

I-91 VIADUCT STUDY

Springfield, Massachusetts



INTERSTATE 91 VIADUCT STUDY

October 2018



Prepared for:

The Massachusetts Department
of Transportation



Prepared by:

Milone & MacBroom, Inc.

In association with:

TranSystems
Regina Villa Associates
Umass Donahue Institute
RDV Systems, Inc
LevelAccess

TABLE OF CONTENTS

1.1 Purpose and Need.....	1
1.2 Study Background	1
1.3 Study Area.....	6
1.3.1 Primary Study Area	6
1.3.2 Regional Study Area	8
1.4 Goals and Objectives.....	10
Goal 1: 10	
Objectives:	10
Goal 2: 10	
Objectives:	10
1.5 Evaluation Criteria	11
1.6 Public Involvement Plan.....	14
1.6.1 Stakeholder Database	14
1.6.2 Internet Communications	14
1.6.3 Public Meetings.....	15
1.6.4 Working Group Meetings.....	15
1.6.5 Press Outreach	16
1.6.6 Coordination with Other Projects	16
1.6.7 Acknowledgements	16
2.1 Introduction.....	1
2.2 Traffic and Transportation.....	2
2.2.1 Existing Conditions, Data Collection, and Analysis.....	2
National Highway System Roadways.....	2
Automatic Traffic Recorder (ATR) Counts.....	8
Intersection Turning Movement Counts	8
Traffic Operations Assessment	17
Freeways Level Of Service (LOS).....	40
Weaving Segments LOS	42
Ramp LOS.....	48
Parking within the Primary Study Area.....	55
Park-and-Ride Program	60

Intelligent Transportation Systems (ITS)	60
Road Safety.....	62
Transit.....	70
Bicycle and Pedestrian Transportation.....	84
Freight Rail.....	93
Utilities.....	93
2.2.2 Future Year Conditions.....	94
Future No-Build Traffic Volumes and Analysis	94
Multimodal Transportation	106
2.3 Land Use and Planning.....	108
2.3.1 Existing Conditions, Data Collection, and Analysis.....	108
Municipal Comprehensive Plans.....	108
Review of Previous Conceptual Planning Studies.....	112
Existing Land Use and Zoning	117
Socioeconomics	123
2.3.2 Future Year Conditions.....	136
Socioeconomics	136
2.4 Environmental Conditions	153
2.4.1 Existing Conditions, Data Collection, and Analysis.....	153
Surface Water Resources.....	153
Floodplains.....	153
Wetlands.....	156
Existing Surficial Geology.....	156
Stormwater Management	158
Protected Open Space	158
Areas of Critical Environmental Concern (ACEC)	160
Hazardous Material Sites.....	160
Noise Levels	162
Air Quality.....	162
Cultural, Historical and Archaeological Resources	163
Threatened and Endangered Species	165
2.5 Public Health.....	167

2.5.1	Background	167
2.5.2	Key Informant Interviews.....	167
2.5.3	Existing Conditions, Data Collection, and Analysis.....	170
	Environmental Justice Populations.....	174
2.6	Definition, Inventory, and Evaluation of Issues and Opportunities	177
2.6.1	Issues.....	177
2.6.2	Constraints.....	184
2.6.3	Opportunities.....	186
Chapter II - Summary of Findings		190
3.1	Introduction	1
3.2	Development of Preliminary Alternatives	4
	Retain Existing Elevated Viaduct.....	5
	At-Grade Section.....	6
	Depressed Section	7
	Depressed Section with Relocated Railroad	8
	Tunnel Section	9
	Elevated Section (Elevated Viaduct)	10
	U.S. Route 5 Realignment	12
	I-91 Relocation to West Side.....	13
	Northbound & Southbound Split	14
	Relocation of Railroad Right-of-Way	15
3.3	Refinement of Alternatives.....	16
4.1	Introduction	1
4.2	Evaluation Criteria	2
4.2.1	Evaluation Criteria Development	2
4.2.2	Evaluation Criteria Descriptions	3
4.2.3	Evaluation Matrix: Interpretation and Definitions	18
4.3	Evaluation Methodologies.....	25
4.3.1	Methodological Overview	25
4.3.2	Design Overview and Considerations	26
4.3.3	Development Scenarios and Socioeconomic Impacts.....	60
4.3.4	Traffic Modeling and Simulation	63

