Newton Corner Improvements Project Study

Interstate I-90 (Massachusetts Turnpike) Interchange 127 (Newton Corner) MassDOT Project Number: 609228

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Executive Summary

This study identifies and evaluates potential operational and interchange improvements within the roadway network at the Newton Corner interchange (Exit 127) on I-90 (Massachusetts Turnpike) in Newton, Massachusetts. This study identifies short-term and mid-term improvements to enhance safety, increase multimodal connectivity, and reduce congestion in Newton Corner and addresses the critical need for a more efficient and safer transportation system serving the residents, employees, and visitors of Newton Corner.

Study Framework

This study, led by the Highway Division at the Massachusetts Department of Transportation (MassDOT), followed the following process:

- A review of existing and future conditions to understand baseline conditions without any improvements.
- Development and evaluation of short-term and mid-term alternatives identifying opportunities to improve safety and congestion in Newton Corner.
- As the need became apparent for immediate solutions to improve safety, the short-term improvements were separated from this study to become an independent project.
- An alternatives analysis was conducted to develop one preferred mid-term alternative for the overall Study Area.
- Next steps were identified to provide recommendations on how to advance the preferred mid-term alternative.

Study Area

The first step in development of the study involved defining the Study Area. The Study Area, depicted in Figure ES-1, includes the Washington Street eastbound and westbound circulating roadways around Newton Corner and the I-90 eastbound and westbound on/off-ramps. The Study Area also includes all intersecting local roadways at Newton Corner as well as the consideration of bus service and pedestrian and bicycle accommodations within the Study Area.

Study Goals

The study's goals, objectives, and evaluation criteria were developed and refined in collaboration with MassDOT project team. The six study area goals are presented in Table ES-1.

These goals define the general intentions and purposes for conducting the study based on the issues identified. The objectives describe the ways that the goals could be reached, and the evaluation criteria were used to measure how well each alternative met the goals and objectives.

Table ES-1 Study Goals

Goal
Enhance Safety
Improve Traffic Operations and Reduce Congestion
Expand Multimodal Infrastructure
Improve Transit
Land Use / Placemaking
Property Access and Parking Issues

Public Involvement

Public involvement and direct feedback from stakeholders and local residents were key components of the study in ensuring public support throughout the study process. Four (4) public informational meetings and over twenty (20) working group sessions with MassDOT and City of Newton staff occurred throughout the study process to gather and collect feedback. Public opinions and community feedback gathered during the study highlighted concerns about traffic congestion, safety, and the need for better pedestrian and bicycle facilities. The preferred alternative was developed and identified based on this public and stakeholder input.

