ARSENAL STREET
CORRIDOR STUDY

PREPARED FOR

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Executive Summary

The Arsenal Street Corridor Transportation Study (the study) is a partnership between the Massachusetts Department of Transportation (MassDOT), Massachusetts Bay Transportation Authority (MBTA), the Town of Watertown, and surrounding municipalities. The consultant team is led by VHB with support from Regina Villa Associates (RVA) and RKG Associates, Inc. (RKG). The study evaluates the existing and future multimodal transportation conditions along the Arsenal Street corridor in Watertown and the effects of/to adjacent municipalities. The study develops and analyzes alternatives that are intended to improve transportation conditions, with a primary focus on the bus service along Arsenal Street and locations where the bus service interfaces with other crossing routes. Alternatives are evaluated in the context of the overall traffic network, for their impact on vehicular, bicycle and pedestrian use, bus service, land use, and cost.

The study examined and analyzed mobility under existing conditions and under year 2040 conditions. Immediate-term, short-term, medium-term, and long-term recommendations have been developed using both quantitative information from analyses and qualitative feedback provided by the study's Working Group and the public. In some cases, Watertown has been proactive in starting to address identified issues and carry out immediate-term recommendations. The study includes an "Action Plan" for implementation of the short-, medium-, and long-term study recommendations.

This report is organized into six chapters that generally correspond to the major work tasks. Highlights from each chapter are discussed below.

ES.1 Chapter 1: Study Process and Framework

Chapter 1 outlines the study process and background, study area, goals and objectives, and the evaluation criteria developed to test the feasibility of alternatives. The chapter also highlights the public participation plan established for the project and each outreach meeting held throughout the course of the study.

ES.2 Chapter 2: Existing Conditions

Chapter 2 describes the existing (2016) conditions in the study area, including discussions of demographics, environmental resources, land use and economic development, public health, a multimodal transportation assessment, a safety evaluation, and a summary of the transportation infrastructure deficiencies within the study area.

ES.3 Chapter 3: Future Conditions, Issues and Opportunities

Chapter 3 assesses the 2040 Future Conditions, including land use forecasts, planned infrastructure improvements, future traffic demand forecasts, and future traffic operations within the study area. Issues, opportunities, and constraints that evolved from a thorough review of data and the compilation of concerns and desired outcomes (identified through the public outreach process) are also discussed. The analysis of existing and future transportation conditions and development of issues, opportunities and constraints in the study area identified areas of the transportation network that require improvements and guided the development of study alternatives.

ES.4 Chapter 4: Alternatives Development and Screening

Chapter 4 outlines the alternatives developed for study through the public outreach process. A range of 18 transportation improvements were identified through Working Group guidance and public outreach. These alternatives were organized into four categories:

- Bicycle Improvements
- Multi-modal Improvements
- Transit Options
- Vehicle Options

For each of the 18 alternatives, a "fatal flaw" analysis was completed to determine which components could be feasible solutions to congestion issues and multimodal deficiencies in the study area. The project goals were used as an abbreviated list of criteria against which to measure the alternatives. Any alternative showing merit was retained for consideration and subject to a more detailed technical analysis to determine the transportation benefit versus the associated impacts to the environment, economic development in the area, and

other factors. The chapter also identifies which alternatives were considered, but dismissed, prior to detailed analysis. Table ES-1 summarizes the results of the alternatives screening process.

In addition to the alternatives screened above, three categories of improvements were identified for immediate implementation by the Town: road safety audits (RSAs), traffic signal deficiencies/ compliance, and curb ramp improvements. While implementation is still ongoing, it is noted that an RSA for the intersection of Galen Street at Watertown Street/Nonantum Road was recently completed by MassDOT. Where appropriate, findings from the RSA are incorporated into the alternatives development at Watertown Square.

