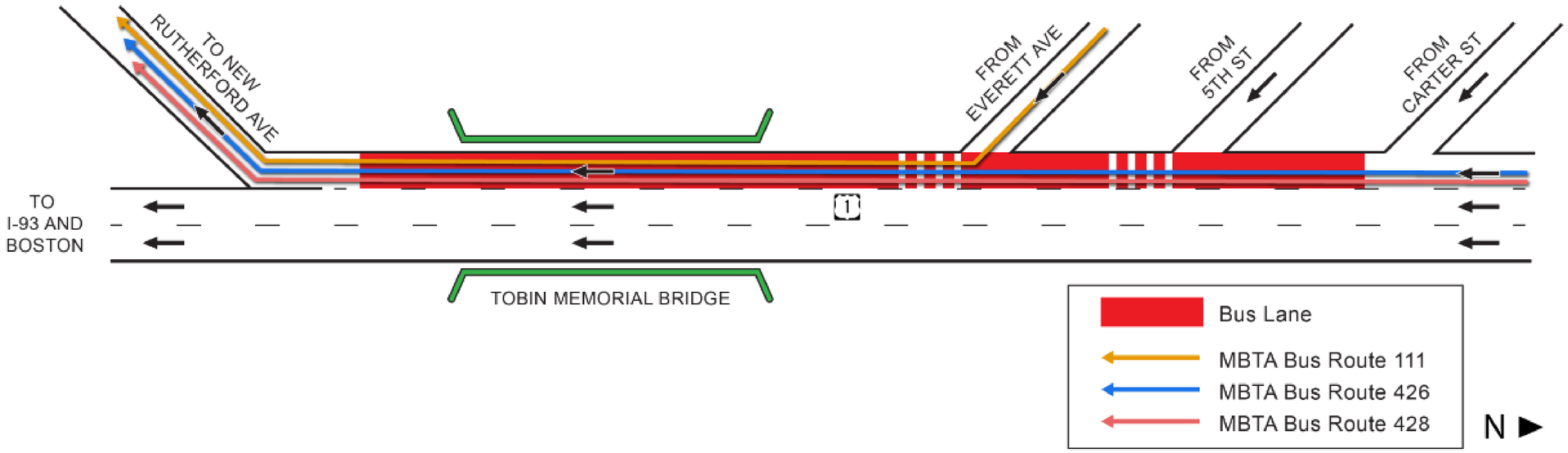
COVID is going to end and all commuting patterns will go back to the way they were





Managed Lane Design

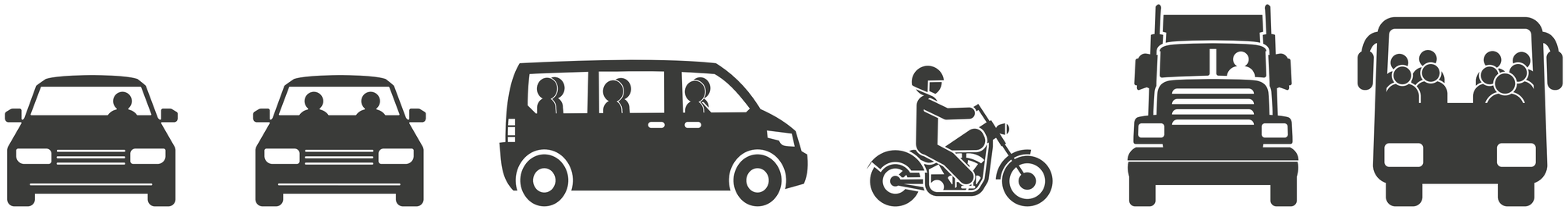
- Right-side versus left studied preliminarily
  - Bus enters and exits on right, so right side selected
- Extended far enough upstream to avoid queue



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Current Mode Split

AM SB Peak Period (6:00am – 9:00am)



	Single Occupant	2 Occupants	3+ Occupants	Motorcycle	Heavy Vehicle	Bus
Sept 2020 field collection	78.5%	14.1%	0.6%	0.3%	5.9%	0.4%

* 0.1% unknown

Multi-Resolution Modeling Approach

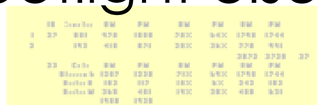
- Travel Demand Modeling
  - Year 2018 analysis – pre-COVID and pre-lane closure
  - Performed by Boston MPO (CTPS)

- VISSIM Microscopic Simulation Modeling

- No future year analysis
  - Project has short implementation timeframe
  - Area is built out and has adjacent bottlenecks