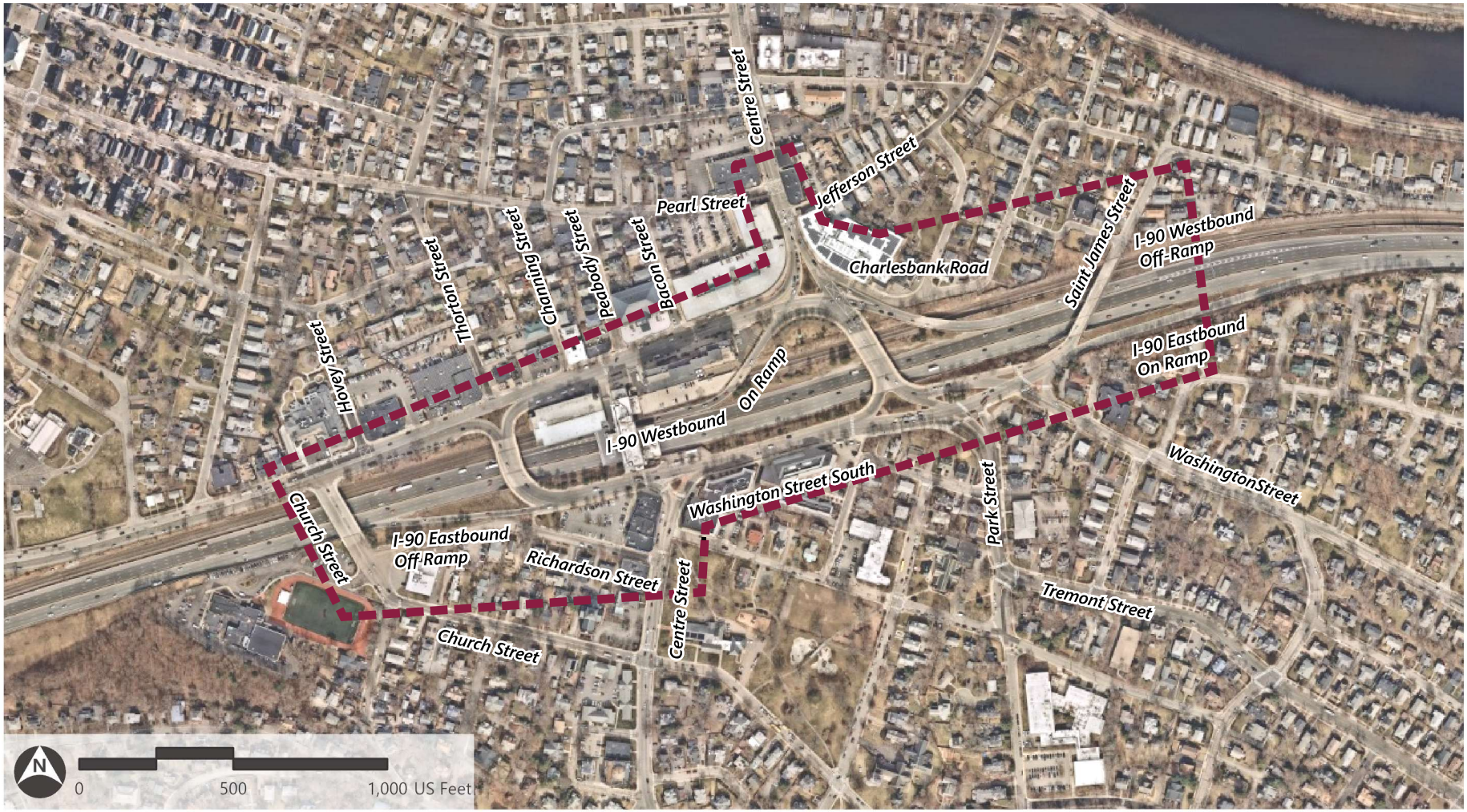
Key Findings

Current Transportation System

As the only full-access interchange along the approximately eight-mile stretch of I-90 between Route 128/I-95 and Allston/Brighton, Newton Corner carries regional significance as a high-traffic nexus. This area routinely experiences traffic volumes that exceed roadway capacity, giving rise to significant safety and operational issues. These issues not only ripple throughout the entire transportation system, affecting both I-90 and local roads, but also elevate the risk of congestion-related accidents. Notably, the queue on the I-90 eastbound off-ramp frequently extends back onto the I-90 mainline, creating a major operational and safety issue.

Figure ES-1: Study Area

Newton Corner | Newton, Massachusetts



Study Area

Source: Nearmap, MassGIS

Existing Conditions Key Takeaways

- The Newton Corner area today is designed to process vehicles entering and exiting I-90, with the roadway network prioritizing vehicle throughput. However, some intersections and roadway links are operating over capacity, especially the I-90 eastbound off-ramp.
- This area is a high crash location with existing geometry, volumes, and traffic control contributing to the high number of crashes.
- The Newton Corner neighborhood is a key public bus transit hub for the area with 8 MBTA bus routes. The existing bus routes suffer from poor reliability with 7 out of 8 routes having an average reliability below 60% as of October 2023.
- There are major gaps in the pedestrian network with missing crosswalk links at key intersections, such as across the I-90 eastbound off-ramp, and not all existing facilities meet ADA standards.
- There are few dedicated bicycle accommodations in the study area with no easy way for bicyclists to cross from one side of I-90 to the other side.

Future Conditions

Traffic volumes and congestion are expected to increase over the next ten years due to new developments in Newton, Watertown, and Brighton. The Newton Corner area will continue to be a bus transit hub with six routes serving the neighborhood after the MBTA implements the Bus Network Redesign plan between 2024 and 2029, consolidating the current eight routes down to six. There are no current plans beyond this study to improve pedestrian and bicycle connectivity, despite the growing demand.