Table ES-1 Alternatives Screening Summary

Retained for Further Evaluation	Discarded from Consideration	Comments
Alternative 1: Bike Lanes East of School Street		Analysis will identify property impacts and develop typical cross-sections and consider planned athenahealth improvements.
	Alternative 2: Off-Road, Parallel Connections to Charles River	Discarded due to constructability concerns and in favor of Alternative 3. Alternative 2 could be pursued separately by the Town and/or DCR.
Alternative 3: Cross Connectivity between the Greenway and Charles River		Analysis will identify potential cross-connections and impacted property owners and develop typical cross-sections.
	Alternative 4: Separated Bike Lane East of School Street	Discarded due to impacts to private property. There may be an opportunity to incorporate separated bike lanes along Arsenal Street where right-of-way allows into Alternative 1.
Alternative 5: Road Diet East of School Street		Analysis will include a roadway capacity threshold evaluation and identification of potentially impacted parallel routes.
Alternative 6: Soldiers Field Road Gateway Improvement		Analysis will evaluate signal timing/phasing modifications, intersection geometry changes, incorporation of pedestrian accommodations, restriping, and/or Coolidge Avenue relocation.
Alternative 7: Watertown Square Gateway Improvement		Analysis will evaluate signal timing/phasing modifications, improved coordination, lane use changes, pedestrian accommodation enhancements, and/or Charles River Road relocation.
	Alternative 8: Traffic Signal Optimization	Discard as retiming is being progressed as part of on-going development projects within the study area.
	Alternative 9: Wayfinding	Discarded as a stand-alone improvement. Consider incorporating into preferred bicycle alternative and/or Alternatives 6 and 7.
Alternative 10: Express Bus along North Beacon Street		Analysis will evaluate whether the service could draw sufficient ridership to warrant full study.
Alternative 11: Transit Signal Priority (TSP)		Analysis will include queue bypass lanes, traffic signal timing/phasing options, and bus stop relocation/consolidation.
	Alternative 12: Watertown Square Bus Alternative	Discarded as a stand-alone improvement. Consider incorporating into Alternative 7.
Alternative 13: Transit Stop Turnouts/Curb Extensions		Analysis will consider spatial constraints (ADA guidelines) and qualitatively assess benefits to on-time performance and travel time improvements for bus bays versus curb extensions.
Alternative 14: Transit Shelters		Analysis will consider spatial requirements for installation of a shelter and identify existing constraints to the extent feasible.
Alternative 15: Existing Transit Service Improvements		Analysis will consider impacts on on-time performance, passenger crowding, and travel times of each sub-alternative.
	Alternative 16: Consolidated Shuttle Service	Discarded due to limited operational services at this time. Could be pursued by others when there are services from multiple employers operational.
Alternative 17: Adaptive Signal Control (ASC)		Analysis of this alterative will consider various ACS technologies and evaluate their appropriateness for the Arsenal Street corridor.
	Alternative 18: Overhead Lane Indication Signage	Discarded as a stand-alone improvement. Consider incorporating into Alternative 7.

ES.5 Chapter 5: Alternatives Analysis

Chapter 5 presents a detailed evaluation of each alternative carried forward for technical analysis. Of the 11 alternatives analyzed, nine are advanced as study recommendations (as discussed in Section ES.6). The two alternatives dismissed include:

Alternative 5: Road Diet East of School Street: Alternative 5 evaluated a road diet for the four-lane section of Arsenal Street from east of School Street to Greenough Boulevard to improve multimodal conditions. Two potential road diet options were considered, both within the existing curb-to-curb width. For either road diet option to be successful, significant traffic diversions would be necessary during the peak hours which may not be feasible given the significant land use nodes, both existing and planned, along the corridor. Further, there are limited parallel routes to accommodate diverted traffic from Arsenal Street and impacts to neighborhoods both to the north and south are anticipated. The study recommends eliminating Alternative 5 from consideration due to severe impacts to Arsenal Street mobility and anticipated parallel route diversions.

Alternative 13: Transit Stop Turnouts/Curb Extensions: This alternative considered the spatial requirements for bus turnouts and curb extensions. Bus turnouts require buses to exit the travel lane and can have negative impacts to transit operations and reliability due to the delays of buses in entering traffic from the turnout. While curb extensions are preferable for transit operations, they would impact general traffic flow, on-street parking, and potentially bicycle accommodations. Given the limited available width along the corridor and the potential to further disrupt transit operations, both options were discarded from consideration.

ES.6 Chapter 6: Recommendations

Chapter 6 summarizes the benefits of each recommended alternative and presents an "Action Plan" for the study recommendations. The study recommendations include:

Alternative 1: Bike Lanes East of School Street: This alternative considers options to extend bicycle accommodations in each direction of Arsenal Street east of School Street to the Charles River. Narrowing the travel lanes to 11-feet would not create enough space for the provision of five-foot bike lanes within the existing right-of-way (ROW). Two options to provide narrower accommodations were developed and analyzed. It is recommended that the Town continue to advance this alternative and, where practical, strive to achieve a five-foot width. Benefits of this alternative include the potential to reduce auto dependency, improve connectivity, and support active transportation initiatives.

Alternative 3: Cross Connectivity between the Greenway and Charles River: This alternative considers cross connections between the Watertown Greenway/Arsenal Street and the Charles River. Several connections are being advanced by either the Town of Watertown or private developers. Additional north-south connections along Irving Street, Beechwood Avenue, and Louise Street/Paul Street were considered to further improve access between the residential neighborhoods both north and south of Arsenal Street and the Charles River. It is recommended that the Town consider community outreach to develop specific recommendations, including potential shared lane markings and potentially formalizing Charles River Road crossings. Similar to Alternative 1, benefits of this alternative include the potential to reduce auto dependency, improve connectivity, and support active transportation initiatives.

