

## **Appendix B – Memorandums**



**The Commonwealth of Massachusetts**  
William Francis Galvin, Secretary of the Commonwealth  
Massachusetts Historical Commission

September 9, 2015

Ethan Britland  
Project Manager  
MassDOT  
10 Park Plaza  
Boston, Ma 02116

SEP 14 2015

RE: Interstate 91 Viaduct Study, Springfield, MA; MHC# RC.55833

Dear Mr. Britland:

Staff of the Massachusetts Historical Commission (MHC) have reviewed the Project Notification Form (PNF) for the project referenced above that was submitted by Milone & MacBroom, Inc., received at this office on August 10, 2015. The staff of the MHC have the following comments.

The proposed project consists of a planning study that will evaluate alternative alignments for Interstate 91 between State Street and the interchange with Interstate 291 in Springfield. The proposed project will be utilizing funding from the Federal Highway Administration (FHWA) and the Massachusetts Department of Transportation (MassDOT), and as such the MHC will review the overall project under Section 106 of the National Historic Preservation Act of 1966 (36 CFR 800) and the terms of the Programmatic Agreement with the FHWA and MassDOT.

The MHC notes that there are several historic properties within the proposed project area, including the Forest Park Heights Historic District (SPR.BD), Outing Park Historic District (SPR.CJ), Court Square Historic District (SPR.AT), Downtown Springfield Railroad District (SPR.BC), and many others. The MHC also notes that the presence of several archaeological sites (19-HD-82, 19-HD-83, 19-HD-151) within the project area, recorded in MHC's *Inventory of Historic and Archaeological Assets of the Commonwealth*.

The MHC requests that the scope of the proposed planning study include potential impacts to historic and archaeological resources.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966 (36 CFR 800), M.G.L. Chapter 9, sections 26-27C, (950 CMR 71.00), and MEPA (301 CMR 11). Please do not hesitate to contact Elizabeth Sherva or Linda Santoro of my staff if you have any questions.

Sincerely,

A handwritten signature in cursive script, appearing to read "Brona Simon".

Brona Simon  
State Historic Preservation Officer  
Executive Director  
Massachusetts Historical Commission

xc: Jeffrey Shrimpton, MADOT  
Ralph Slate, Springfield Historical Commission  
Michael Gagnon, Milone & MacBroom, Inc.



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



TO: I-91 Viaduct Study Working Group  
FROM: I-91 Viaduct Study Team  
DATE: May 4, 2016  
SUBJECT: Removal of the 'West Side Alternative'

The Massachusetts Department of Transportation (MassDOT)'s I-91 Viaduct Study seeks to identify existing issues and evaluate alternative alignments for the viaduct section of I-91 which may be less disruptive to Springfield's urban environment and provide a regional highway connection that is more environmentally and financially sustainable in the long-term than the existing configuration. Providing stronger connections between downtown Springfield, the South End, and other Springfield neighborhoods with the Connecticut River stands as a key objective of the study.

During the fall of 2015 and winter of 2016 MassDOT and its study consultant Milone & MacBroom (the "Study Team") carried out the Alternatives Development phase of the study. Over this period, 12 (twelve) alternatives were introduced which reimaged both the viaduct and rail line as it is currently aligned through Springfield. Six of these ideas, such as realigning Route 5, splitting northbound and southbound travel on I-91, and placing the highway at-grade were removed from consideration between the December 2015 and January 2016 Working Group meetings due to feasibility concerns and identification of fatal flaws. A March 16<sup>th</sup>, 2016 Working Group meeting further refined the list of long-term alternatives to be carried forward for Alternatives Analysis to three. These alternatives were an elevated viaduct structure to provide additional space to facilitate connections underneath and two variations of a sunken or depressed structure which would provide access over a partial or fully-covered highway and rail line between the city and the waterfront.

Some members of the Working Group felt that one alternative removed at this juncture, which would carry the highway and rail line from the east side of the Connecticut River in Springfield to the west side of the river in West Springfield and Agawam (the "West Side Alternative"), did not have its benefits and impacts fully qualified and quantified in order to warrant removal from further consideration. A follow-up meeting on March 22<sup>nd</sup>, 2016 provided proponents and opponents of the West Side Alternative opportunity to more fully discuss their thoughts and raise design ideas that the Study Team could develop and analyze in more detail.

In the time since these meetings, the Study Team further developed potential highway and rail line alignments along the west side of the Connecticut River which could reduce potential impacts. The goal of this effort was to position a West Side Alternative to the greatest extent viable for long-term permitting, funding, construction, and operation, particularly regarding the three advanced alternatives. The current concept for the West Side Alternative is available at the end of this document.

With this additional work now completed, the Study Team has confirmed that the West Side Alternative is not suitable to advance to the Alternatives Analysis stage of the study. The primary reasons for this determination are outlined below:

**Property and Land Impacts:** A primary point of concern among West Side Alternative proponents was that the initial estimation of the number of property takings associated with the alternative was not accurate and that an attempt to reduce the number of takings by selecting an alignment with the least amount of impacts should be explored. The Study Team carried out this step and found that the least impactful alignment would still involve the taking of 48 structures in West Springfield and 55 structures in Agawam. These takings would include businesses, utility structures, single-family homes, and multi-family residences.

Acquisition costs for each of these properties would be significant, and widespread community opposition would likely be encountered, endangering the support needed to construct this alternative.

School Street Park in Agawam would be heavily impacted under the proposed West Side Alternative, particularly in regards to its presence near a possible US-5/Route 57 interchange. Section 4(f) of the Department of Transportation Act of 1966 obligates any project which uses Federal funding to avoid use of any land from a public park, recreation area, wildlife and waterfowl refuge, or historic site unless there is no feasible and prudent alternative and the project has exhausted all possible planning to minimize harm to these facilities. A Section 4(f) evaluation must be approved by the Federal Highway Administration for the project to move forward. Mitigation of impacted lands or facilities must be included in the project.

Section 106 of the National Historic Preservation Act of 1966 would also obligate MassDOT to account for any historic properties listed in the National Register of Historic Places or properties which meet the criteria for the National Register with any alignment. If adverse effects are discovered MassDOT must seek ways to avoid, minimize, or mitigate these effects. The School Street Barn at 551 School Street in Agawam, which the West Side Alternative would intercept, is listed on the National Register of Historic Places. Furthermore, any structure over 50 years old is eligible to be listed on the National Register required that it meets other criteria regarding its historical significance.

The West Side Alternative would also need to acquire applicable Federal and State wetland permitting. Wetlands impacted under the West Side Alternative exist around the Westfield River and to the area west of the existing US-5 alignment and north of the Westfield River. Regulations require that the project avoid or minimize impacts to wetlands.

The Alternative would additionally be subject to Massachusetts Environmental Policy Act (MEPA) and National Environmental Policy Act (NEPA) permitting in addition to any of the regulations discussed above.

Given the presence of the existing I-91 viaduct and rail line in Springfield, any West Side Alternative which impacts parks, recreation areas, historic sites, and wetlands would likely fail to acquire the proper permitting, as an alternate route already exists. Additionally, even for those matters that MassDOT could attain the proper permitting to address, the agency generally strives to minimize these types of impacts as a matter of best practice for its projects. Doing so reduces project costs, accelerates project delivery, and helps engender community support.

In addition to direct property takings, several indirect impacts would be imposed upon nearby properties. Noise and visual impacts can be expected for properties abutting the new highway and rail line alignment, potentially leading to property value losses which would be harmful on an individual and community level.

**Access Concerns:** A lack of access from the new interstate facility to West Springfield and Agawam acts to reduce the benefits each community can gain from the project. The proposed West Side Alternative would feature one interchange throughout its run in West Springfield and Agawam. A reconfigured interchange with US-5 and Route 57 in Agawam would provide access over the South End Bridge east into Springfield and west into Agawam and Southwick on Route 57. As Route 57 is a limited-access highway in its current configuration access to neighborhoods near this interchange would be lost, including access to Meadow Street westbound and River Road southbound. In the current configuration, the land required for on and off-ramps for this access would have impacts to Corey Street, River Road, South and North Alhambra Circle, Barney Street and Sterling Road.

No interchange is proposed for West Springfield due to the presence of the Connecticut River immediately to the east of the reconfigured highway and rail line. Configuration of the highway to allow space for an interchange would considerably add to the land and property takings of the project. Access between Springfield and West Springfield across the Memorial Bridge via the Memorial Circle could require reconfiguration of roadways to account for the new highway and rail line. Pedestrian and bicycle access to the Memorial Bridge would be impacted.

As exits for private enterprises are not allowed off of interstate facilities, access to the Springfield Water and Sewer Commission facility in Agawam would need to be addressed.

Although a realigned highway and rail line away from Springfield could drastically change access from the city's downtown and South End neighborhoods to the Connecticut River waterfront, concerns exist about the loss of regional access this project would create. Residents and businesses strongly consider access in choosing where to locate. To take a notable example, the MGM Springfield resort casino project proponents may have concerns about any alternative which redirects access for patrons across the region.

**Costs:** Each of the three alternatives the Study Team wishes to move forward for Alternatives Analysis would carry significant costs due to the scale and complexity of a relocation or reconfiguration of the I-91 viaduct structure. However, the West Side Alternative would more than likely contain much higher costs due to the significantly higher number of components involved and complications which must be overcome. Although an estimated construction cost is not attainable without advancing the idea through Alternatives Analysis it can be reasonably expected that reconfiguration of the I-91/I-291 interchange in Springfield to carry I-91 over the Connecticut River; new construction or reconstruction of the existing rail bridge to divert rail traffic on to a new line southbound along the Connecticut River; the remainder of the new rail line; upgrades to US-5 to bring it to interstate standards; right-of-way impacts; a reconfigured interchange with US-5 and Route 57; and a new highway and rail bridge over the Connecticut River to meet the existing highway and rail line in Longmeadow would cost well into the billions of dollars.

In addition to the engineering challenges inherent with these actions, considerable engineering obstacles would also raise the cost of the West Side Alternative. Vertical grade challenges would need to be addressed at every proposed interchange, particularly where a new rail line would meet the existing rail bridge in West Springfield. Controlling grades into both Union Station in Springfield and the existing rail yard in West Springfield would also need to be remedied. There are expected to be stormwater, groundwater, and water level impacts. Some of these costs can be reasonably expected for any of the alternatives, but the scale of the West Side Alternative renders these impacts most dominant.

As the current US-5 highway does not meet Interstate standards, there would be costs associated with achieving this. Much of the right-of-way acquisition would be tied to this activity but a reconstruction of the roadway itself would also likely be required.

Utility impacts are expected to be significant with this alternative. CSX, the owner of the existing rail line in Springfield, may likely demand significant compensation for disruption of freight services.

Additionally, mitigation efforts to reduce disruption during the construction period would contribute to the total cost of the project. Construction of new barriers to ease visual impacts and achieve noise abatement can be expected. Long-term diversion of vehicular traffic and rail activity will be required. As the current I-91 alignment and rail line in Springfield would be reconfigured as part of this alternative mitigation efforts would need to take place on both sides of the Connecticut River.