Alternatives Development

Alternatives were developed based on feedback collected from the public and stakeholders and based on needs and deficiencies identified during the existing and future conditions review, including the desire to improve safety and operations and enhance multimodal connections. Alternatives generally fell into two categories: short-term improvements achievable within one or two years, and mid-term improvements achievable within five to ten years.

- 7 short-term alternatives were identified and evaluated. As the need became apparent for immediate solutions to improve safety, the short-term improvements project was separated from this study as an independent project that could be implemented prior to the completion of this report.
- 35 mid-term alternatives were identified and evaluated, with significant input from key stakeholders and members of the public. Mid-term alternatives were screened and evaluated based on a set of key evaluation criteria, which included alignment with study goals and objectives and technical design control and evaluation criteria.

Through this process, 11 mid-term alternatives across the four Study Area quadrants were advanced to the Alternatives Analysis phase.

Alternative Analysis

The mid-term alternatives that progressed beyond the development stage went through a further analysis to determine a preferred alternative. Intersection capacity analyses and traffic simulation models were used to help evaluate the alternatives. Scoring matrices were developed to determine potential impacts in relation to each of the six study goals and objectives. The alternatives within each quadrant were compared to determine which quadrant alternative should be progressed forward. Based on the results of the analyses, one preferred alternative was developed in each of the four quadrants to determine a preferred alternative for the full study area.

Recommendations

Recommendations and next steps are provided for how to implement the preferred alternatives.

Short-term Solutions

A preferred short-term alternative was identified to address immediate safety issues. The improvement plan includes updated traffic signal equipment throughout the study area, new pavement markings, and the extension of the I-90 eastbound off-ramp to an upgraded signalized intersection at Centre Avenue at Centre Street.

As the need became apparent for immediate solutions to improve safety, these short-term improvements were separated from this study to become an independent project that could be implemented prior to the completion of this report. In 2023, the Newton Corner Immediate Safety Improvement project was initiated by MassDOT District 6 and construction was completed in Fall 2024 by MassDOT District 6 using maintenance funds.

Mid-term Solutions

A preferred mid-term alternative was identified to enhance the study area based on the six study goals. The preferred alternative includes the installation of new traffic signals to reduce weaving conditions and limit conflict between vehicles, updated traffic signal equipment and pavement markings, new pedestrian and bicycle accommodations including new signalized crossings and a new shared-use path along the west and south sides of Newton Corner, as well as additional improvements. As outlined in this report, the preferred mid-term was chosen based on its ability to meet the project goals, including enhancing roadway safety, improving pedestrian and bicycle accommodations, and accommodating all roadway users.