Alternative 6: Soldiers Field Road Gateway Improvement: Alternative 6 evolved to focus on the Arsenal Street at Coolidge Avenue/Arlington Avenue intersection due to ongoing City of Boston involvement with current development projects along Western Avenue. Two improvement options were developed to relocate Coolidge Avenue; the alternative also includes signal timing and phasing modifications. Both relocation options are anticipated to require extensive environmental permitting. The study recommends advancing Alternative 6 by initiating outreach to affected Coolidge Avenue stakeholders and determining whether a preferred alternative can be progressed from the conceptual designs. Benefits of this alternative include improved traffic flow, intersection safety, operations, and systems reliability; increased access for all users; and modifications to noted safety deficiencies.

Alternative 7: Watertown Square Gateway Improvement: This alternative includes signal timing/phasing and coordination modifications, lane use changes, pedestrian accommodation enhancements, the potential relocation of Charles River Road, relocation of the Routes 70/70A eastbound bus stop, and enhanced wayfinding. The study recommends advancing Alternative 7 by initiating public outreach and progressing the concept plan through design development. Benefits of this alternative include enhanced safety, improving approach/movement alignments, and modifying north/south phasing; reduced queues; improved pedestrian and bicycle accommodations, and the creation of additional open space. Eliminating the Charles River Road approach to the intersection may also reduce “cut-through” traffic in the adjacent neighborhood. However, it was noted through the public outreach process that Alternative 7 would include further refinement, traffic analysis, and more detailed evaluation of the potential benefits and impacts on adjacent neighborhoods, specifically along North Beacon Street, Irving Street, Riverside Street, and Charles River Road. The compatibility of modified traffic patterns as part of this alternative would be considered in conjunction with incorporating potential Complete Streets elements as identified in Alternative 3.

Alternative 10: Express Bus along North Beacon Street: Alternative 10 considers supplementing the existing MBTA Route 70/70A service with express bus service along North Beacon Street to improve connections between Watertown and Boston. Preliminary ridership estimates generally support this type of service for the peak periods. Based on potential travel times, service headways, and MBTA resource constraints, it is recommended that a pilot commuter shuttle program be advanced between Watertown Square and the Boston Landing commuter rail station in Brighton. The primary benefits of this alternative include the potential to reduce crowding on Routes 70/70A and/or other bus routes serving Watertown Square and increased transportation options and connections, particularly to rapid growth areas of South Boston.

Alternative 11: Transit Signal Priority (TSP): The study recommends implementing TSP at eight signalized intersections to the east of Watertown Square. To maximize system effectiveness, relocation or consolidation of four bus stops is also recommended. Benefits of this alternative include improved system reliability, primarily for transit services; a potential decrease in auto dependency; and minimized greenhouse gas emissions.

Alternative 14: Transit Shelters: This alternative considered transit shelters at eight bus stops that meet MBTA eligibility criteria. Based on a review of spatial requirements and existing constraints, transit shelters are recommended at four locations where only minor to moderate property impacts are anticipated, primarily to grass buffers. The primary benefit of this alternative is that it supports healthy design principles. If combined with other transit improvements, shelters may help to reduce auto dependency.

Alternative 15: Existing Transit Service Improvements: This alternative involves both short- and medium-term actions. In the short term, the MBTA may consider service frequency and scheduling improvements that can be implemented with existing resources, aimed at reducing Route 70/70A overcrowding and providing more evenly timed service along the Arsenal Street Corridor. In the medium term and beyond, expanding the bus fleet could support additional adjustments to routing and increased service frequency. It is recommended that consideration be given to splitting the existing Routes 70 and 70A into three routes - the existing Route 70, the overlapping "Trunk Route" portion of Routes 70 and 70A, and the North Waltham "Loop Circulator" portion of Route 70A. Consideration should be given to improving service and/or expanding the service span on the "Loop Circulator," as the split routes would create one of the largest bus-to-bus transfer points in the MBTA system at Waltham Center. Further consideration may be given to adding limited-stop express service on the "Trunk Route" or providing consolidated stop service for all trips. This package of medium-term improvements would further benefit from schedule and service frequency adjustments to accommodate future ridership demand, which may include trip shifts and additional trips during the off-peak and peak periods. Benefits of these recommendations include improved reliability

and on-time performance, ability to target service increases to alleviate crowding, more evenly distributed service headways, potential for reduced travel times, increased capacity to accommodate projected demand, and potential to induce new transit demand.

Alternative 17: Adaptive Signal Control (ASC): Alternative 17 involves implementing ASC technologies at ten locations east of Watertown Square to optimize traffic flow and progression. Benefits of this alternative include improved traffic flow, operations, and system reliability; the potential to minimize greenhouse gas emissions; enhanced existing transit services; and the potential for real-time monitoring of traffic volumes and operations.