**Lack of Community Support:** During the March 16<sup>th</sup> and March 22<sup>nd</sup>, 2016 Working Group meetings, representatives from the cities of West Springfield and Agawam each voiced their opposition to the West Side alternative. Selection of the West Side

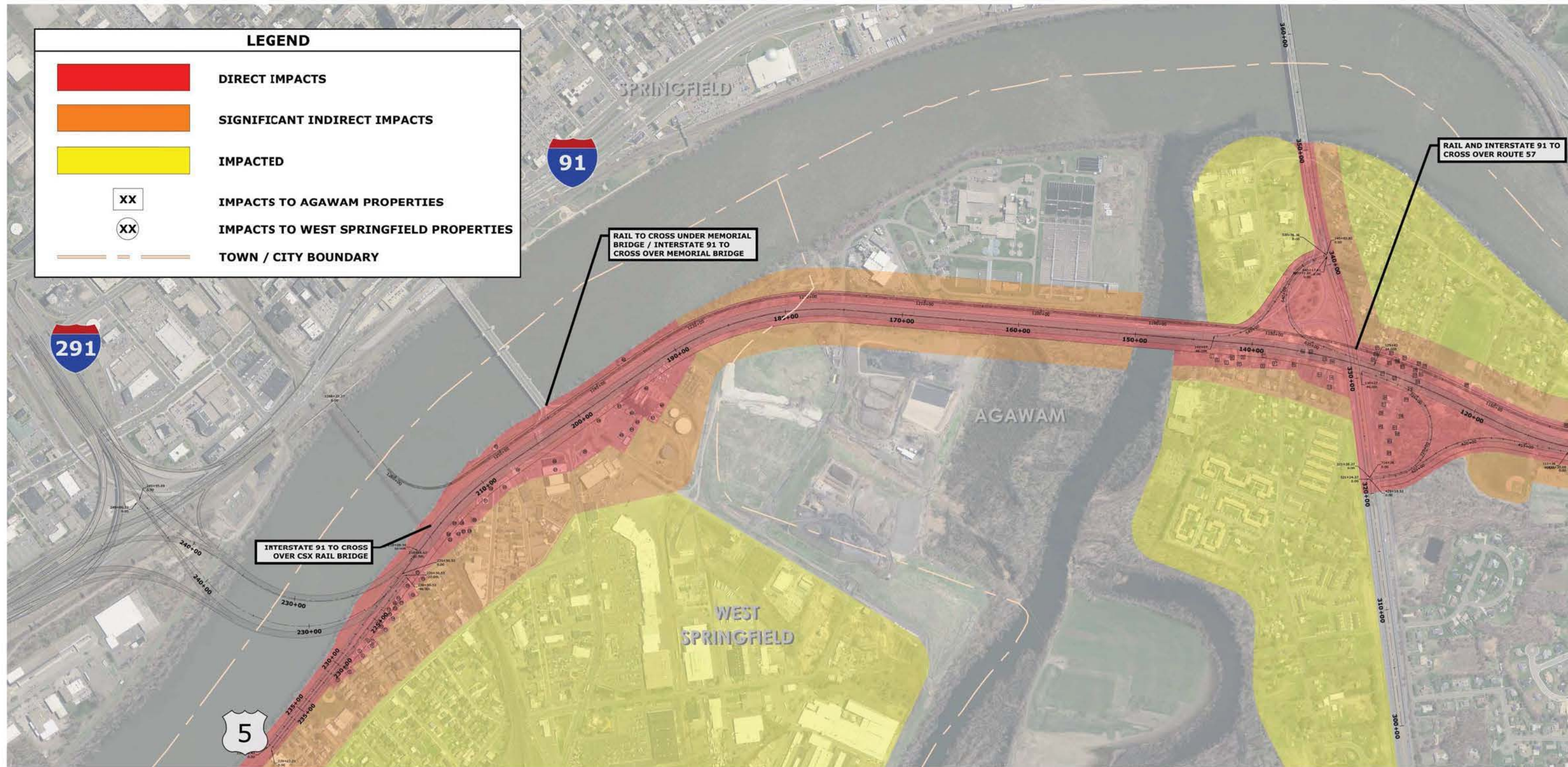
Alternative would annul or indirectly impact several projects each community has underway in the area.

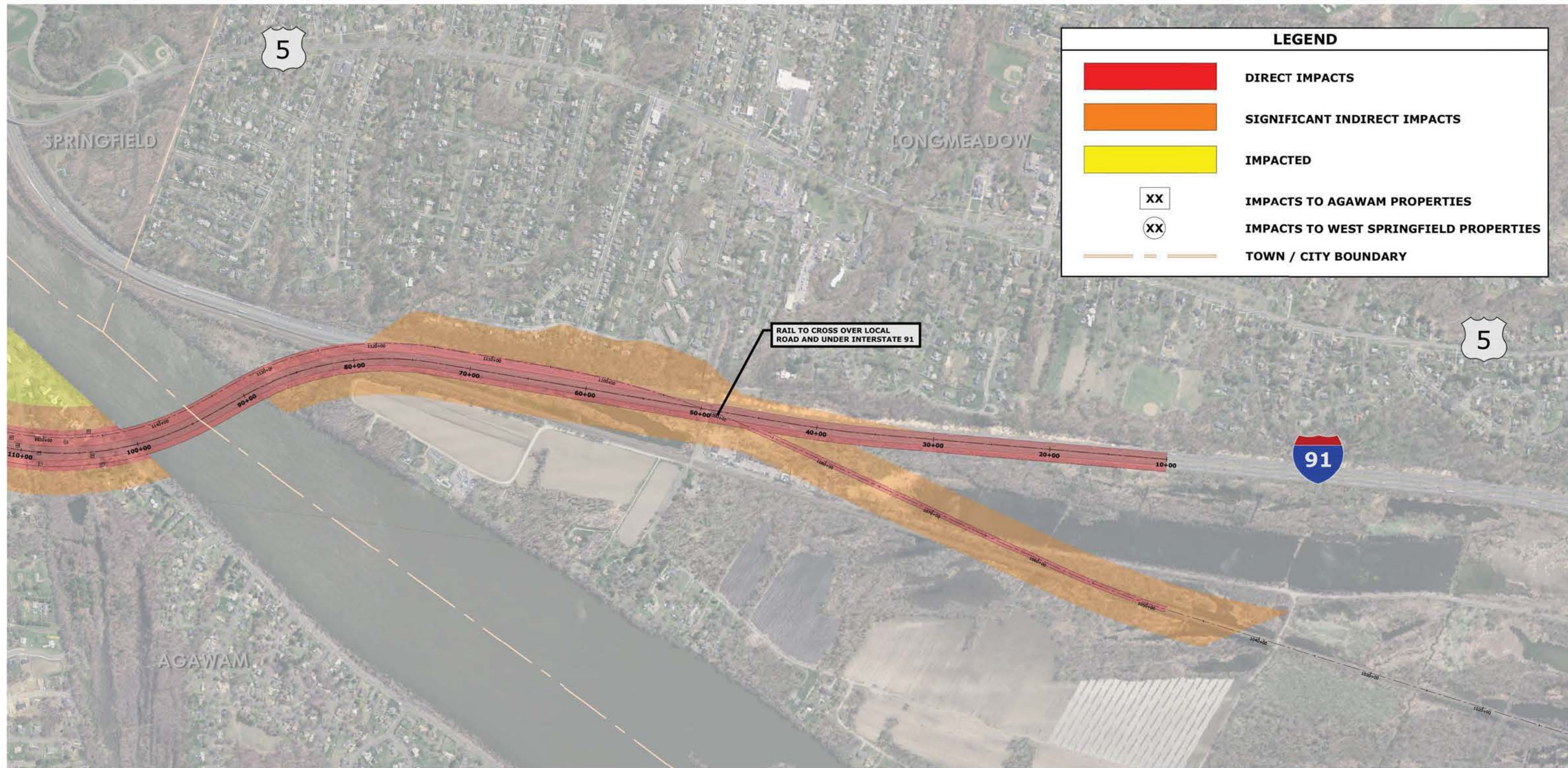
In West Springfield the city recently created a canoe launch and is finalizing the design for a Riverwalk connection with neighborhood communities. A redesign of Memorial Avenue with a Complete Streets layout is also nearing construction. An Environmental Justice population north of the Memorial Rotary may be impacted and the business community in this area could also be affected by the project.

In Agawam, the isolation area that a new highway and rail line alignment would create was brought up as a concern by the Planning and Police Department. Sewer force mains at the Connecticut River confluence with US-5 would also be affected. Impacts to businesses, noise impacts, conflicts with the Riverwalk, and ramp access issues were also raised by city officials.

An argument posited in favor of the West Side Alternative relates to the magnitude of potential benefits from removing the viaduct structure and rail line from the Connecticut River waterfront in Springfield. Reconnecting downtown Springfield and the South End neighborhood with the Connecticut River could, in the long-term, bring about greater economic benefits to the region relative to the other three alternatives given Springfield's standing as the region's commercial center. However, it was deemed not prudent to pursue these potential gains, given the significant level of identified impacts of the West Side Alternative along with the lack of support by West Springfield and Agawam.

In conclusion, the sum of the West Side Alternative's impacts leads to an alternative which would be difficult, if not infeasible, to acquire the appropriate permitting, generate community, regional, and statewide support, overcome engineering challenges, gain funding, and achieve an overall benefit for the region's residents, visitors, and employers. The Study Team firmly believes that the three alternatives being advanced for further analysis could bring about significant (mobility, economic, accessibility, livability, recreational, etc.) benefits to the city of Springfield without imposing an undue burden on neighborhoods along the west side of the Connecticut River.







*The Economic Development Council  
Of Western Massachusetts*

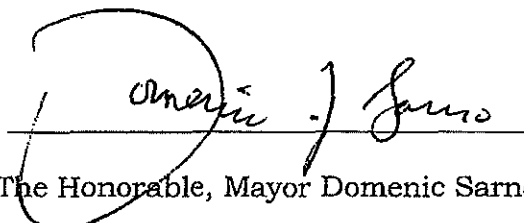
Western Massachusetts Mayors, Joint Statement of Support for the "Depressed Alternative" for the Future Construction of Route 91.

We undersigned Mayors, representing communities in the Western Massachusetts Region, recognize the Route 91 Corridor as an important transportation and economic development asset. We state our support for the "Depressed Alternative" for the future construction of Route 91 and the corresponding railroad corridor.

We urge MassDOT to depress Route 91 from Liberty Street Springfield, MA to the "Longmeadow curve". This alternative will build the roadway and the rail corridor in close proximity to each other, remove the overhead visual and physical impediments of the current I-91 viaduct structures, and create a green corridor redevelopment opportunity along the River. It will also relieve traffic congestion and maintain 3 lanes of traffic, each way, in the corridor. We also urge that the "depressed option" be built so as to support the development/construction of buildings between 6-10 stories on top of the depressed road/railway to maximize the economic development potential of the City of Springfield and the region.

We appreciate the public process that MassDOT has undertaken, the many alternatives that have been developed, and the opportunities that have been provided for the public to participate in this important design and hoped for construction project.

Sincerely yours,



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The Honorable Mayor Richard Cohen

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The Honorable, Mayor Richard Kos

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## Memorandum

To: Michael Clark, MassDOT  
Stephanie DiNezio, MassDOT

Date: May 3, 2017

Project #: 12869.04

From: Quan Tat, Project Manager

Re: I-91 Springfield Conceptual Level Noise Assessment

The purpose of this memorandum is to provide a planning level noise assessment of the three conceptual designs of the I-91 corridor in Springfield, Massachusetts. The noise evaluation calculated the potential sound levels associated with the change in roadway alignments and vehicular traffic using the Federal Highway Administration's (FHWA's) Traffic Noise Model (TNM) Version 2.5.<sup>1</sup> The study determined the number of potential impacted receptor locations under the various alternatives. Figure 1 depicts the extent of the I-91 corridor for this study.

### Alternatives

The noise evaluation determined the number of impacted receptor locations for No-Build conditions and the three alternatives. All three I-91 alternatives involve varying changes to the ramp system with I-291. The differences between the three alternatives consist of the following:

#### Alternative 1 (see Figure 2):

- I-91 tunneled underneath East and West Columbus Avenue
- East and West Columbus Avenue retain same alignment as Existing conditions

#### Alternative 2 (see Figure 3):

- I-91 tunneled underneath East and West Columbus Avenue
- East and West Columbus Avenue realigned including:
  - Rotary addition at Boland Way/Memorial Bridge interchange
  - Union Street/West Columbus interchange removed