Volume Development

- Variety of sources
  - Travel Demand Model
  - Historical (Pre-COVID & pre-construction) counts
  - Counts collected for this project
- COVID adjustment factor
  - Developed from Tobin Bridge toll gantry volumes
- Weaving volumes
  - Field-collected at key locations
  - Estimated with Streetlight elsewhere



Key Questions

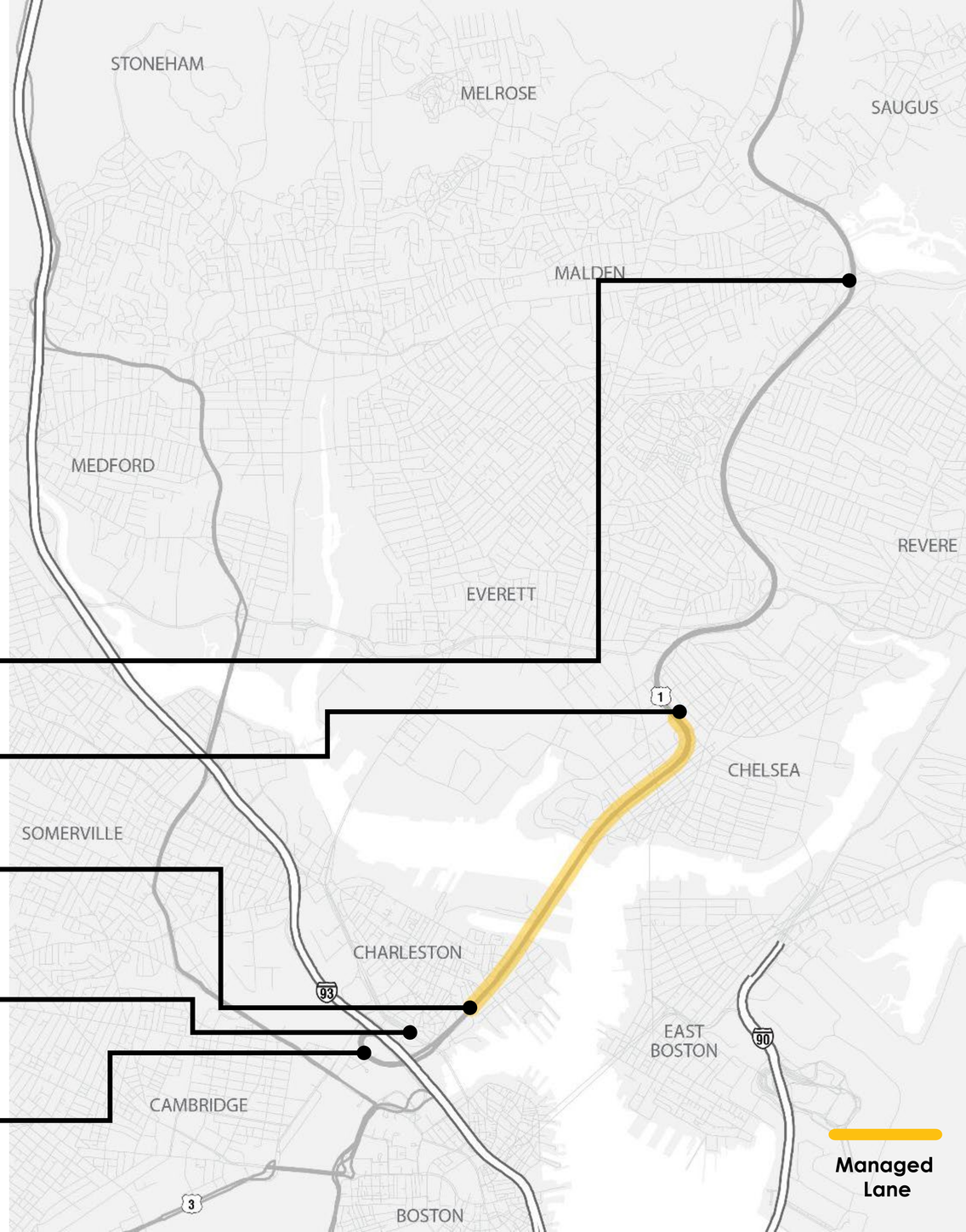
- How will person throughput change?
  - How will bus ridership change?
  - How will volumes change?
  - How will mode split change?
  - What amount of diversion will occur?