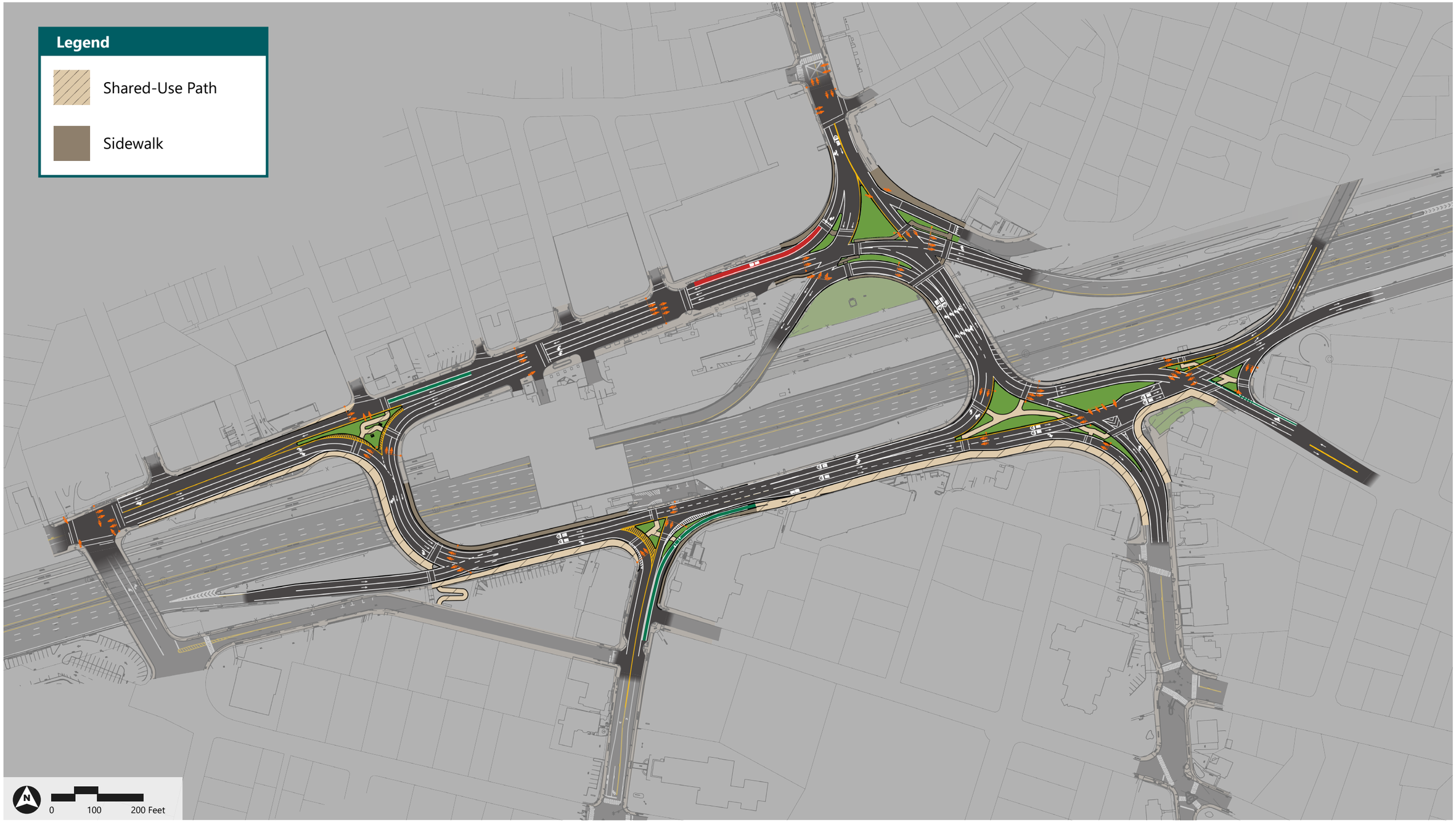
A graphic of the preferred mid-term alternative is presented in Figure ES-2.

Next Steps

The project team recommends advancing the preferred alternative into the design stage through the MassDOT project development process. Final design details will be refined to ensure the project improves safety and mobility for all users while meeting local and state design guidelines. The City of Newton will serve as the Project Champion and can initiate the design phase. Several potential funding sources, including the State Transportation Improvement Plan (TIP), could be used for the project.

Figure ES-2: Preferred Alternative Concept

Traffic Signal and Safety Improvements at Interchange 127 | Newton, MA



1

Study Process and Framework

This chapter describes the process and framework for this study, including the study goals and objectives along with the criteria by which they are evaluated. Public outreach was woven throughout the study process, ensuring an open, transparent, and collaborative approach to this effort, including input on the goals, objectives, and evaluation methodologies.

Introduction

The Newton Corner Traffic Operations and Safety Improvements Transportation Study (the Study), led by the Highway Division at the Massachusetts Department of Transportation (MassDOT), identifies and evaluates potential short-term and mid-term operational and interchange improvements to address safety and congestion within the roadway network at the Newton Corner interchange (Exit 127) on I-90 in Newton, Massachusetts. This Study included an alternatives analysis for Newton Corner, which developed and evaluated options for modifications to traffic control and roadway configuration to address safety and operational issues. Concept alternatives presented in the Study also identified opportunities to enhance multimodal access and accommodations, for pedestrians, bicyclists, and transit users. The Study also explores opportunities to provide and enhance access/egress from business and neighborhoods adjacent to Newton Corner.

The Study team identified, screened, and evaluated potential intermediate and mid-term concepts intended improve safety, traffic operations, pedestrian and bicycle accommodations, and transit operations, and solicited direct input on goals, objectives, and evaluation criteria from key stakeholders through a robust public engagement process.