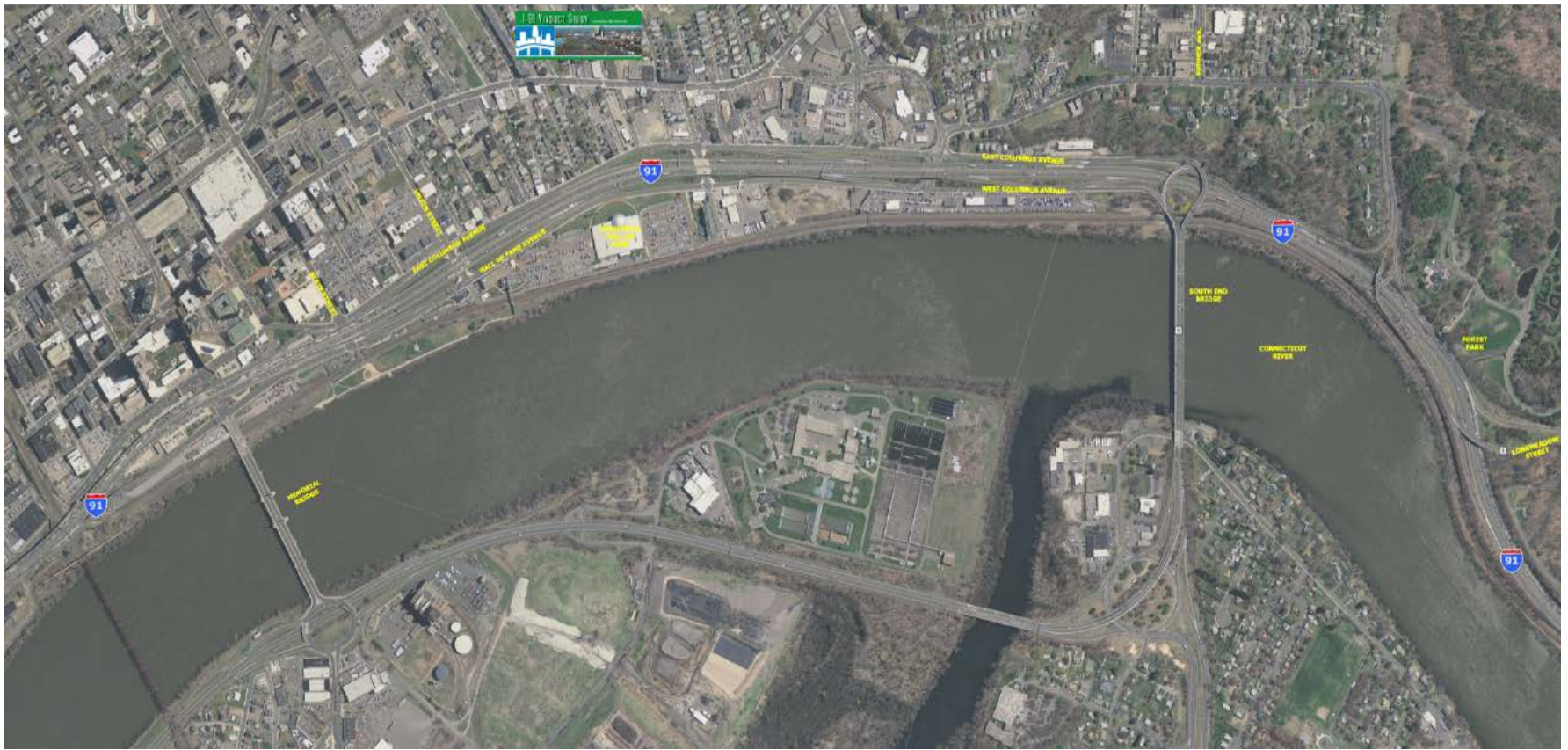
#### Alternative 3 (see Figure 4):

- I-91 viaduct raised between Gridiron Street and Union Street
- Renovations to I-91 viaduct

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<sup>1</sup> Traffic Noise Model 2.5 (TNM), Federal Highway Administration, February 2004.

Figure 1: I-91 Existing Conditions



Source: I-91 Viaduct Study, Study Area Plan, Milone & MacBroom



## Memorandum

Figure 2: I-91 Alternative 1 – Sunken Same Alignment



Source: I-91 Viaduct Study, Study Area Plan – Alt. No. 1 – Sunken Same Alignment, Milone & MacBroom



## Memorandum

Figure 3: I-91 Alternative 2 – Sunken New Alignment



Source: I-91 Viaduct Study, Study Area Plan – Alt. No. 2 – Sunken New Alignment, Milone & MacBroom



## Memorandum

Figure 4: I-91 Alternative 3 – Elevated Section



Source: I-91 Viaduct Study, Study Area Plan – Alt. No. 3 – Elevated Section, Milone & MacBroom



## Memorandum

### Methodology

FHWA has established Noise Abatement Criteria (NAC) to help protect the public health and welfare from excessive traffic noise, which the Massachusetts Department of Transportation (MassDOT) has endorsed. Recognizing that different areas are sensitive to noise in different ways, the NAC varies according to land use. The NAC for residential land use is 67 dB(A) and 72 dB(A) for commercial uses. MassDOT endorses the FHWA's procedures and considers noise impacts to occur when existing or future sound levels approach (within 1 dB(A)) or exceed the NAC (66 dB(A) for residential use and 71 dB(A) for commercial uses). MassDOT also considers noise impacts when future sound levels exceed the existing sound levels by 10 dB(A) or more. For each alternative, a TNM model was used to calculate the distance from the primary roadways to where the sound level would exceed 66 dB(A) for residential use and 71 dB(A) for commercial uses. An abbreviated approach was used in developing the terrain for the project area noise model. Based on tax parcel data from MassGIS<sup>2</sup>, the number of impacted receptors was then determined for the various land uses within the respective 66 dB(A) or 71 dB(A) noise contour lines.

### Results

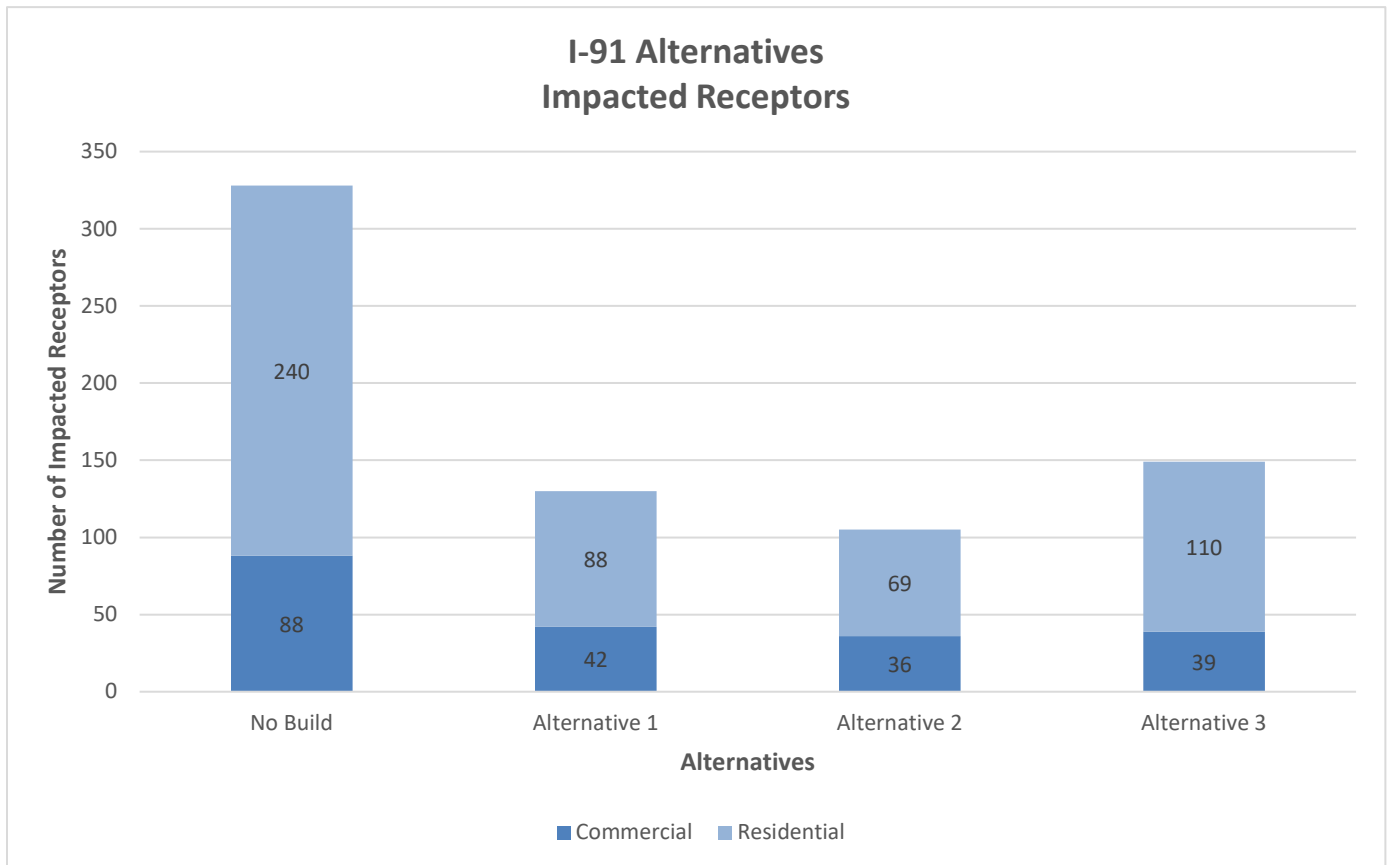
FHWA's TNM program was used to calculate sound levels associated with each of the I-91 conceptual design alternatives for the Build conditions. The results of the noise analysis demonstrated that there are changes in the sound levels between the Existing Conditions and Build Alternatives. The number of impacted receptors decreased with all three Build alternatives. These changes in sound levels are associated with the change in traffic along the I-91 corridor. Alternatives 1 and 2 result in the fewest impacts as a portion of the I-91 corridor is in a tunnel, which is serving as a barrier to the receptor locations. A summary of the results is presented in Table 1 and Figure 5.

**Table 1: Potential Impacts**

	No Build Conditions		Build Conditions	
	Impact Distance (ft)	Impacted Receptors	Impact Distance (ft)	Impacted Receptors
<b>Alternative 1</b>				
Commercial Use	350 – 575	88	65 – 300	42
Residential Use	625 – 800	240	70 – 730	88
<b>Alternative 2</b>				
Commercial Use	350 – 575	88	65 – 275	36
Residential Use	625 – 800	240	70 – 615	<u>69</u>
<b>Alternative 3</b>				
Commercial Use	350 – 575	88	65 – 465	39
Residential Use	625 – 800	240	70 – 800	<u>110</u>

<sup>2</sup> MassGIS Data Download - Level 3 Assessor's Parcels, <http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/download-level3-parcels.html>

Figure 5 Potential Impacts



### Concept Alternatives Ranking

Based upon this planning level evaluation, the alternatives can be ranked based upon the total number of impacted receptor locations.

1. Alternative 2 with 105 impacted receptor locations;
2. Alternative 1 with 130 impacted receptor locations;
3. Alternative 3 with 149 impacted receptor locations.