Vehicle Volumes – All Lanes

AM SB Peak Hour (7:00am – 8:00am)

	Baseline	HOV 2+	HOV 3+	Bus Only Lane
Copeland Circle	2,500	2,488	2,369	2,374
Managed Lane Start	2,900	2,642	2,044	2,160
Managed Lane End	3,600	3,479	2,903	2,997
RAMP: New Rutherford Off Ramp	1,200	1,008	818	903
RAMP: I-93/US 1 Off Ramp	2,400	2,471	2,085	2,094

Note: These volumes come from the balanced volumes from the travel demand model



Percent Southbound Vehicle Increase Across Key Bridges and Tunnels

AM Peak Period
(6:00am – 9:00am)

HOV 2+ Scenario

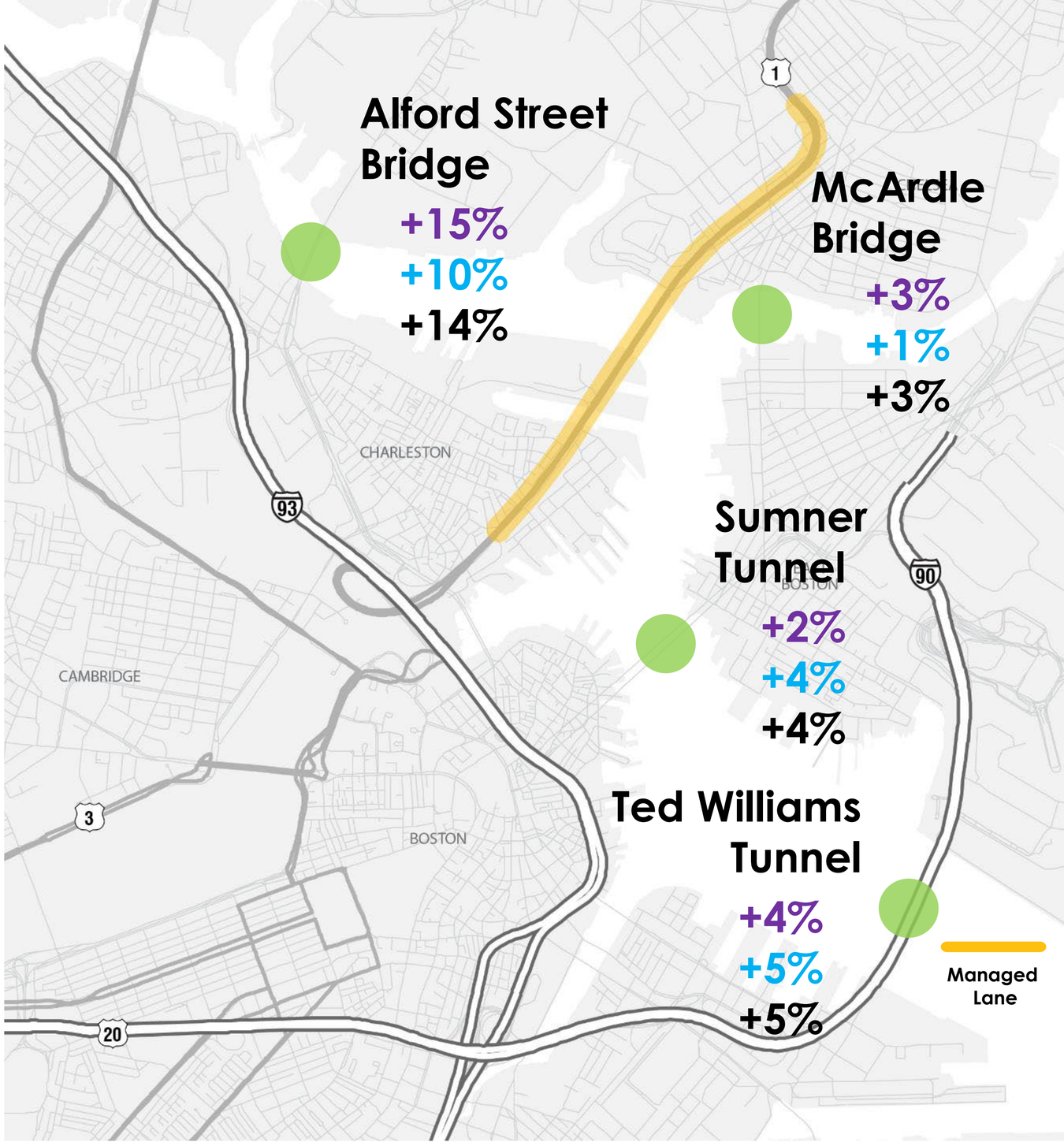


HOV 3+ Scenario



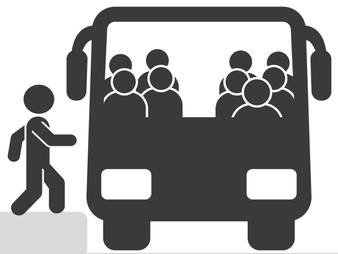
Bus-Only Scenario





Ridership & Managed Lane Usage
AM SB Peak Period (6:00am – 9:00am)