Study Purpose and Need

The purpose of this Study is to identify, evaluate, and develop concept-level improvement alternatives to address safety and operational deficiencies associated with the roadway and ramp network of I-90 Exit 127, and to enhance multimodal access and accommodations within the Study Area. Newton Corner includes Washington Street circulatory roadways over I-90, the I-90 ramps connecting to Washington Street, the two overpass bridges, associated I-90 eastbound and westbound ramp termini, as well as several additional intersecting streets.

As the only full-access interchange along the approximately eight-mile stretch of I-90 between Route 128/I-95 and Allston/Brighton, Newton Corner carries regional significance as a high-traffic nexus. This area routinely experiences traffic volumes that exceed roadway capacity, giving rise to significant safety and operational issues. These issues not only ripple throughout the entire transportation system, affecting both I-90 and local roads, but also elevate the risk of congestion-related accidents. Notably, the queue on the I-90 eastbound off-ramp frequently extends back onto the I-90 mainline, creating a major operational and safety issue.

A critical aspect of this study is recognizing that existing accommodations for pedestrians, bicyclists, transit services, and other modes of transportation have been insufficiently incorporated into the surrounding environment. This is primarily because the existing roadway network was originally designed to favor vehicular traffic over other modes of transportation. Notably, five locations within the Study Area were identified as Highway Safety Improvement Program (HSIP) High Crash Clusters from 2013-2015, indicating that they are among the top 5 percent high-crash locations within the Metropolitan Area Planning Council (MAPC) region.

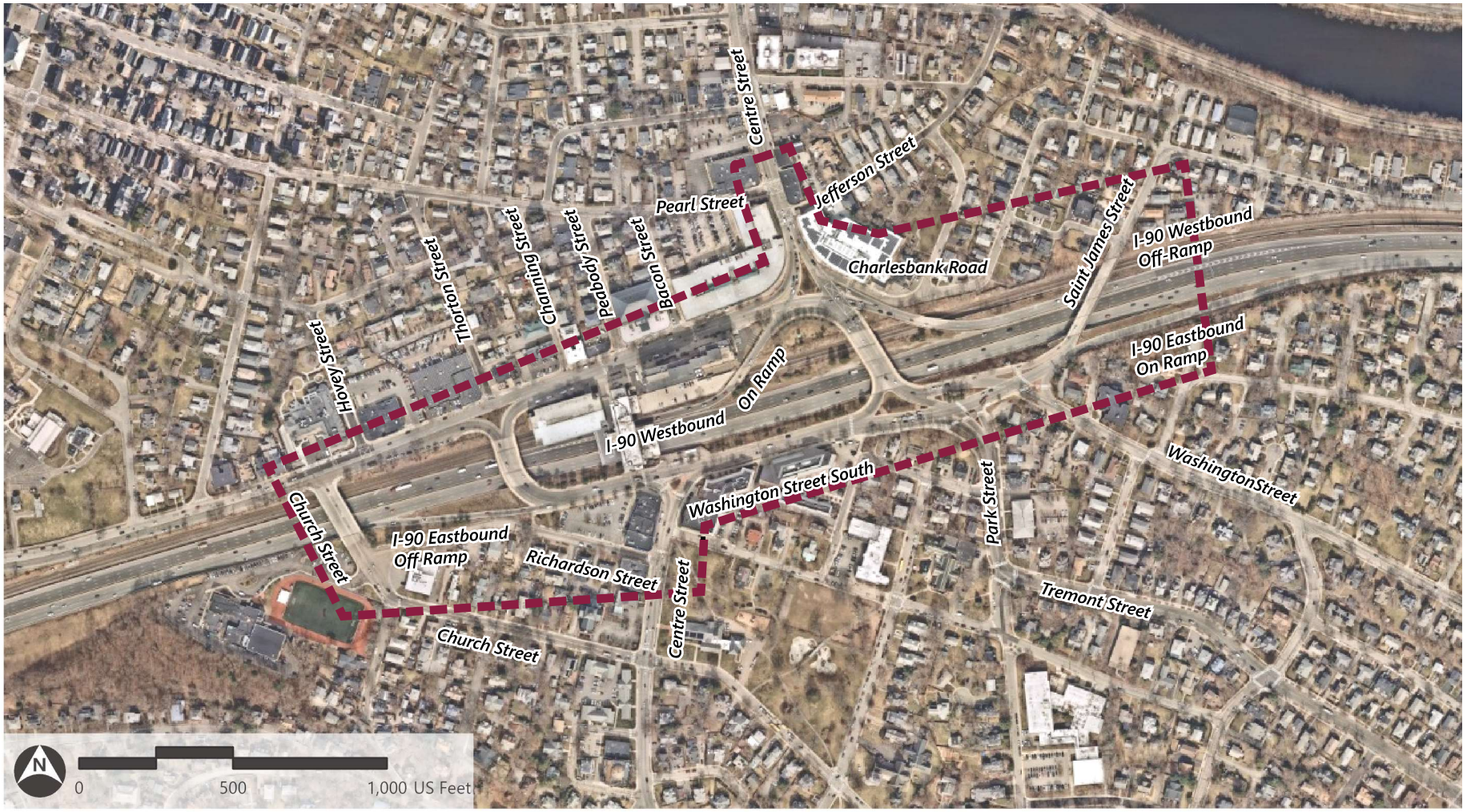
The Study aims to implement safety-driven improvements that will not only mitigate the current operational deficiencies but also provide a safer, more accommodating environment for all users.