# I-91 VIADUCT STUDY

Springfield, Massachusetts

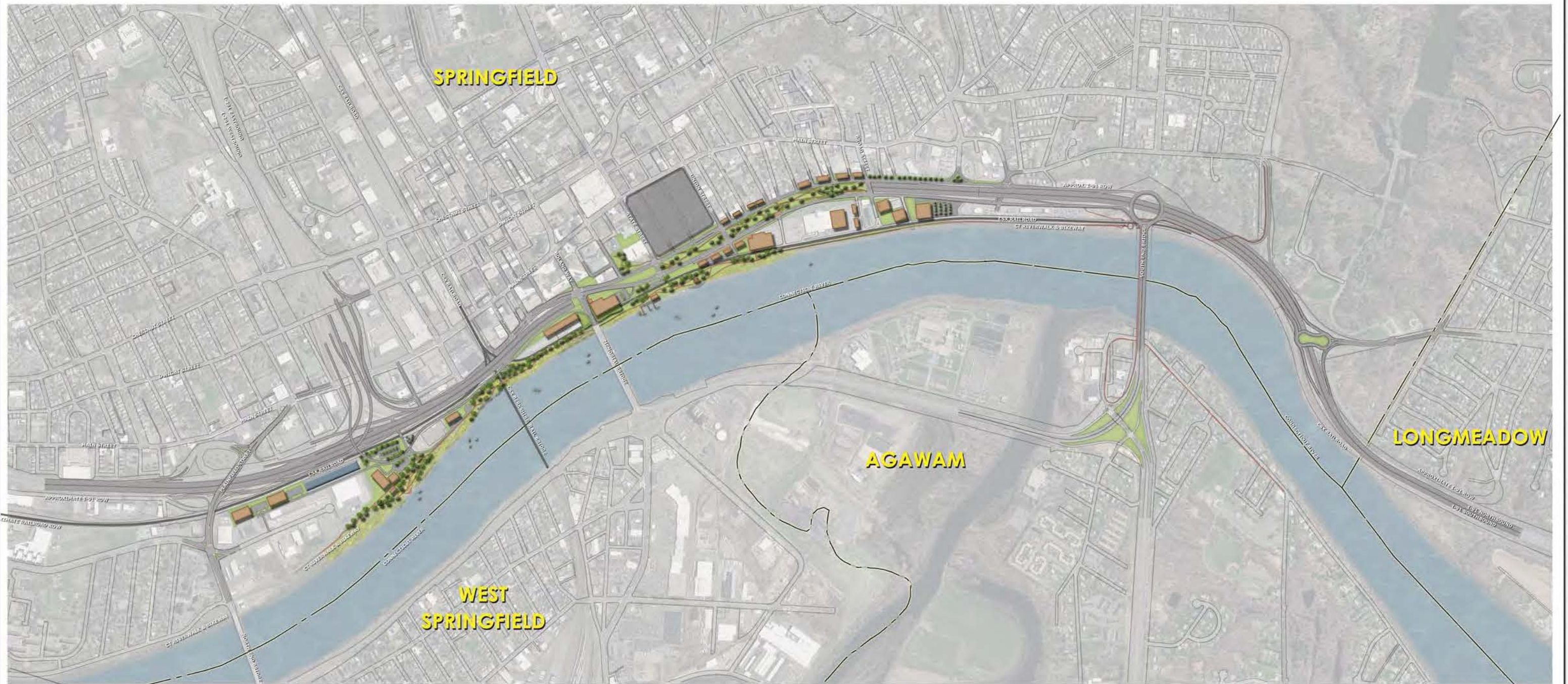


## I-91 Viaduct Study – Evaluation Criteria

### Workbook

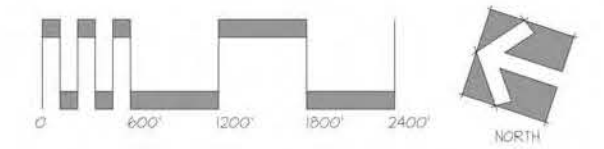
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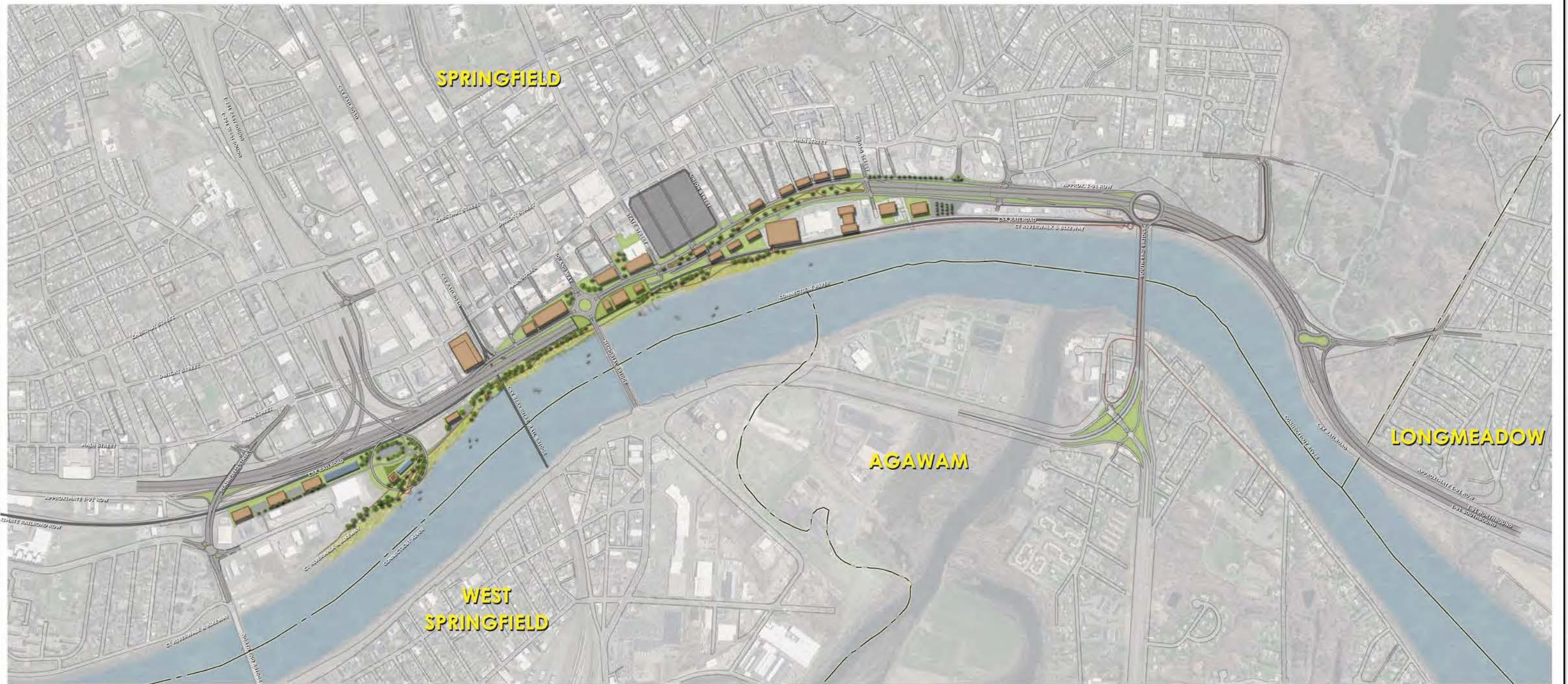




STUDY AREA PLAN - ALT. NO. 1 - SUNKEN SAME ALIGNMENT  
**I-91 VIADUCT STUDY**

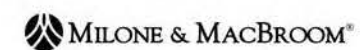
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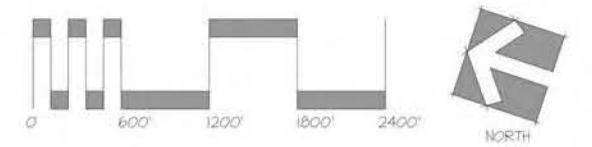


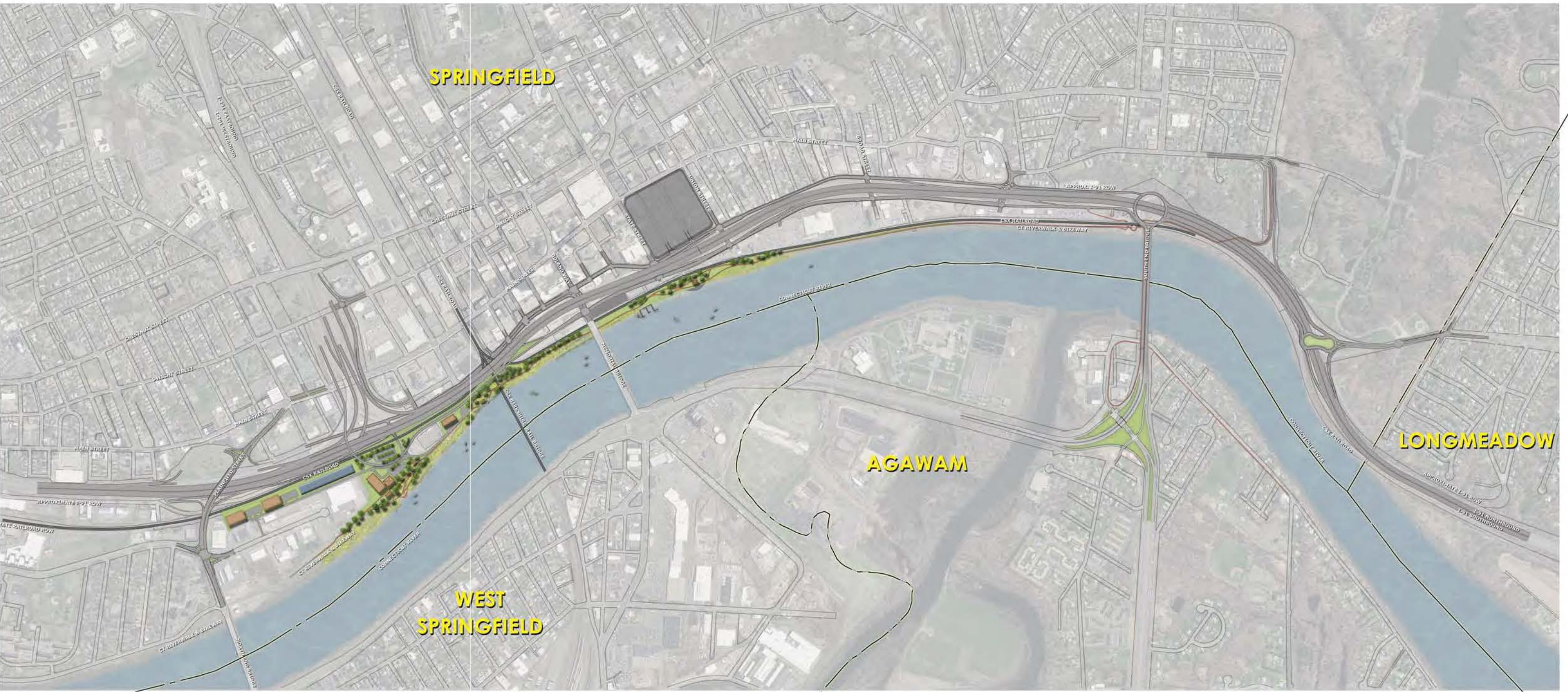
STUDY AREA PLAN - ALT NO.2 - SUNKEN, NEW ALIGNMENT

**I-91 VIADUCT STUDY**



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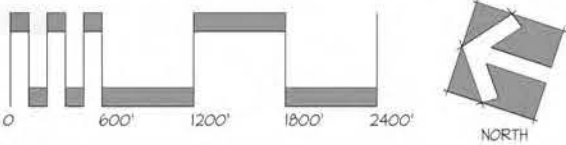


STUDY AREA PLAN - ALT. NO. 3 - ELEVATED SECTION

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1. **Mobility and Accessibility** – This set of criteria was developed to evaluate each alternatives ability to maintain or improve the conveyance of regional traffic through the corridor, while enhancing the connectivity of all modes of transportation into and around the City and its waterfront.

## **1.1 Roadway Operational Functionality**

### **1.1.1 Intersection Level of Service**

*Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The level of service of a facility is designated with a letter, A to F, with A representing the best operating conditions and F the worst. For this section, the Level of service is for signalized intersections. Typically, LOS that performs at a LOS D or better is considered acceptable. In this criterion, only those intersections that scored a LOS E or worse for either the morning (AM) and afternoon (PM) Peak periods were used for analysis.*

### **1.1.2 Volume to Capacity Ratio**

*Volume to capacity ratio is in which the volume (V) is the total number of vehicles passing a point in one hour and the capacity (C) for the maximum number of cars that can pass a certain point for a reasonable traffic condition. In other words, this measurement of effectiveness deals with ability of the roadways to handle the number of vehicles expected to be on those roads in 2040. A higher ratio value will be a more negative result.*

### **1.1.3 Queue Length**

*Queue length is a line of vehicles waiting to proceed through an intersection. Slowly moving vehicles joining the back of the queue are usually considered part of the queue. The internal queue dynamics can involve starts and stops. A faster-moving line of vehicles is often referred to as a moving queue or a platoon. For this criterion, the queues were added for all approaches at all the studied intersections. Any reductions in queue lengths would be a positive result.*

### **1.1.4 Level of Service Merge, Diverge and Weave Locations**

*Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The level of service of a facility is designated with a letter, A to F, with A representing the best operating conditions and F the worst. For this section the Level of service is for weaving, where one movement must cross the path of another along a length of facility without any aid of traffic control devices. Merging is when two separate traffic streams form a single lane and diverge is when one flow of traffic separates to form two separate lanes. Typically, LOS that performs at a LOS D or better is considered acceptable. In this criterion, only those intersections that scored a LOS E or worse for either the morning (AM) and afternoon (PM) Peak periods were used for analysis. A smaller number of LOS E's or worse would be a positive result.*

#### 1.1.5 Level of Service Ramps and Highway Segments

*Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The level of service of a facility is designated with a letter, A to F, with A representing the best operating conditions and F the worst. For this section the Level of service is for interstate on and off ramps and also interstate segments. Typically LOS that performs at a LOS D or better is considered acceptable. Locations were listed when their LOS was E or worse for either or the AM and PM Peak periods. A smaller number of LOS E's or worse would be a positive result*

### 1.2 Travel Time

#### 1.2.1 Travel time along I-91 corridor

*Travel time is the length in time it will take to get to one point from another. The travel time is typically in minutes and seconds. Travel time is equal to the running time plus delay, which can be along a pathway or at a signalized and/or unsignalized intersection. Speed limit is a factor. For this case, the distance or path considered is along I-91 from the Connecticut state line to just north of the Plainfield Street overpass. A distance of 6.68 miles for both directions.*

#### 1.2.2 Travel time through Primary Study Area

*Travel time is the length in time it will take to get to one point from another. The travel time is typically in minutes and seconds. Travel time is equal to the running time plus delay, which can be along a pathway or at a signalized and/or unsignalized intersection. Speed limit is a factor. For this case, the distance or path considered was from the intersection of Union Street at East Columbus Avenue to the intersection of Springfield Street and Chestnut Street. A distance of 2.37 miles from the intersection of Union Street and East Columbus Avenue and Springfield Street and Chestnut Street and 2.68 miles in the opposite direction.*