		HOV 2+	HOV 3+	Bus Only Lane
Vehicles in Managed Lane		**2,500**	**300**	**40**
Bus Ridership	**Bus Route**	**Baseline**		
	111	**1,650**	**2,000**	**2,000**	**2,000**
	426	**290**	**320**	**320**	**320**
	428	**65**	**75**	**75**	**75**



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Person Throughput



AM SB Peak Period (6:00am – 9:00am)

	Baseline	HOV 2+	HOV 3+	Bus Only Lane
SOV Person	9,431	7,872	7,449	7,563
HOV 2 Person	3,048	5,821	3,160	2,719
HOV 3+ Person	73	140	600	66
Bus Person	1,640	2,125	2,139	2,103
Total	**14,192**	↑ **15,958**	↓ **13,348**	↓ **12,451**

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VISSIM Calibration

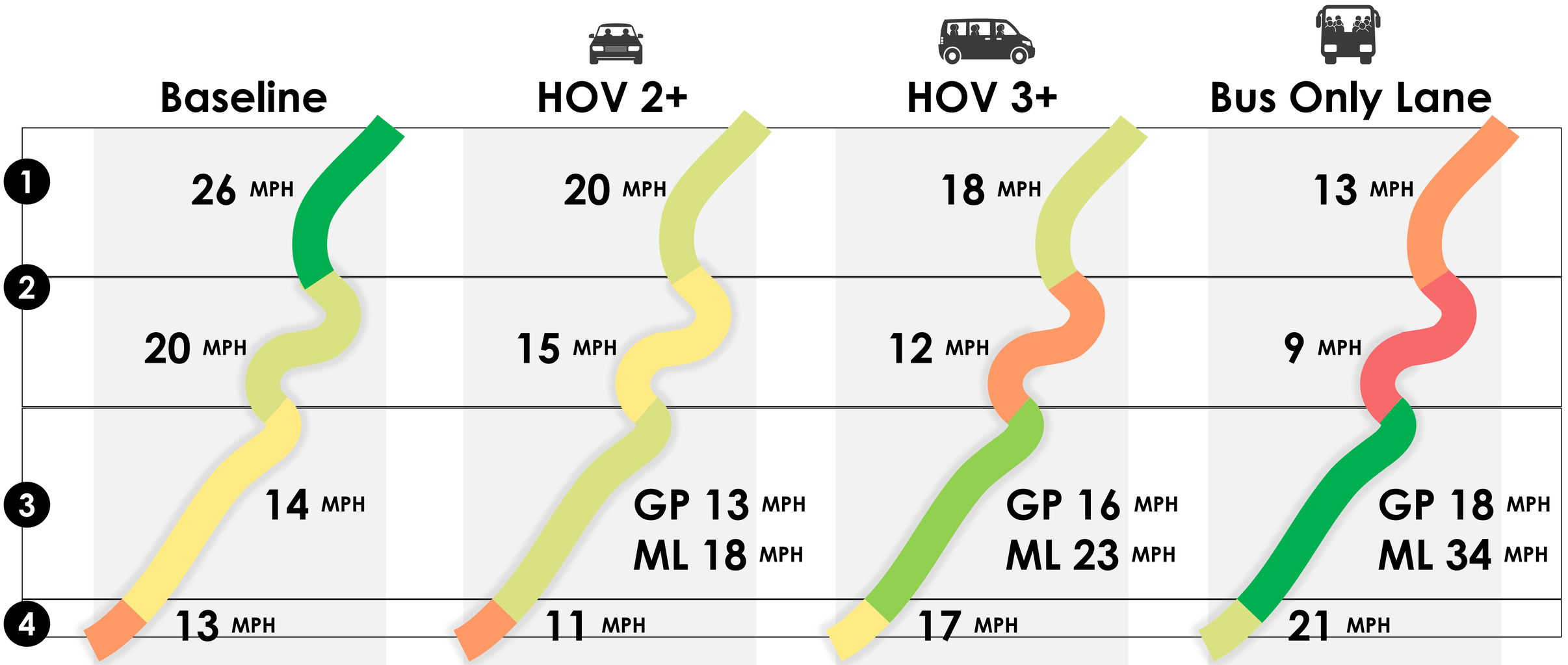
- Comparisons to:
  - RITIS Probe Data
  - Streetlight Data
  - Field Observations