Study Area

The first step in development of the study involved defining the Study Area. The Study Area, depicted in Figure 1-1, includes the Washington Street eastbound and westbound circulating roadways around Newton Corner and the I-90 eastbound and westbound on/off-ramps. The Study Area also includes all intersecting local roadways at Newton Corner as well as the consideration of bus service within the Study Area. Additional details on the Existing Conditions of the Study Area intersections, roadways, and transit services are provided in Chapter 2, *Existing Conditions*.

Figure 1-1: Study Area

Newton Corner | Newton, Massachusetts



Study Area

Source: Nearmap, MassGIS

Study Background

Newton Corner is a unique interchange that was implemented in the 1960s when Interstate 90 (I-90) was constructed. Known as the Massachusetts Turnpike (Mass Pike), I-90 runs west from Boston to the New York State Border, connecting the cities of Boston, Worcester, and Springfield. Newton Corner is home to Exit 127 on I-90, which provides eastbound and westbound access to or from the interstate.

This study is one of three separate efforts to identify short, medium, and long-term improvements at Newton Corner. The short-term effort is being led by MassDOT District 6 to implement maintenance considerations and improvements, focused on improving safety and operations on the I-90 eastbound off-ramp, as well as improving intersection operations upgrading signal equipment throughout Newton Corner. The long-term effort is being led by the MassDOT Office of Transportation Planning (OTP) as a planning study that considers long-term changes to improve safety, congestion, mobility, and access along the I-90 corridor between West Newton and Brighton.

Previous Studies

The Newton Corner area has been the focus of several studies in the past. Prior to starting work on this project, the following studies were reviewed to understand existing infrastructure issues and deficiencies and to leverage existing work that has already been conducted:

- I-90 Interchange 17 (Newton Corner): Traffic Patterns and Operational and Safety Improvements; prepared by Central Transportation Planning Staff (CTPS): September 19, 2006
- Newton Corner Rotary Study, Phase II; prepared by CTPS; January 8, 2009
- Road Safety Audit: I-90 Exit 17 Interchange – Newton Corner; prepared by WSP; May 2020

These studies highlighted existing safety and operational deficiencies and proposed specific recommendations to improve the Newton Corner area, including suggestions to reconfigure roadways and install new pedestrian and bicycle accommodations. The studies also emphasized that enhanced pedestrian, bicycle, and transit accommodations should be a critical component of all proposed infrastructure projects, and a key objective of any project should be to Improve roadway safety and reduce the number of collisions. The information presented in these previous documents were used as a guideline when developing the alternatives proposed in this Study.

Study Timeline

This study is focused on short-term and mid-term solutions to improve safety and operations in the Newton Corner area. For the Study, short-term refers to improvements that could constructed in the next 1-2 years and be funded through MassDOT District 6 maintenance funds. Mid-term refers to improvements that may be constructed in the next 5-10 years and would likely be funded through the State Transportation Improvement Program (STIP).