4.3.5 Air Quality and Noise Impact Evaluation	64
4.3.6 Environmental Justice	67
4.3.7 Cost and Financial Impact Estimates	68
4.4 Evaluation Matrix.....	71
4.5 Alternative Summaries and Comparison	72
4.5.1 Alternative 1: Depressed, Same Alignment.....	72
4.5.2 Alternative 2: Depressed, New Alignment	74
4.5.3 Alternative 3: Elevated Viaduct	76
5.1 Summary of Recommendations	1
5.2 Alternatives Considered	3
5.2.1 Alternatives Development Process.....	3
5.2.2 Summary of Alternatives Evaluated	3
5.2.3 Evaluation Criteria	5
5.2.4 Benefit and Cost Differentiators	6
5.3 Near-/Mid-Term Improvements.....	11
5.3.1 Near-Term Improvements	12
5.3.2 Mid-Term Improvements.....	16
5.3.3 Near- and Mid-Term Recommendations	18
5.4 Implementation.....	19
5.4.1 MASSDOT Project Development and Design Process	19
5.4.2 Environmental Considerations	25
5.4.3 Implementation Summary.....	26

Figures:

Figure 1-1: 1868 Bowles Map of the Primary Study Area	2
Figure 1-2: 1946 USGS Map of the Primary Study Area	3
Figure 1-3: 1958 USGS Map of the Primary Study Area	3
Figure 1-4: 1958 Sunoco Road Map of the Primary Study Area	4
Figure 1-5: 1970 USGS Map of the Primary Study Area	5
Figure 1-6: Primary Study Area	7
Figure 1-7: Primary and Regional Study Areas	9
Figure 1-8: Working Group Meeting Topics	15
Figure 2-1: NHS Roadways within the Regional Study Area	4
Figure 2-2: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Areas – Overview Map	9
Figure 2-3: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #1.....	10
Figure 2-4: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #2.....	11
Figure 2-5: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #3.....	12
Figure 2-6: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #4.....	13
Figure 2-7: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #5 and #6.....	14
Figure 2-8: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #7.....	15
Figure 2-9: Eight-Part Schematic Map Series Showing Existing Traffic Volumes in the Primary and Regional Study Area – #8.....	16
Figure 2-10: Index Plan – Weaving Segments	43
Figure 2-11: W1 – Weaving Segments	44
Figure 2-12: W2 – Weaving Segments	45
Figure 2-13: W3 – Weaving Segments	46
Figure 2-14: Index Plan – Ramp Segments	49
Figure 2-15: R1 Ramp Segment	50
Figure 2-16: R2 Ramp Segments	51
Figure 2-17: R3 Ramp Segments	52

Figure 2-18: Off-Street Parking In Downtown Springfield	57
Figure 2-19: Fiber Optic Cable Attachment on I-91.....	61
Figure 2-20: Crash Clusters.....	63
Figure 2-21: Fatality Locations	67
Figure 2-22: PVTA Springfield Routes.....	71
Figure 2-23: PVTA Springfield Routes (Downtown Inset).....	72
Figure 2-24: PVTA Regional Extent (covers both the Regional Study Area and Primary Study Area)	73
Figure 2-25: Amtrak Springfield Station Daily Services	77
Figure 2-26: Existing Rail Routes	79
Figure 2-27: Regional Rail and Bus Service.....	80
Figure 2-28: Place of Work of Residents – Downtown Census Tracts and Springfield as a Whole	81
Figure 2-29: Journey to Work by Travel Mode – Downtown Census Tracts and Springfield Residents.....	82
Figure 2-30: Wayfinding Sign along State Street for the Connecticut Riverwalk and Bikeway.....	84
Figure 2-31: Main Street Underpass	85
Figure 2-32: Broad Street Underpass	85
Figure 2-33: Union Street Underpass.....	85
Figure 2-34: State Street Underpass	85
Figure 2-35: Boland Way Underpass	85
Figure 2-36: Sidewalk and Bike Path Locations	86
Figure 2-37: Access Points for Pedestrians and Bicyclists Along Interstate 91	87
Figure 2-38: Underpass Below Tracks Off West Columbus Avenue	88
Figure 2-39: Passive At-Grade Highway-Rail Crossing at Riverfront Park	88
Figure 2-40: Pedestrian Bridge	89
Figure 2-41: Rail Crossings for Riverfront Access	90
Figure 2-42: State Street at Main Street	92
Figure 2-43: West Columbus Avenue (Hall of Fame Avenue) at Union Street.....	92
Figure 2-44: 2040 No-Build Traffic Volumes – Overview Map	96
Figure 2-45: 2040 No-Build Traffic Volumes Map – #1	97
Figure 2-46: 2040 No-Build Traffic Volumes Map – #2	98
Figure 2-47: 2040 No-Build Traffic Volumes Map – #3	99
Figure 2-48: 2040 No-Build Traffic Volumes Map – #4	100
Figure 2-49: 2040 No-Build Traffic Volumes Map – #5 and #6.....	101