### 1.3 Pedestrian and Bicycle Functionality and Connectivity

#### 1.3.1 Improve access to the Riverfront from Downtown core

*This section is presented to evaluate proposed changes and enhancements (including sidewalk, shared use paths, crossing improvements, etc.) in connections between downtown urban core and riverfront for bicyclists and pedestrians. Areas that are gauged are the crossings of I-91 and also the rail lines.*

#### 1.3.2 Improve access to community services and social services

*This section is presented to evaluate the number and quality of connections to schools, health care, social services, etc. for bicyclists and pedestrians in the Primary Study Area. Areas that are gauged include roadways within the primary study area, immediately surrounding the downtown core, Interstate 91, and I-291.*

### 1.3.3 Improve access to Retail and Commerce

*This section is presented to evaluate the number of commercial businesses, goods, employment centers, and public and institutional properties for which bicyclists and pedestrians are likely to benefit from enhanced access in the Primary Study Area. Any property within ¼ mile of an enhanced bicycle or pedestrian connection is defined as experiencing an improvement in access. No differentiation between levels of pedestrian or bicycle connection quality is provided (as changes in levels of quality are contingent on design decisions not addressed in this conceptual-level study). Areas that are gauged include roadways within the primary study area, immediately surrounding the downtown core, Interstate 91, and I-291.*

### 1.3.4 Improve connections to Union Station

*This section is dedicated to realizing the change in vehicular, bicycle, pedestrian and transit networks to stimulate connectivity to the renovated Union Station. Each alternative will be examined to determine the extent of new bicycle facilities and additional sidewalks that are or are not being added to improve the connection to the transportation hub at Union Station.*

### 1.3.5 Regional bicycle and pedestrian connectivity

*This section is dedicated to providing comparisons of each alternatives ability to promote longer distance commuting and recreational trips, as well as improved access to regional bicycle and pedestrian facilities such as the Connecticut Riverwalk and Bikeway in Springfield, the Connecticut Riverwalk and Bikeway in Agawam, and Forest Park in Springfield. The map series "Bicycle, Pedestrian, and Transit Connectivity and Employment" illustrates proposed connections under each alternative.*

## 1.4 Mode Shift

### 1.4.1 Increase transit mode share

*This section will evaluate the number of improved connections to transit stops within 0.25 miles of each alternative, providing a better means of access to existing transit stops in the area.*

### 1.4.2 Increase bicycle and pedestrian mode share

*In order to evaluate, the increase of bicycle and pedestrian mode share, this section will tabulate the change in linear feet of both sidewalk and linear feet of designated bicycle facilities.*

2. **Safety** - This set of criteria was developed to evaluate each alternatives ability to create a safer and more user friendly, pedestrian and bicycle system through and across the transportation corridor.

## **2.1 Pedestrian and Bicycle Safety**

### **2.1.1 Improve bicycle and pedestrian safety – minimize conflicts**

*This section will evaluate if the alternatives improve bicycle and pedestrian safety by minimizing conflict points based on the number of intersections that are potentially being mitigated and will improve the overall safety for users other than vehicles.*

### **2.1.2 Improve bicycle and pedestrian safety – ADA compliance**

*This section will evaluate if the alternatives improve pedestrian safety by incorporating the latest ADA/AAB standards at signalized intersections within the primary study area of each alternative. Items that would be included are compliant wheel chair ramps, detectable warning strips, APS push buttons, etc.*

### **2.1.3 Improve bicycle and pedestrian safety – safe crossing accommodations**

*This section will evaluate if the alternatives improve bicycle and pedestrian safety where they may come in contact with interstate on and off ramps. A quantitative number of actual crossings for each alternative will be compared.*

### **2.1.4 Improve bicycle and pedestrian safety – improve crossing times**

*This section will evaluate if the alternatives improve crossing times for the pedestrians at signalized intersections based on modifications that will take place at existing intersections that will be modified or implementing the latest ADA/AAB standards at newly designed standards.*

### **2.1.5 Improve bicycle and pedestrian safety – provision of separated facilities**

*This section will evaluate if the alternatives improve bicycle and pedestrian safety by reviewing the total number of shared-use paths that are separated from the roadways, such as a typical on-street situation.*

## **2.2 Vehicular Safety**

### **2.2.1 Improve interaction and roadway safety – conflict points**

*This section identifies the number of weaving sections along the I-91 corridor within the primary study area. Within these areas there are numerous high crash locations due to the fact that the weaving sections distances are relatively short and there numerous on and off ramps within the Primary Study Area. A reduction of weaving sections and/or lengthen the distance between on and off ramps will mitigate the number of conflict points along the I-91 corridor. Also a standard four-legged signalized intersection typically consists of 80 conflict points with the inclusion of bicycles and pedestrians. If there are less signalized intersections from one alternative to another, generally there would be less conflict points. A tally of the number of signalized intersections is included in this criteria.*

2.2.2 Improve interaction and roadway safety – mitigate high crash locations

*This section identifies the number of high crash locations or clusters within the primary study area that are adjacent to Interstate 91 and 291. Each alternative will list if any of the high crash cluster intersections will be mitigated, which will include design changes, in order to improve intersection and roadway safety.*

**2.3 Public Safety**

2.3.1 Improve Public Safety

*This section compares the levels of how each alternative will improve public safety or the perception thereof. Each alternative may minimize factors that would contribute increased crime or the fear of crime. Poor lit areas, confined spaces, isolated areas and types of land use typically create an unsafe feeling to pedestrians, bicyclists and even motorists. This section will prepare of qualitative review of improvements to site lines, lighting, open spaces, etc.*

**3. Environmental Effects (TBD)** - This set of criteria was developed to evaluate each alternatives ability to improve the overall environmental quality of the transportation corridor

**3.1 Sustainability**

3.1.1 Impacts on environmental resources

*This section compares impacts of each alternative on relevant natural resources, including the 100 foot and 500 foot FEMA floodways, NHESP priority habitat areas, and DEP wetlands.*

3.1.2 Inclusion of Low Impact Development standards

*This section depicts total gain in pervious surface as a result of inclusion of LID standards and improvements as well as creation of additional open space for recreation on or adjacent to the existing viaduct footprint.*

3.1.3 Reduction of pavement footprint

*This section compares the differences in total pervious area within the I-91 corridor between East and West Columbus Avenues within the Primary Study Area.*

**3.2 Air Quality**

3.2.1 Health impacts to vehicle occupants, bicyclists and pedestrians

*This section presents estimates of criteria pollutant emissions as modeled by CTPS. Differences in VMT and associated estimates of NOx, VOC, and CO emissions during AM and PM peaks from the 2040 No-Build scenario are presented for each alternative.*

### 3.2.2 Reduction of greenhouse gas emissions

*This section compares estimated greenhouse gas emissions (specifically CO<sub>2</sub>) between each alternative. Differences in VMT and associated estimates of CO<sub>2</sub> emissions during AM and PM peaks from the 2040 No-Build scenario are presented for each alternative.*

## 3.3 Noise

### 3.3.1 Noise impacts – decibel levels

*Noise impacts of each alternative are measured in terms of the modeled distances from the highway alignment experiencing decibel levels above Noise Abatement Criteria levels (66dB for residential uses, 71 dB for commercial uses). Distances are expressed as a range, as the distance at which given levels of noise are experienced varies based on terrain. Distance estimates are from the I-91 Springfield Conceptual Level Noise Assessment prepared by VHB.*

### 3.3.2 Noise impacts – impacted receptors

*This section provides estimates of the number of receptors (residences or commercial properties) experiencing noise levels above those specified by Noise Abatement Criteria (66dB for residential uses, 71dB for commercial uses) under each alternative. Estimates of impacted receptors are from the I-91 Springfield Conceptual Noise Assessment prepared by VHB.*

4. **Land Use and Economic Development** - This set of criteria was developed to evaluate each alternatives ability to include transportation based improvements that create beneficial land use opportunities for the City and the region that promote both access to open space and new opportunities for economic development

## 4.1 Economic Development Potential

### 4.1.1 Parcel Growth

*This section quantifies the estimated area of lands that will be made available for new development or green space. This space includes both lands made available through enhanced access to currently constrained waterfront parcels, and through the creation of new greenspace and/or developable areas within the existing I-91 right of way under the sunken alignments presented in Alternatives 1 and 2.*

### 4.1.2 Improve accessibility to potential and existing development parcels

*This section identifies the number and quality of connections to the waterfront and development areas. High-quality connections are assessed as those with complete streets elements that provide for safe accommodations for pedestrians and bicyclists as well as vehicular traffic.*

### 4.1.3 Improve bicycle and pedestrian infrastructure

*This section will evaluate if the alternatives improve bicycle and pedestrian facilities, specifically with the evaluation of complete streets elements within the primary study area that include improved bike and pedestrian accommodation*

#### 4.1.4 Increase density

*This section quantifies the estimated impacts to population, households, and jobs within the study area based on the development scenarios associated with each of Alternatives 1-3. Potential increases in population and households are derived from the number of housing units proposed for each scenario at full buildout, average occupancy rates, and average household sizes of comparable units. The potential increase in jobs is based on the size of commercial and industrial developments and average ratios of building size to employment across sectors. As the study area geography remains static across Alternatives and through time, any increase in population, households, or jobs results in an increase in residential/employment density.*

#### 4.1.5 Incur new tax generation

*This section provides estimates of the potential property tax generation that would accrue to the City of Springfield under each of the development scenarios associated with each of Alternatives 1-3. Estimates of tax generation are derived separately for residential units and commercial/industrial development. Residential tax revenues are based on local comps for condo sales with an upwards adjustment to account for the likely price premium for new waterfront units, and are calculated on a per-unit basis. Commercial/industrial tax revenues are based on local comps for office/retail and industrial properties in the waterfront area, with upwards adjustment for building age and condition; these revenues are calculated on a square footage basis. All values are based on 2016 property values and tax rates in the City of Springfield, and are expressed in 2016 dollars.*

### **4.2 Socio-Economic Impacts**

#### 4.2.1 Increase employment

*This section quantifies the estimated impacts to jobs within the primary study area based on the development scenarios associated with each of Alternatives 1-3. The potential increase in jobs in the PSA/City of Springfield is based on the size of commercial and industrial developments and average ratios of building size to employment across sectors.*

#### 4.2.2 Increase population

*This section quantifies the estimated impacts to population within the primary study area based on the development scenarios associated with each of Alternatives 1-3. Potential increases in population in the PSA/City of Springfield are derived from the number of housing units proposed for each scenario at full buildout, average occupancy rates, and average household sizes of comparable units.*

#### 4.2.3 Increase housing

*This section quantifies the estimated number of housing units within the primary study area based on the development scenarios associated with each of Alternatives 1-3. The number of housing units added to the PSA/City of Springfield associated with each development scenario is based on developable land available under the design Alternatives as well as potential market demand.*

#### 4.2.4 Improve affordability – housing in proximity to transit

*This section compares the quantity of housing generated within ¼ mile of Union Station, a major transportation hub for downtown Springfield. Expansion of housing stock near Union Station can provide an increase in housing options that allows households to meaningfully decrease costs, e.g. by reducing vehicle ownership and reducing combined housing and transportation costs.*

#### 4.2.5 Improve public service provision

*This section quantifies the extent to which additional public services may be enabled by incremental tax revenue generated within the primary study area and accruing to the City of Springfield by the development scenarios associated with Alternatives 1-3. Estimates of tax generation are derived separately for residential units and commercial/industrial development. Residential tax revenues are based on local comps for condo sales with an upwards adjustment to account for the likely price premium for new waterfront units, and are calculated on a per-unit basis. Commercial/industrial tax revenues are based on local comps for office/retail and industrial properties in the waterfront area, with upwards adjustment for building age and condition; these revenues are calculated on a square footage basis. All values are based on 2016 property values and tax rates in the City of Springfield, and are expressed in 2016 dollars.*

#### 4.2.6 Promote reduced travel costs

*This section provides a qualitative assessment of design, environmental, and population-based factors that may act to reduce travel costs (including time and safety) for travel via modes other than single-occupancy vehicles. Because no changes in transit service are contemplated under Alternatives 1-3 vs. the no-build option, potential improvements in first/last mile connections based on enhancements to bicycle and pedestrian infrastructure that may benefit transit users and transit ridership.*