Table ES-2 presents the details of the Action Plan for the recommended improvements, including construction cost estimates, potential funding sources, the responsible facilitating organizations, the implementation timeframe, and specific next steps.

Table ES-2 Recommended Action Plan – Commitment Matrix and Implementation Timeframe

Alternative	Construction Cost [1]	Possible Funding Source(s)	Facilitating Organizations: MassDOT	MBTA	DCR	Town of Watertown	EEA	Implementation Timeframe (Years): Short-Term 1	2	3	4	5	Medium-Term 6	7	8	9	10	Long-Term 10+	Next Steps	Responsible Party	Notes
1. Bicycle Lanes east of School Street	$75,000 to $2,100,000[2]	• State Complete Streets • State Chapter 90 • Private developer			X	X													Advance to final design. Seek funding source(s).	Town	No environmental review/perming anticipated. Preferable to coordinate with athenahealth bike lanes.
3. Cross Connectivity between the Greenway and Charles River	Variable	• Paths being advanced by others • Town funds for shared lane markings			X	X													Support path development by others. Determine support for Complete Streets elements on neighborhood streets.	Town	No environmental review/perming anticipated. May be required if formal crossings of Charles River Road are developed
6. Soldier's Field Road Gateway Improvements	$1,500,000 to $2,500,000	• Town funds • Private developer • State Transportation Improvement Program	X		X	X	X						Permitting and Design					Construction	Advance design. Stakeholder outreach. Research permitting requirements.	Town	ROW acquisition anticipated. Will require additional public and stakeholder outreach.
7. Watertown Square Gateway Improvements	$950,000 to $1,500,000[3]	• Town funds • Private developer • State Transportation Improvement Program	X	X	X	X	X			Permitting and Design			Construction						Advance design. Engage DCR. Study Charles River Road cut-through traffic impacts.	Town	ROW acquisition anticipated. Will require additional public and stakeholder outreach.
10. North Beacon Street Express Bus	Variable	• Area stakeholders • MBTA • TMA		X		X							Pilot Program					Full Service	Establish pilot program.	Town/MBTA	Potential ROW acquisition for transit stops.
11. Transit Signal Priority	$250,000 + Upgrades[4]	• Town funds • Private Developer		X		X													Advance system design. Coordinate bus stop modifications. Identify signal upgrades.	Town/MBTA	ROW acquisition or easements anticipated for relocation of bus stops.
14. Transit Shelters	$30,000/ location	• Town funds • Private Developer • MBTA		X		X													Determine installation & maintenance responsibility. Initiate easement process.	Town/MBTA	All locations require small easements from property owners (ROW acquisition).
15. Transit Service Improvements to Existing Routes	$3,600,000[5]	• MBTA		X		X							With Existing Fleet					With Expanded Fleet	Further analyze and refine as part of the MBTA's bus service planning process and bus improvement plan initiative.	MBTA	Alternative 15 cost estimates are intended solely for purposes of comparing alternatives within the context of this study and are not for budgeting purposes. Capital and operating costs will depend on the allocation of MBTA resources across all system routes based on systemwide priorities.
17. Adaptive Signal Control	$250,000 to $500,000[4,6]	• Town funds • Private Developer		X		X					Planning/ Implementation		Refinement/Upgrades					Maintenance	Advance system design. Identify signal upgrades. Further evaluate Watertown Square operations.	Town	

MassDOT - Massachusetts Department of Transportation, MBTA - Massachusetts Bay Transportation Authority, DCR - Department of Conservation and Recreation, EEA - Executive Office of Energy and Environmental Affairs

Information on state funding sources can be found at the following locations: Complete Streets (mass.gov/massdot/completestreets), Chapter 90 (mass.gov/massdot/chapter90), State Transportation Improvement Program (ctps.org/tip-dev)

1 Construction cost estimates in 2017 dollars. Estimates do not include survey, design fees, right-of-way (ROW) acquisition, permitting, drainage improvements, or utility modifications (if necessary).

2 Lower cost estimate includes removal of paint markings and restriping only. Higher cost estimate includes cold plane/overlay in addition to restriping.

3 Costs may be increased by signal system upgrades/modifications, hardscape/ landscape design, pedestrian lighting, site furnishings.

4 New traffic signal cabinet assembly may be required at some locations. The cost of a new assembly is approximately $40,000 per location. If the intersection is recommended for both transit signal priority and adaptive signal control, this cost is incurred only once.

5 Estimate includes capital cost only for additional vehicles anticipated for medium-term recommendations, and excludes capital costs associated with expanded fleet storage and maintenance facilities. Incremental operating costs are estimated at $200,000 and $800,000 per year for short-term and medium-term recommendations, respectively.

6 Ultimate cost will be dependent on type of communication and server chosen.