- Downstream bottlenecks
  - Interchange at I-93
  - Ramps into downtown Boston
  - I-93 Big Dig

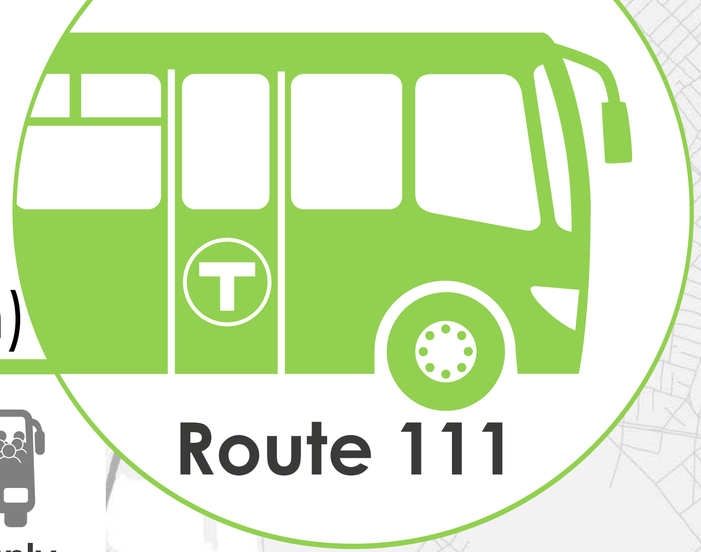
- Congestion on Tobin Bridge primarily associated with queue spillback

Vehicle Speeds on US 1
AM SB Peak Period (6:00am – 9:00am)

The bottleneck moves!



MBTA Route 111
Average Travel Times on US 1
AM SB Peak Period (6:00am – 9:00am)



		Baseline	HOV 2+	HOV 3+	Bus Only Lane
1	US 1 On Ramp near Beacon Street to Managed Lane Start	5.6 MINUTES	0.8 MINUTES	0.6 MINUTES	1.1 MINUTES
2	Managed Lane Start to Managed Lane End	6.6 MINUTES	2.5 MINUTES	1.8 MINUTES	1.9 MINUTES
3	Managed Lane End to New Rutherford Avenue	1.4 MINUTES	2.0 MINUTES	1.7 MINUTES	1.4 MINUTES
	Total	13.6 MINUTES	5.3 MINUTES	4.1 MINUTES	4.4 MINUTES

Note: The number of buses for each of the scenarios remained the same. Following the 2019 Route 111 bus schedule, it was assumed that there are 15 buses from 6:00-7:00; 9 buses from 7:00-8:00; and 11 buses from 8:00-9:00

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FINDINGS

Evaluation of Goals
AM SB Peak Period (6:00am – 9:00am)

Goal	Performance Measure	Baseline	HOV 2+	HOV 3+	Bus-Only Lane
Maximize Person-Throughput Across All Lanes	Peak Period Person-Throughput[1] (all lanes)	14,192	15,958	13,348	12,451
Reduce Bus Travel Time	Route 111 Average Inbound Peak Period Travel Times, US 1 to Ramps[2]	13.6	5.3	4.1	4.4
Maintain Reasonable Level of Mobility for All Modes	SOV Average Inbound Peak Period Travel Times, Copeland Circle to I-93[2]	21.3	27.7	25.1	27.6

[1] *from CTPS travel demand model*
[2] *from VISSIM model with times in minutes*

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Other Findings – Volumes/Persons

AM SB Peak Period (6:00am – 9:00am)



Other Findings – AM SB Traffic Operations

Within the Managed Lane Section

- Travel times for the vehicles in the general-purpose lanes are similar for both the Baseline Scenario and the HOV 2+ Scenario because the demand is similar. The corridor's primary bottleneck is at I-93.
- The travel times and speeds are similar for the Bus-Only Scenario and the HOV 3+ Scenario because the start of the managed lane moves the primary bottleneck upstream of the Tobin Bridge.
- Travel times and speeds for all vehicles (including MBTA bus routes 426, 428, and 111) for all scenarios improve or remain the same after the managed lane start compared to the Baseline Scenario.