Figure 2-50: 2040 No-Build Traffic Volumes Map – #7	102
Figure 2-51: 2040 No-Build Traffic Volumes Map – #8	103
Figure 2-52: Proposed Development Projects in the Vicinity of the Primary Study Area	114
Figure 2-53: 2015 Rendering of the Revised Plans for the MGM Springfield Project	116
Figure 2-54: Primary Study Area Zoning.....	117
Figure 2-55: Map of Downtown Census Tracts, Encompassing Tracts 8008 and 8011.01	125
Figure 2-56: Housing Values – City of Springfield.....	127
Figure 2-57: Gross Rent in Downtown Census Tracts and City of Springfield	128
Figure 2-58: Gross Rent as a Percentage of Income.....	128
Figure 2-59: Unemployment Rate for Springfield and Other Areas	130
Figure 2-60: Industry Composition of Employment – Springfield and Massachusetts	132
Figure 2-61: Percent of Population by Age Group	136
Figure 2-62: Projected Population in 2040, By Traffic Analysis Zone	138
Figure 2-63: Projected Population Change, By Traffic Analysis Zone	139
Figure 2-64: Projected Household Composition, Percent One-Person Households in 2040, By Traffic Analysis Zone	141
Figure 2-65: Projected Household Composition, Percent Two-Person Households in 2040, By Traffic Analysis Zone	142
Figure 2-66: Projected Household Composition, Percent Three-Person Households in 2040, By Traffic Analysis Zone	143
Figure 2-67: Projected Household Composition, Percent Four-Person Households in 2040, By Traffic Analysis Zone	144
Figure 2-68: Projected Household Composition, Percent Five-Person Households in 2040, By Traffic Analysis Zone	145
Figure 2-69: Projected Employment, Basic Sector Employment in 2040, By Traffic Analysis Zone	147
Figure 2-70: Projected Growth in Basic Sector Employment, 2010 - 2040, By Traffic Analysis Zone	148
Figure 2-71: Projected Employment, Retail Sector Employment in 2040, By Traffic Analysis Zone	149
Figure 2-72: Projected Growth in Retail Sector Employment, 2010 - 2040, By Traffic Analysis Zone	150
Figure 2-73: Projected Service Sector Employment, 2010 - 2040, By Traffic Analysis Zone	151
Figure 2-74: Projected Service Sector Employment, 2010 - 2040, By Traffic Analysis Zone	152
Figure 2-75: Wetlands and FEMA Flood Hazard Area	155
Figure 2-76: Surficial Geology	157
Figure 2-77: Open Space	159