Study Framework

The Study was organized into discreet tasks to ensure that the planning effort was accomplished efficiently, and that a comprehensive set of alternatives were developed and evaluated.

The six primary tasks for the Study are outlined in Table 1-1.

Table 1-1 Study Tasks

Task	Description
Task 1: Define Study Area Goals and Study Objectives	Develop the framework for the study, including Study Area, goals and objectives, evaluation criteria, and the public involvement plan.
Task 2: Existing Conditions Data Collection & Analysis	Evaluate existing conditions for the Study Area, including traffic congestion, transit services, pedestrian and bicyclist accommodations, safety, and environmental issues.
Task 3: Development of Design Controls and Constraints	Identify existing issues, opportunities, and constraints to guide the development of potential alternatives.
Task 4: Alternatives Development	Develop and refine a range of potential short- and mid-term alternatives based on transportation deficiencies, issues, and constraints, particularly as they relate to safety, operations, and multimodal needs throughout the study area.
Task 5: Alternatives Analysis and Screening	Evaluate the expected effectiveness of each mid-term alternative using quantitative analyses and score each alternative as they compare against each other
Task 6: Recommendations and Next Steps	Develop a recommended alternative and identify next steps.

Goals and Objectives

The Study team collaborated with MassDOT and the City of Newton to identify six goals and objectives for the Study. Goals define the general intentions and purposes for conducting the Study based on issues that must be addressed. Objectives describe ways that the goals could be accomplished.

At Public Meeting #2 on March 1, 2023, the goals and objectives were presented, and the public was asked to rank the six Study Area goals in order of importance from most important to least important. The results of this feedback were used when evaluating alternatives to determine which goals were the most important for the public.

Table 1-2 lists the six goals, and the objectives associated with each goal.

Table 1-2 Goals and Objectives

	Goals	Objectives
	**Enhance Safety**	› Improve signal operations and roadway geometry at locations that pose potential hazards › Ensure the transportation infrastructure meets current safe design standards and accommodates needs of all road users.
	**Improve Traffic Operations & Reduce Congestion**	› Decrease congestion and reduce delays › Improve system reliability
	**Expand Multimodal Infrastructure**	› Provide safe and robust bicycle infrastructure › Provide safe and robust pedestrian infrastructure
	**Improve Transit**	› Provide appropriate accommodations for transit vehicles and transit riders
	**Land Use/Placemaking**	› Develop a sense of place for Newton Corner that respects current land uses
	**Property Access & Parking Issues**	› Provide safe access to local properties › Ensure appropriate supply of parking spaces for local land uses

Stakeholder Involvement

Throughout the Study, stakeholder involvement was crucial in developing alternatives and determining the feasibility of each alternative. Working sessions occurred with several different stakeholders, including:

- 8 working group sessions with the City of Newton planning and engineering staff,
- 15 working group sessions with different groups within MassDOT, including safety and traffic,
- 1 coordination meeting with MBTA, and
- 2 briefings with the Mayor of Newton and/or elected officials.

Feedback was also collected electronically from stakeholders in between working group sessions and was incorporated into the different alternatives.

Public Involvement

Public involvement and direct feedback from local residents were key components of the Study in ensuring public support for the recommended alternatives. The Study included a wide variety of public involvement and included public informational meetings at different stages of the project, as presented in Table 1-3.

Table 1-3 Public Involvement

Meeting	Date	Topics	Format
Public Meeting #1	September 28, 2022	Introductory Meeting	Virtual
Public Meeting #2	March 1, 2023	Existing Conditions / Evaluation Criteria	Virtual
Public Meeting #3	October 24, 2023	Improvement Alternatives / Preliminary Scoring	Virtual
Public Meeting #4	June 6, 2024	Recommended Alternative / Next Steps	Virtual

During and after each public informational meeting, feedback was collected from participants and was used to progress the next stage of the Project. Input from residents was critical to fully understand the existing issues within the Study Area and the desirability of each proposed alternative.