Bottleneck Forms Prior to Managed Lane Start

- Bottleneck increases travel time for all managed lane scenarios.
- Travel times are lowest for the HOV 3+ Scenario compared to the other managed lane scenarios. The travel times are higher for the HOV 2+ Scenario due to the higher overall demand along US 1. The travel times are higher for the Bus-Only Scenario.
- Bottleneck impacts MBTA Route 426 and 428 but not 111.

Quick-Build Installation – December 2020



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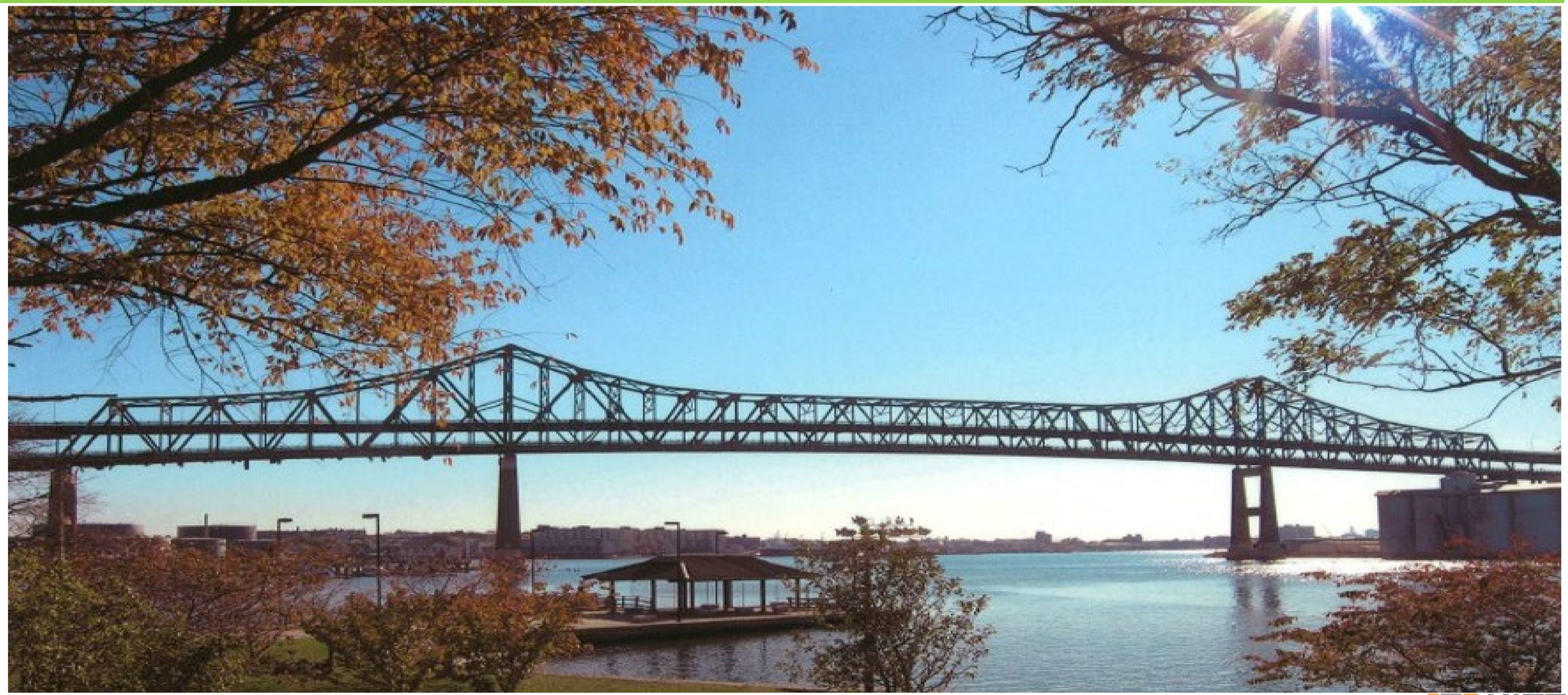
Some Lessons Learned

- Sometimes it's OK to just go install something – it helps if you have a construction project before a pandemic and multi-billion dollar downstream bottlenecks
- Complete Streets -> Complete Freeways?
- Streetlight is a good tool for microscopic simulation model calibration
- Great care is needed when determining the extends of a large simulation

Next Step: Post-Implementation Evaluation

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Questions



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