Figure 2-78: MassDEP AUL Sites & Watershed Delineations	161
Figure 2-79: MHC Historic Inventory.....	164
Figure 2-80: NHESP Regulated Areas	166
Figure 2-81: Environmental Justice Areas by Criteria.....	176
Figure 2-82: Existing Bicycle Detection - State Street at Main Street	177
Figure 2-83: Underpass I-91 over State Street	178
Figure 2-84: Unsafe Connection to Connecticut Riverwalk and Bikeway	179
Figure 3-1: Existing Elevated Viaduct Concept	5
Figure 3-2: At-Grade Alignment Concept	6
Figure 3-3: Example At-Grade Urban Highway.....	6
Figure 3-4: Depressed Alignment Concept.....	7
Figure 3-5: Covered I-70 Concept, Denver, CO.....	8
Figure 3-6: Depressed I-70 Corridor, St. Louis, MO	8
Figure 3-7: Depressed Section with Relocated Railroad	8
Figure 3-8: Tunnel Section Concept	9
Figure 3-9: Illustrative Examples – Tunneled Interstate Alignments.....	10
Figure 3-10: Elevated Section Concept.....	10
Figure 3-11: Elevated Viaduct Example.....	11
Figure 3-12: U.S. Route 5 Realignment Concept	12
Figure 3-13: I-91 West Side Concept	13
Figure 3-14: Northbound & Southbound Split Concept	14
Figure 3-15: Relocation of Railroad Right-of-Way Concept.....	15
Figure 4-1 Air Quality Pathway	20
Figure 4-2 Noise Pathway	21
Figure 4-3 Mobility and Connectivity Pathway	22
Figure 4-4 Public Safety Pathway	23
Figure 4-5 Socioeconomic Pathway	24
Figure 4-6 Overview of Evaluation Workflow	26
Figure 4-7 Original "Line Drawings" developed as part of the early alternatives development process.....	27
Figure 4-8 Initial development of highway and roadway alignment, lane widths, ramp locations, and green space	27
Figure 4-9 More detail is included as the alternatives begin to take shape; impacts and opportunities begin to be better defined for the purposes of the evaluation process to follow.	28

Figure 4-10	Final detailed conceptual alternative plans are developed for all three alternatives. The level of detail developed for each option is commensurate with the level of detail required to complete the evaluation criteria.....	28
Figure 4-11	Index Plan (Alternative 1).....	29
Figure 4-12	Alternative 1 – North Plan.....	29
Figure 4-13	Conceptual view of proposed Downtown Springfield waterfront conditions possible as part of Alternative 1.....	32
Figure 4-14	Alternative 1 – Central Plan	32
Figure 4-15	Alternative 1 – South Plan.....	34
Figure 4-16	Interchange Concept for I-91 and U.S. Route 5	37
Figure 4-17	Alternative 2 – North Plan.....	39
Figure 4-18	Alternative 2 – Central Plan	42
Figure 4-19	Conceptual view of proposed Downtown Springfield riverfront conditions possible as part of Alternative 2.....	42
Figure 4-20	Alternative 2 – South Plan.....	44
Figure 4-21	Alternative 3 – North Plan.....	45
Figure 4-22	Alternative 3 – Central Plan	48
Figure 4-23	Conceptual view of proposed Downtown Springfield riverfront conditions possible as part of Alternative 3.....	49
Figure 4-24	Alternative 3 – South Plan.....	50
Figure 4-25	Under-Viaduct Enhancement Examples.....	51
Figure 4-26	Conceptual Rendering of I-91 Under-Viaduct Enhancements	52
Figure 4-27	Conceptual Rendering of I-91 Pedestrian Improvements to Rail Crossings/Connecticut Riverwalk and Bikeway.....	52
Figure 4-28	Pedestrian Improvements to Rail Crossings and Connections to Connecticut Riverwalk and Bikeway	53
Figure 4-29	Maintenance deficiencies in path and stairway connecting South End Bridge and River Road	54
Figure 4-30	Opportunity for ADA Accommodations	54
Figure 4-31	Potential Shared-Use Path (Forest Park – Longmeadow)	56
Figure 4-32	Pedestrian-Friendly Countdown Signal; Nonconforming Pedestrian Ramp in Study Area; Interstate Symbol Example	57
Figure 4-33	Longmeadow Curve	58
Figure 4-34	South End Bridge and Agawam Rotary	58
Figure 4-35	I-91 & I-291 Interchange	59
Figure 4-36	Plainfield and Main Streets	60
Figure 4-37	Development Concept Example – Avocado Street and Clinton Street	62
Figure 4-38	VISSIM Output Example	64
Figure 4-39	CTPS Summary of Air Quality Metrics by Scenario	65

Figure 4-40	VHB Summary of Noise Impacts by Scenario (Draft Result)	67
Figure 4-41	Project Cost Estimates	69
Figure 4-42	Tax Revenue Estimates	70
Figure 4-43	Illustrative Elevation – Alternative 1	73
Figure 4-44	Plan View of Green Space above Viaduct Footprint (Alternative 2)	75
Figure 4-45	Elevated Viaduct Visualization (Conceptual I-91 Viaduct)	77
Figure 4-46	Evaluation Criteria.....	79
Figure 5-1	Near- and Mid-Term Improvements (South Section)	11
Figure 5-2	Near- and Mid-Term Improvements (North Section)	12
Figure 5-3	Conceptual Rendering of Under-Viaduct Enhancements	13
Figure 5-4	I-91/I-291 Interchange Improvements.....	17
Figure 5-5	Plainfield Street Improvements	17
Figure 5-6	Schematic Project Development Time Line	25