#### 4.2.7 Improve social cohesion

*This section inventories the transportation and open space impacts of each of the alternatives with respect to factors that may increase opportunities for social and recreational travel between neighborhoods, and improve connections to open space areas suited for recreation, community events, and socialization between residents of different neighborhoods and backgrounds.*

#### **4.3 Freight Rail Impacts**

##### **4.3.1 Operational Impacts**

*This section identifies whether there will be any operational impacts to freight rail based on the mitigation measures in each alternative. Each alternative assumes that if any direct impacts may occur, mitigation measures will be made to the rail in order not to impact any freight rail operations.*

##### **4.3.2 Implementation Costs**

*This section identifies whether there will be any operational impacts to freight rail based on the mitigation measures in each alternative. Each alternative assumes that if any direct impacts may occur, mitigation measures will be made to the rail in order not to impact any freight rail operations. For example, temporary tracks, etc. This section identifies if the mitigation measure measures required to the rail will be categorized as no-impacts to severe impacts. Actual implementation costs are not depicted with a monetary value.*

#### **4.4 Parking Impacts**

##### **4.4.1 Impacts to parking under I-91**

*Currently there are two parking garages controlled by the Springfield Parking Authority, the North and South garages underneath the Interstate 91 viaduct between State Street and Hampden Street. There are approximately 1760 parking spaces available underneath I-91 in these two garages, approximately 1100 in the North garage and 660 in the South Garage. This section is being looked at to understand the impacts each alternative will have on these garages, whether or not they will be removed and/or maintained as many individuals in the downtown core area utilize these garages.*

5. **Community Effects** - This set of criteria was developed to evaluate each alternative's ability to minimize temporary impacts to all stakeholders, while understanding and maximizing the future benefits of a completed project

#### **5.1 Visual Impacts**

##### **5.1.1 Visual perception of I-91 Viaduct**

*The visual perception of the I-91 viaduct is being reviewed in this section to assess the vertical location and horizontal alignment in number of feet relative to activity center proxies. This is important to understand and evaluate, each alternative will influence a person's opinion on safety, connection to the Riverfront, aesthetics, etc. based on the location of the interstate, vertically and horizontally.*

## **5.2 Construction Impacts**

### **5.2.1 Construction Duration**

*The time estimated for the completion of construction of each alternative, typically the value/time frame will be in years for a potential project of this magnitude. This is primarily evaluated to understand what hardships or burdens, effects that will be placed on commuters and directly impacted business owners who utilize these facilities on a daily basis.*

### **5.2.2 Lane closures and detours**

*In order to complete the construction of a project, certain mitigation measures are typically required, in this case lane closures and/or detours. Lane closure and detours maybe required to be implemented prior to construction depending on construction staging. Thus, closures and detours are intended to possibly start prior to construction and also for the duration of the project depending on construction stages and the means and methods of construction.*

### **5.2.3 Maintenance of access to abutters**

*Many businesses, residents and visitors will be impacted by the construction of each of the alternatives. This section will assume the length (in years) of anticipated closures, temporary and/or permanent for each alternative. The length is determined by anticipated construction stages for different locals and also considers the all the impacts that are required for the construction of each alternative, for example mitigation measures needed prior to the start of the actual construction to the viaduct and other features in the overall alternative design. Access to a potential business and/ or residence maybe reduced and/or detoured for certain periods of time.*

### **5.2.4 Disruption of local businesses**

*Many businesses and their visitors will be impacted by the construction of each of the alternatives. This section will assume the length (in years) of anticipated closures, temporary and/or permanent for each alternative. The length is determined by anticipated construction stages for different locals and also considers the all the impacts that are required for the construction of each alternative, for example mitigation measures needed prior to the start of the actual construction to the viaduct and other features in the overall alternative design. Access to a potential business maybe reduced and/or detoured for certain periods of time. This may have an effect on both vehicles and/or foot traffic.*

## **5.3 Compatibility**

### **5.3.1 Compatibility with local and regional transportation plans, strategies, conservation and development**

*The section takes into consideration regional and local transportation plans, strategies, conservation and development. Alternatives where reviewed to see if in fact that they*

*support or differentiate with plans and developments that the City of Springfield and surrounding communities.*

5.3.2 Consistency with MassDOT goals, policies and directives

*MassDOT currently has certain goals, policies and directives in which designs follow, particularly for transportation projects. An example would be to provide pedestrian and bicycle accommodations for all roadway projects. Each alternative will be reviewed on this section to determine if the conceptual design meets and follows the latest goals, policies and directives.*

**5.4 Environmental Justice Impacts**

5.4.1 Availability of Jobs in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, the increase in availability of jobs within EJ areas is identical to the increase in jobs discussed in 4.2.1.*

5.4.2 Availability of education and health services in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, the increase in availability of education and health services within EJ areas is identical to the increase in availability of those services discussed in 1.3.2.*

5.4.3 Mobility impacts in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, mobility impacts within EJ areas are identical to the impacts discussed in 4.1.3.*

5.4.4 Improve local access from urban core to riverfront in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, enhanced access from the urban core to riverfront in EJ areas is identical to the impacts discussed in 4.1.2.*

5.4.5 Improve access to community resources and social services in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, improved access to community resources and social services in EJ areas is identical to the increase in availability of those services discussed in 1.3.2.*

5.4.6 Improve access to retail and commerce in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, improved access to retail and commerce in EJ areas is identical to the impacts discussed in 1.3.3.*

5.4.7 Environmental Impacts in EJ areas

*Because the entirety of the Primary Study Area geography is classified as environmental justice areas, environmental impacts in EJ areas will be identical to the impacts identified in Section 3.2 (pending CTPS analysis results).*

August 31, 2017

Mr. Michael Clark  
Office of Transportation Planning  
Massachusetts Department of Transportation  
10 Park Plaza, suite #4150  
Boston, MA 02116

**RE: I-91 Working Meeting #10 – Evaluation Criteria Workbook Comments  
MMI #3869-16-4**

Dear Michael:

We are in receipt of the comments received regarding the above-referenced project and offer the following responses to them:

Comments from Richard Masse (DOT) to Milone & MacBroom Inc.:

- C1. The simulations that were viewed at the end of the meeting, for the I-91 side, in the second half where it moves north from the peanut to focus on the South End bridge rotary, The NB queue at the approach to the rotary seems to grow throughout the simulation and it looks like the approach may be above capacity. Although there is a gap on the rotary coming up right at the end of the simulation, it is unclear that the volume on the approach is going to be able to clear.
- R1. **A slip lane has been added for vehicles heading onto I-91 and East Columbus Avenue, which has alleviated the potential backup under this scenario. Simulations have been revised accordingly.**
- C2. Van – you mentioned something about the volume in the simulation being conservatively large, that you had volumes larger than modeled that were in the simulation, or something like that. Can you please elaborate on that or provide some info for all the approaches to the South End bridge rotary. Is a NB bypass lane needed? SB also looks to be building quite a queue. Screenshot below.
- R2. **We chose to show a representative clip of the entire "Longmeadow curve section" in a short period of time and to keep the file size manageable. A conservative approach was taken in the analysis by adding vehicles to represent the peak queuing for all ramps and approaches in a short period of time for visualization purposes. We did this to better represent some of the anticipated queuing for the ramps at the "peanut" shaped interchange, which we believe would happen at a different time period than the South End Bridge Rotary section congestion.**

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Comments from Donna Feng (DOT) to Michael Clark (DOT):

- C3. Under 5.2 (Construction Impacts), it's been my experience that a new alignment is the least worst alternative with regards to traffic management. In the evaluation table, Alt 3 is given a ¼ moon (because the duration is shorter?), but I think Alt 2 should be considered less terrible than Alt 1 for Construction Impacts and should rate a ¼ moon.
- R3. While the comment is understood and it is agreed that the levels of construction impacts with both Alternates 1 and 2 will be extensive, we feel that it cannot be discerned as to which will be worse at this level of design.**

Comments from Gary Roux to Michael Clark (DOT):

- C4. As I brought up at the last I-91 Viaduct Study Working Group Meeting, I'd like to request that all comments submitted on the workbook be summarized and distributed to the Working Group.
- R4. A comment/response letter has been prepared.**
- C5. I am not sure if this has been addressed at a previous meeting of the Working Group, but it is unclear if some of the options such as the improvements to the South End Bridge and Route 5/57 rotary that are part of each of the alternatives would be considered to be part of the "No Build" alternative as well.
- R5. This option is under consideration by the MassDOT as an "Enhanced" No-build. Currently, the No-build Alternative does not include any South End Bridge and Route 5/57 rotary improvements.**
- C6. It has been suggested that the scale used rate each of the criteria in the matrix are weighted from -2 to 2 points. It would be helpful to have a total score for each of the four alternatives as a whole and for each major topic, i.e. "Mobility and Accessibility", "Safety", etc.
- R6. Totals and subtotals have been tabulated. See comment/response #17.**
- C7. Under criteria 1.1.4 "Provide or maintain acceptable merge, diverge, and weave level of service on I-91 mainline", the Depressed/New Alignment Alternative receives a score of "better" or a "1" despite having an overall listed LOS of "F". This is contrary to the scores of "same" or "0" for the other 3 alternatives. I'd interpret this to be a "worse" or "-1" score given the listed LOS "F" values for the 2 on-ramps.
- R7. The ratings for 1.1.4 were reviewed and left as-is. Please note that the listed LOS scores reflect only those locations where LOS is rated as E or worse, not overall LOS across the study area. Alternative 2 (Depressed/New Alignment) has the fewest locations projected to experience**

**LOS E/F conditions and therefore scores better (score of 1) in relation to the No-Build and other alternative scenarios.**

- C8. Under criteria 1.2.2, the scoring for the Depressed/New Alignment alternatives is listed as a "worse" or "-1" despite it having improved times in the Southbound direction. I would suggest this be scored as "same" or "0" given the modest improvements in one direction. Similarly, the Elevated Viaduct Alternative is scored as a "worse" or "-2" yet results in improvements in travel time for 3 out of 4 of the categories. I believe this should be scored as "better" or "2".
- R8. The ratings for 1.2.2 were reviewed and adjusted in the case of Alternative 3 (Elevated Viaduct). In the case of Alternative 2 (Depressed/New Alignment), the assigned rating reflects the net increase in travel time when averaged across both directions and AM/PM peaks. While the southbound direction is projected to experience faster travel times, the increase in times for the northbound direction is of a greater magnitude, hence the rating of -1 reflecting a small increase in overall travel times throughout the primary study area.**
- C9. Criteria 3.1.1 – the number of square feet of DEP reported wetlands appears to be incorrect in three of the alternatives.
- R9. Square feet of impacted wetlands have been reviewed and revised.**
- C10. Criteria 3.3.2 – Noise Impacts. I would suggest that the Depressed/Same Alignment Alternative only receive a score of "1" given its projected impact on residential receptors.
- R10. The data has been reviewed for 3.3.2. The assigned score reflects a substantial improvement in both residential and total impacted receptors relative to both the projected No-Build and Alternative 3 (Elevated Viaduct) conditions.**
- C11. Criteria 4.2.7 – Improve Social Cohesion. The Elevated Viaduct Option is scored as a "2" under these criteria, yet provides far less greenspace than other alternatives. I would recommend this be scored as a "1".
- R11. The rating has been revised accordingly.**
- C12. Freight Rail Impacts – the descriptions for both of these measures is unclear. Further information should be provided on what mitigation measures may be required for freight rail operations and what defines a "limited", "moderate", and "significant" impact.
- R12. Additional descriptions and examples will be provided in "Discussion" text for each Alternative.**
- C13. Criteria 4.3.1 – Operational Impacts. Each of the alternatives are labeled as having no impacts to freight operations but 3 of them are scored as a "-1". Please provide additional supporting information on this scoring.