Tables:

Table 1-1: Evaluation Criteria, Categories, and Corresponding Goals.....	11
Table 1-2: Evaluation Criteria	12
Table 2-1: Level of Service Criteria	17
Table 2-2: Signalized Intersections Summary Table	20
Table 2-3: Unsignalized Intersections Summary Table.....	33
Table 2-4: Rotaries and Roundabouts Summary Table	38
Table 2-5: Existing Conditions of LOS Grades Along Freeway Segments	40
Table 2-6: Existing Conditions of LOS Grades Along Freeway Weaving Segments	47
Table 2-7: Existing Conditions of LOS Grades Along Freeway Ramp Segments	53
Table 2-8: Off-Street Parking Facilities	55
Table 2-9: Downtown Springfield Off-Street Parking Capacity Summary	58
Table 2-10: 2011 and 2012 Crash Data for Primary Study Area Sample Set	64
Table 2-11: Roadway Segment Crash Data in Primary Study Area.....	65
Table 2-12: Top Crash Locations within the Regional and Primary Study Areas.....	66
Table 2-13: Primary Study Area Locations Listed Among the Top 100 High Crash Intersections in the Pioneer Valley in 2007-2009	68
Table 2-14: Primary Study Area Locations Listed Among the Top 25 High Crash Roadway Segments in the Pioneer Valley in 2007-2009	69
Table 2-15: PVTA Springfield Route Headways	70
Table 2-16: 2014 PVTA Ridership	74
Table 2-17: Commuting Destinations for Springfield Residents.....	83
Table 2-18: Domains, Recommendations, and Action Steps from the Rebuild Springfield Plan	109
Table 2-19: Springfield's Zoning Districts in the Primary Study Area	119
Table 2-20: Agawam's Zoning Districts in the Primary Study Area	120
Table 2-21: Longmeadow's Zoning Districts in the Primary Study Area.....	121
Table 2-22: West Springfield's Zoning Districts Most Proximate to the Primary Study Area.....	122
Table 2-23: Demographic Characteristics of Agawam, Chicopee, Holyoke, Longmeadow, Springfield, and West Springfield.....	123
Table 2-24: Selected Years' Population and 10-Year Growth – Springfield, Surrounding Cities and Towns, and Massachusetts.....	126
Table 2-25: Number of Housing Units	127
Table 2-26: Summary Employment and Labor Force – Downtown Census Tracts and Springfield as a Whole....	129

Table 2-27: Summary Employment Data for Springfield and Surrounding Areas	131
Table 2-28: Place of Residence of Those Working in Springfield	133
Table 2-29: Household Income Ranges for Downtown Census Tracts, Springfield as a Whole, and the Commonwealth of Massachusetts	134
Table 2-30: Median Incomes for Towns in Regional Study Area and the Commonwealth of Massachusetts.....	135
Table 2-31: Key Health-Related Recommendations for I-91 Viaduct Study.....	169
Table 2-32: Health Data, Geography, Data Sources, and Methods Useful for Transportation-Related Health Impact Assessments	172
Table 2-33: Statistical Significance of Rates of Hospitalization for Asthma, Heart Attack, and Prevalence of Pediatric Asthma Compared to Statewide Rates in 2012	173
Table 2-34: Select Health Behavior Indicators by Select Zip Codes in the I-91 Primary Study Area	173
Table 5-1 Alternatives Comparison (Viaduct Only).....	9
Table 5-2 Project Development Summary	23

APPENDICES

Appendix A – Cost Estimates

Appendix B – Memorandums

Appendix C – Public Correspondence

Appendix D – Stakeholders

Appendix E – Health Data

Appendix F – Existing Crash Data and Analysis

Appendix G – Existing Traffic Analysis

Appendix H – Future No-Build Traffic Analysis

Appendix I – Alternative 1 Traffic Analysis

Appendix J – Alternative 2 Traffic Analysis

Appendix K – Alternative 3 Traffic Analysis