- R13. The description will be revised to remove the phrase "no impact", and additional text will be provided to better describe the potential impacts.**
- C14. Criteria 4.3.2 – Implementation Costs. The three Viaduct alternatives are described as having a different level of impact. It would appear the Elevated Viaduct alternative should be scored as a "0" given the projected limited impacts it is expected to have under these criteria.
- R14. Rating has been revised accordingly.**
- C15. Criteria 5.2 Construction Impacts. I would recommend that all of the Viaduct Alternatives be given a score of "worse" or "-2" under all measures for construction impacts. Local residents and businesses have had to endure many significant construction projects such as the I-91 ramp reversal project, the I-91 fiber project, and the current Viaduct improvement project. Any disruption to local businesses and residents has a significant impact that will have negative adverse impacts regardless of the proposed length of time.
- R15. While we understand each of the three Alternatives will have significant impacts, when comparing all aspects of the types of construction, Alternative 3 will have more significant impacts than the no-build conditions in that it would also require new piers and a deck replacement at time of construction. Alternative 1 and Alternative 2 would require significantly more excavation, dewatering, and detouring in order to construct the sunken sections of highway, hence the difference in rating given.**
- C16. Criteria 5.4.4 – Improve local access to the riverfront. I would recommend scoring the Elevated Viaduct alternative as a "2" under this category due to the additional waterfront connector that is part of this alternative.
- R16. The rating has been revised for Alternative 3.**
- C17. Criteria 5.4.7 – Environmental Impacts in EJ areas. The scoring for the alternatives appears to be inconsistent. Both of the Depressed Alternatives are scored as a "1" while the Elevated Alternative is scored as a "0". From the numbers presented in the matrix, it appears the scoring should be a "0" for the Depressed Alternatives and a "1" for the Elevated Alternative as the Elevated Alternatives results in less of an impact.
- R17. The ratings and data have been reviewed and revised to reflect the overall balance of impacts from both air quality and noise emissions. Across all alternatives, the magnitude of changes in VMT/air quality emissions relative to the no-build scenario is relatively small. Alternatives 1 and 2 are projected to produce greater air quality impacts but lesser noise impacts while the inverse is true of Alternative 3. For these reasons, the impacts of each alternative from a combined air quality/noise standpoint were assessed as neutral.**

C18. Criteria 6.1.1 – Order of magnitude of implementation cost. The cost estimates are presented on 2017 dollars. While this is helpful, FHWA requires all project cost estimates to include an inflation factor to the actual year of construction. This inflation factor is currently 4% / year for the regional Transportation Improvement Plan (TIP) and Regional Transportation Plan (RTP). It would be helpful to have additional information on potential inflation impacts on these cost estimates including information on a more realistic rate of inflation that might be appropriate for this type and scale of transportation improvement.

**R18. Criteria 6.1.1 – The order-of-magnitude construction cost for each was determined using the year 2017 dollars values, not the year 2015; this has been revised. Although an inflation rate could be used in this evaluation, it was determined that a similar comparison could be drawn by using the year 2017 values or inflated values for some future construction year.**

**Criteria 6.2.2 – While we recognize the FHWA inflation rate is 4%, we also recognized that rate is used for relatively short-term (several years) budgetary planning for TIP and RTP purposes. We chose to use an inflation rate of 3% as an average inflation rate to allow for fluctuation in inflation over 55 years, reflecting the life-cycle costs. Although no rate can be predicted in certainty, for the purposes of this study, a 3% rate was used to reflect inflation annually to the year 2075.**

Comments from Rana Al-Jammal:

C19. The evaluation criteria description text is very difficult to read due to the use of bright blue (cyan) color as text color. I recommend using all black text in the body of this study's documentation to achieve the accessibility high contrast standard. Printing the document in grayscale did not solve the issue because the text appeared faded which made it difficult to see.

**R19. The color of the text has been revised.**

C20. When the ranking points are tallied for all three alternatives, as they stand currently, the following outcome was achieved. Since there were 62 items to be ranked which could achieve a maximum of 2 points each, the base total amounted to 124. Dividing the total Point score by the base total Points achievable yielded the following percentages of potential improvements compared to the Future No Build Scenario. While this is what the top of the matrix indicates, it was not clear from the criteria description in the workbook whether each ranking was in comparison to the No Build. It would be helpful to explain this in advance of the matrix presentation.

Future No Build: 0

Alternative 1: 53 Points, 43%

Alternative 2: 47 Points, 38%

Alternative 3: 35 Points, 28%

- R.20** All three alternatives should be compared to the No-build option, not against one another. A total and subtotal per category have been tabulated and are included below (and will be presented in a similar format in Chapter 4).

TOPIC AREA	Scenario			
	No-Build	Alt. 1	Alt. 2	Alt. 3
MOBILITY AND ACCESSIBILITY	0	14	10	13
SAFETY	1	13	13	14
ENVIRONMENTAL EFFECTS	0	7	7	3
LAND USE AND ECONOMIC DEVELOPMENT	0	19	18	11
COMMUNITY EFFECTS	0	4	4	7
COST	1	-1	-1	-1
<b>TOTAL</b>	<b>2</b>	<b>56</b>	<b>51</b>	<b>47</b>

Comments from Laura Hanson (DOT) to Richard Masse (DOT), Donna Feng (DOT), & Patrick Paul (DOT):

- C21. I agree with Rich's comments regarding South End Bridge Rotary simulation that shows a large queue for NB traffic entering the rotary. Perhaps M&M should use current traffic volumes for a more realistic view, and share the new simulation?
- R21. Refer to prior Rich Masse comments and responses.**
- C22. After review of the data tables it is interesting that a goal of MassDOT for increasing bike/ped/transit modes of Transportation are not really differentiated in the spreadsheet. The three alternatives show the same score in 12 sections with regard to these modes and safety (1.3.2/ 1.3.3/ 1.3.5/ 1.4.1/ 1.4.2/ 2.1.1/ 2.1.2/ 2.1.3/2.1.5/2.2.1/ 2.2.2/ 2.3.1,) Is there another way to represent the data to be more helpful? Alt 1 moves ahead from Alt 2 & 3 mainly in Travel Time (Sections 1.2.1 and 1.2.2), where several questions were raised, and may further influence outcome. Alt 3 moves down from Alt 1 & 2 mainly in Economic Development (Section 4), which makes sense. Alt 1 scores the best overall but may be influenced by Public Health data
- R22. When considering bicycle, pedestrian, and transit travel, it has been assumed and figured into the concepts that all roadways that would be impacted by a project will be brought up to meet or exceed current or future MassDOT design standards for bicycle, pedestrian, and transit accommodations. The bulk of the improvements that are not related to on-road accommodations would occur over the top of the sunken highway in Alternatives 1 and 2 and in more limited portions under the viaduct in Alternative 3.**
- C23. At the end of the 6/27/2017 meeting, it was suggested to extend the project deadline to Oct 2017, and hold another Working Group meeting (Sept 2017?). I concur with this suggestion for three reasons: see new simulation at rotary, answer questions from 6/27/17 (meeting #10), and

Mr. Michael Clark  
August 31, 2017  
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discuss influence and share the public health data/ scoring with the group, get a summary of the overall outcome of this study

**R23. The simulations completed to date will be reviewed and modified per several comments discussed in this letter. However, no new simulations will be completed per budget limitations. MassDOT will provide further discussion to the Working Group regarding the public health outcomes and DPH involvement.**

If you have any further questions or comments, please do not hesitate to contact me.

Very truly yours,

MILONE & MACBROOM, INC.

A handwritten signature in black ink, appearing to read 'Mark Arigoni', with a long horizontal line extending to the right.

Mark Arigoni, L.A., Principal  
Massachusetts Regional Manager

3869-16-4-au3117-ltr

## ***TECHNICAL MEMORANDUM***

**DATE:** August 16, 2018  
**TO:** Bob Frey, Director of Project-Oriented Planning  
Office of Transportation Planning, MassDOT  
**FROM:** Scott A. Peterson, Edward Bromage, and Jieping Li  
**RE:** I-91 Viaduct Study Air Quality Results and Analysis

### **1 INTRODUCTION**

The purpose of this memo is to document the analysis methodology used in the Interstate 91 (I-91) viaduct study air quality analysis. The Massachusetts Department of Transportation (MassDOT) had retained a consultant to complete the I-91 viaduct rehabilitation project and replace the existing deck on the bridge. To expedite completion of the analysis portion of the rehabilitation work and to provide consistency with other air quality analyses, Central Transportation Planning Staff (CTPS) was retained by MassDOT to provide project-level air quality analysis.

The consultant prepared the estimated traffic volumes and data for five project scenarios, which included the base year 2014, the future year 2040 no-build (NB), and three 2040 build alternatives (Alt1, Alt2, Alt3). The data consisted of AM and PM peak period assignment results and the corresponding land use data.<sup>1</sup> Based upon these scenario data, CTPS estimated and analyzed both highway air quality and cold start emissions.

### **2 AIR QUALITY ESTIMATION METHOD AND ASSUMPTIONS**

CTPS has developed a sophisticated system to estimate the air quality and cold start emissions. The highway air quality is estimated by applying the cross-classification factors of the Environmental Protection Agency's latest emissions model, Motor Vehicle Emissions Simulator (MOVES), to an output of the travel demand model, vehicle miles traveled (VMT). To calculate mobile emissions from cars and trucks for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and volatile organic compounds (VOC), the MOVES emission

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<sup>1</sup> AM peak means the time period from 6 AM to 9 AM. PM peak means the time period from 3 PM to 6 PM.

rates by speed categories, by functional class, and by land use in grams per mile for vehicle type are applied to the link volume resulting from the travel demand model associated with different scenarios. Then the link level emissions are aggregated by different geography, such as transportation analysis zones (TAZ), town/city, and bigger geographic levels.

The MOVES emission factors require separating VMT between automobiles and trucks since the emission rates are quite different between them. However, the estimated highway assignment volumes from the I-91 viaduct study were combined between automobiles and trucks. CTPS assumed that 90 percent of the VMT is related to auto travel and 10 percent of them are for truck when calculating the highway air quality results.

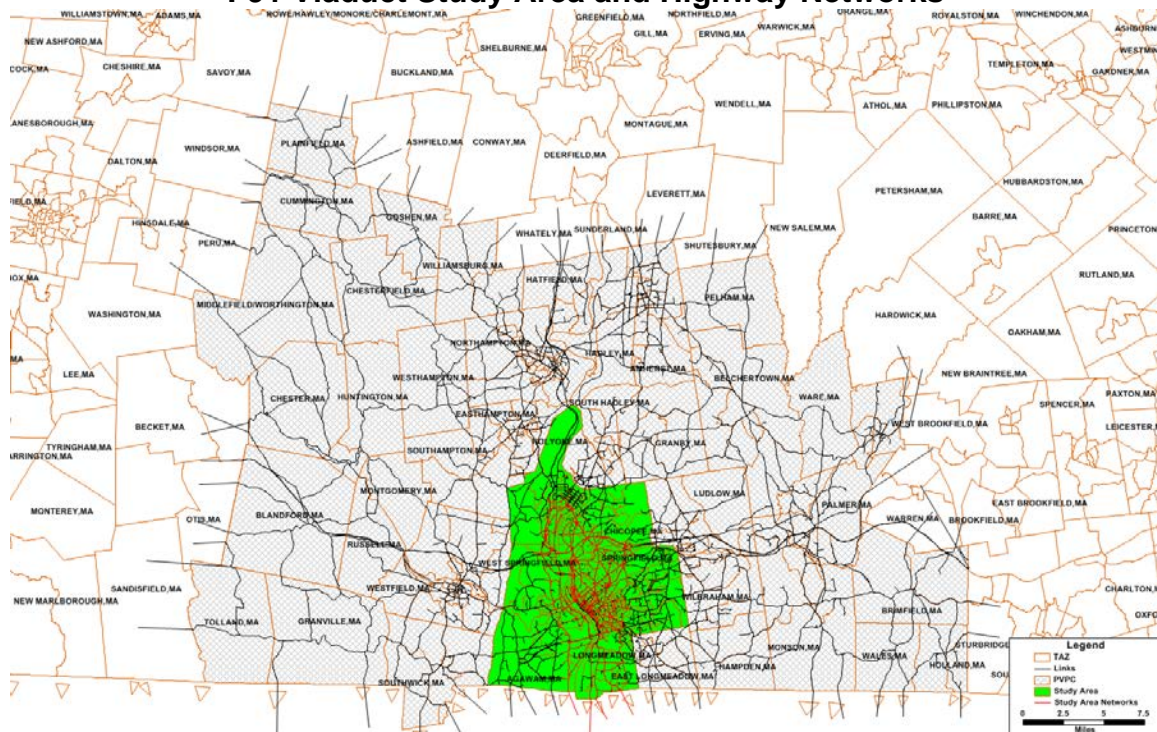
Cold start emissions are calculated based upon the assumptions of per vehicle emission rates under different conditions. For the base year, the cold start is calculated using the existing vehicle information. For future years, cold start is a function of the vehicles associated with the forecasted household vehicles.

CTPS has existing 2012 and 2016 MOVES emission rates, but no subarea study base year 2014 emission rates. CTPS interpolated the 2014 emission rates using the 2012 and 2016 MOVES data. The interpolated 2014 MOVES emission rates were applied to estimate the highway air quality and cold start emissions for the base year of 2014. The 2040 MOVES emission rates were applied to estimate the highway air quality and cold start emissions for the 2040 NB and 2040 build alternatives.

### **3 STUDY AREA GEOGRAPHY AND LAND USE ASSUMPTIONS**

The study area covers parts of the six communities along the I-91 viaduct area, including Agawam, Chicopee, Holyoke, Longmeadow, Springfield, and West Springfield. The study area geography and highway networks are shown in Figure 1. The study area is in green, indicating the area affected by the I-91 viaduct project. The networks in the map in red are the modeled roadways in the study area.

**Figure 1**  
**I-91 Viaduct Study Area and Highway Networks**



Population, employment, and vehicle information are important to understanding the highway air quality and the cold start emissions. Table 1 presents these demographic data for the study area across the five analyzed scenarios. The total population, employment, and vehicles change by 7 percent, 5 percent, and 7 percent, respectively, between the base year of 2014 and the 2040 NB. The total population, employment, and vehicles all increase from the 2040 NB alternative in each of the three 2040 build alternatives. Table 2 shows the land use assumption changes between the five scenarios. The 2040 Alt2 has the highest amount of change for total population, employment, and vehicles from the 2040 NB compared with the other two 2040 build alternatives.

**Table 1**  
**Land Use Assumptions Between Scenarios**

<b>Scenarios</b>	<b>Total Population</b>	<b>Total Employment</b>	<b>Total Vehicle</b>
2014	323,306	149,140	172,689
2040 NB	346,824	157,303	184,542
2040 Alt1	347,062	157,882	184,753
2040 Alt2	347,208	158,319	184,882
2040 Alt3	346,869	157,362	184,582

**Table 2**  
**Land Use Assumption Changes Between Scenarios**

<b>Changes</b>	<b>Total Population</b>	<b>Total Employment</b>	<b>Total Vehicle</b>
from 2014 to 2040 NB	23,518	8,163	11,853
Growth Rates from 2014 to 2040 NB	7%	5%	7%
from 2040 NB to 2040 Alt1	238	579	211
from 2040 NB to 2040 Alt2	384	1,016	340
from 2040 NB to 2040 Alt3	45	59	40

## 4 HIGHWAY AIR QUALITY RESULTS

Highway air quality results and changes between scenarios are listed in Table 3 and Table 4. Air quality numbers are calculated for CO<sub>2</sub>, CO, NO<sub>x</sub>, and VOC. For the 2040 NB, VMT is projected to increase by 8 percent and 9 percent for AM and PM peak periods, respectively. However, because of technology improvements, emission rates drop dramatically. This lead to 2040 NB air quality results that are much lower than that of 2014.

**Table 3**  
**I-91 Viaduct Study Air Quality Results**

Scenario	AM/PM	VMT	CO2(kg)	VOC(kg)	CO(kg)	NOx(kg)
2014	AM	697,549	278,196	78.56	2,094	425.15
	PM	1,003,910	436,585	122.96	4,139	613.60
2040 NB	AM	753,940	170,916	14.00	667	45.11
	PM	1,091,945	270,370	20.94	1,273	64.18
2040 Alt1	AM	757,748	171,880	14.09	669	45.29
	PM	1,101,185	272,823	21.13	1,285	64.79
2040 Alt2	AM	760,559	172,714	14.16	670	45.36
	PM	1,111,613	276,332	21.39	1,293	65.26
2040 Alt3	AM	753,908	170,978	14.01	665	45.07
	PM	1,092,900	270,760	20.97	1,276	64.32

CO = carbon monoxide. CO2 = carbon dioxide. kg = kilograms. NOx = nitrogen oxides. VMT = vehicle miles traveled.  
VOC = volatile organic compounds.

Notes: The 2014 MOVES rates are derived from the 2012 and 2016 MOVES rates.

As shown in table 4, 2040 Alt 2 has the greatest air quality impacts among the three build alternatives. Two driving forces contribute to this result. The first reason is that 2040 Alt 2 has the most aggressive land use growth among the three 2040 build alternatives (see Table 2). The other reason is that 2040 Alt2 has a set of improvements that result in the highest VMT among the three 2040 build alternatives. According to the presentation file from the I-91 Viaduct Study Working Group Meeting on June 27, 2016, 2040 Alt2 was designed to remove seven ramps, while 2040 Alt1 and 2040 Alt3 only planned to remove six and two ramps, respectively.<sup>2</sup> Removing the ramps will require the vehicles to drive longer distances to get into downtown Springfield and other communities along the corridor. These two factors explain why 2040 Alt2 has the maximum VMT changes compared with 2040 Alt1 and 2040 Alt3. Similarly, 2040 Alt3 does not have significant highway air quality changes since it only removed two ramps and the land use changes are relatively minor among the three future build alternatives.

<sup>2</sup> Massachusetts Department of Transportation, June 27, 2016, I-91 Viaduct Study Working Group Meeting #7. Accessed on 5/8/2017.

<http://www.massdot.state.ma.us/Portals/43/Docs/Meeting%20Notes62316.pdf>.

**Table 4**  
**I-91 Viaduct Study Highway Air Quality Changes**

Changes	AM/PM	VMT	CO2(kg)	VOC(kg)	CO(kg)	NOx(kg)
from 2014 to 2040 NB	AM	56,390	(107,280)	(64.57)	(1,427)	(380.04)
	PM	88,035	(166,215)	(102.02)	(2,866)	(549.43)
from 2040 NB to 2040 Alt1	AM	3,808	964	0.09	2	0.18
	PM	9,240	2,453	0.19	12	0.61
from 2040 NB to 2040 Alt2	AM	6,619	1,798	0.16	2	0.25
	PM	19,668	5,963	0.45	19	1.08
from 2040 NB to 2040 Alt3	AM	(32)	62	0.02	(2)	(0.05)
	PM	955	391	0.03	3	0.14

CO = carbon monoxide. CO2 = carbon dioxide. kg = kilograms. NOx = nitrogen oxides. VMT = vehicle miles traveled.  
VOC = volatile organic compounds.

## 5 COLD START EMISSION RESULTS

Cold start emissions capture the additional emissions that result from starting vehicle engines and driving before the engine has completely warmed up. The estimated number of vehicles and shares between trucks and automobiles were applied to MOVES cold start emission rates to calculate the cold start emissions. Table 5 and Table 6 present the cold start emission results and differences between the five alternatives. The driving forces for cold start emissions are the land use assumptions. The 2040 NB has lower cold start emissions than that of the 2014 because of auto emission technology improvement. Among the three build alternatives, 2040 Alt2 has the highest cold start increase since it has the maximum changes of population, employment, and vehicles compared with the other two future build alternatives.

**Table 5**  
**I-91 Viaduct Study Cold Start Emission Results**

Scenario	AM/PM	CO2(kg)	VOC(kg)	CO(kg)	NOx(kg)
2014	AM	21,718	318	2,595	95.01
	PM	12,552	209	1,715	114.53
2040 NB	AM	17,529	96.74	906	30.43
	PM	10,016	54.46	480	32.39
2040 Alt1	AM	17,546	96.82	907	30.47
	PM	10,025	54.50	480	32.42
2040 Alt2	AM	17,556	96.89	907	30.48
	PM	10,032	54.54	481	32.43
2040 Alt3	AM	17,533	96.76	906	30.44
	PM	10,018	54.47	480	32.39

CO = carbon monoxide. CO2 = carbon dioxide. kg = kilograms. NOx = nitrogen oxides. VOC = volatile organic compounds.

**Table 6**  
**I-91 Viaduct Study Cold Start Emission Changes**

Changes	AM/PM	CO2(kg)	VOC(kg)	CO(kg)	NOx(kg)
from 2014 to 2040 NB	AM	(4,188)	(221)	(1,689.26)	(65)
	PM	(2,536)	(154)	(1,235.39)	(82)
from 2040 NB to 2040 Alt1	AM	16.87	0.09	0.96	0.03
	PM	8.82	0.04	0.44	0.03
from 2040 NB to 2040 Alt2	AM	26.64	0.15	1.34	0.04
	PM	15.57	0.09	0.74	0.05
from 2040 NB to 2040 Alt3	AM	3.70	0.02	0.19	0.01
	PM	2.12	0.01	0.10	0.01

CO = carbon monoxide. CO2 = carbon dioxide. kg = kilograms. NOx = nitrogen oxides. VOC = volatile organic compounds.

## 6 SUMMARY AND CONCLUSIONS

Table 7 shows the summary of VMT, vehicle hours traveled (VHT), and total air quality results, which include both highway air quality and cold start emissions for the five alternatives previously mentioned. As shown in Table 7, the base year 2014 has the highest number of air quality emissions among the five alternatives, although its VMT and VHT are much lower than those from the other four scenarios, since the MOVES emission rates drop significantly from 2014 to 2040. Average speeds for AM and PM peaks calculated from the VMT and VHT decrease slightly from the 2014 to the 2040 future scenarios because of higher population and employment projections and associated traffic.

**Table 7**  
**Summary of 1-91 Viaduct Study Air Quality Results**

Scen.	AM/PM	VMT	VHT (hrs)	Average Speeds	CO2 (kg)	VOC (kg)	CO (kg)	NOx (kg)
2014	AM	697,549	17,497	39.87	299,913	396	4,689	520
	PM	1,003,910	26,803	37.46	449,137	331	5,854	728
2040 NB	AM	753,940	19,085	39.50	188,445	110.73	1,573	75.55
	PM	1,091,945	29,665	36.81	280,386	75.40	1,753	96.56
2040 Alt1	AM	757,748	19,251	39.36	189,426	110.91	1,576	75.76
	PM	1,101,185	29,908	36.82	282,847	75.64	1,765	97.21
2040 Alt2	AM	760,559	19,450	39.10	190,270	111.05	1,577	75.84
	PM	1,111,613	30,551	36.39	286,364	75.94	1,773	97.70
2040 Alt3	AM	753,908	19,146	39.38	188,511	110.77	1,572	75.51
	PM	1,092,900	29,648	36.86	280,779	75.44	1,756	96.71

CO = carbon monoxide. CO2 = carbon dioxide. NOx = nitrogen oxides. VHT = vehicle hours traveled. VMT = vehicle miles traveled. VOC = volatile organic compounds.

Table 8 summarizes changes for VMT, VHT, and total air quality results for both highway air quality and cold start emissions combined for the five alternatives previously mentioned. Table 8 shows the differences in these values between selected pairs of alternatives. The first section shows the changes projected between the 2014 and the 2040 no-build. They are the greatest changes

because of 26 years of demographic growth and the introduction of new vehicle technologies.

The differences between the 2040 NB and three build alternatives are also shown in Table 8. The air quality differences between 2040 Alt3 and 2040 NB are negligible. Both 2040 Alt1 and 2040 Alt2 have much higher VMT, VHT, and CO<sub>2</sub> impact compared with 2040 Alt3.

**Table 8**  
**Summary of I-91 Viaduct Study Air Quality Changes**

Changes	AM/PM	VMT	VHT	Average Speeds	CO <sub>2</sub> (kg)	VOC (kg)	CO (kg)	NO <sub>x</sub> (kg)
from 2014 to 2040 NB	AM	56,390	1,588	(0.36)	(111,468)	(285)	(3,116)	(445)
	PM	88,035	2,862	(0.65)	(168,751)	(256)	(4,101)	(632)
from 2040 NB to 2040 Alt1	AM	3,808	166	(0.14)	981	0.17	2.66	0.21
	PM	9,240	244	0.01	2,462	0.24	12.26	0.65
from 2040 NB to 2040 Alt2	AM	6,619	365	(0.40)	1,825	0.31	3.74	0.30
	PM	19,668	886	(0.42)	5,978	0.54	19.99	1.13
from 2040 NB to 2040 Alt3	AM	(32)	61	(0.13)	66	0.04	(1.65)	(0.04)
	PM	955	(17)	0.05	393	0.05	2.84	0.15

CO = carbon monoxide. CO<sub>2</sub> = carbon dioxide. NO<sub>x</sub> = nitrogen oxides. VHT = vehicle hours traveled. VMT = vehicle miles traveled. VOC = volatile organic compounds.

In conclusion, all three 2040 build alternatives for the I-91 viaduct rehabilitation project have net increases in emissions when compared to the 2040 NB. This is principally due to the increase in capacity in the project area. However, the system as a whole may decrease globally, but this decrease is beyond the geographic scope of this analysis. The air quality results are not only determined by land use and roadway assumptions, but also by the study area geography and the emission rates.

SP/EB/JL/jl

Encl.