Public Meeting #1

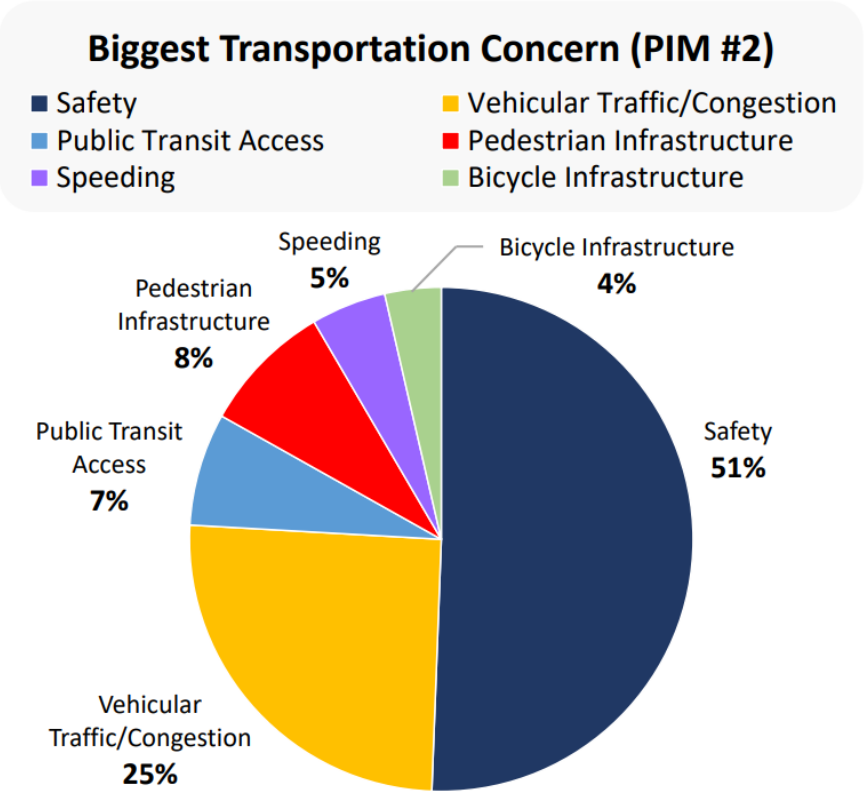
During the first Public Meeting, the project was introduced and participants participated in a breakout session to discuss what is most important to the attendees and where efforts should be focuses. Participants were broken out into ten virtual meeting rooms to have focused discussions on the following topics throughout the study area. In each breakout room, MassDOT and VHB team members were present to lead the discussion and take notes. Figure 1-2 shows an example of the notes collected in one of the ten breakout rooms during the first Public Meeting and a full record of the meeting notes is provided in Appendix B.

Figure 1-2 Public Meeting #1 Breakout Room Notes

Public Meeting #2

During the second Public Meeting, the existing conditions were presented, and participants were polled to identify the biggest transportation concern for Newton Corner. These identified concerns were used to inform Study goals and objectives. Figure 1-3 summarizes participant responses.

Figure 1-3 Public Meeting #2 Public Poll Responses



Public Meeting #3

In the third Public Meeting, the improvement alternatives were presented. The study area was divided into four quadrants and two-to-four potential alternatives were presented for each quadrant. During this meeting, members of the public were able to respond live to a poll to choose which concepts they thought best met the goals of the project. The polling results are presented in Chapter 5, *Alternatives Analysis*.

Public Meeting #4

In the fourth and final Public Meeting, the recommended alternative for each of the four quadrants were presented, along with the next steps and the path forward to eventual construction. The public was thanked for their involvement throughout the course of the study.

2

Existing Conditions

This chapter provides an assessment of Existing Conditions within the Study Area, including the vehicular network and traffic volumes, transit services and operations, pedestrian and bicycle accommodations, safety data, and a summary of environmental resources.

Existing Conditions Key Takeaways

- The Newton Corner area today is designed to process vehicles entering and exiting I-90, with the roadway network prioritizing vehicle throughput. However, some intersections and roadway links are operating over capacity, especially the I-90 eastbound off-ramp.
- This area is a high crash location with existing geometry, volumes, and traffic control contributing to the high number of crashes.
- The Newton Corner neighborhood is a key public bus transit hub for the area with 8 MBTA bus routes. The existing bus routes suffer from poor reliability with 7 out of 8 routes having an average reliability below 60% as of October 2023.
- There are major gaps in the pedestrian network with missing crosswalk links at key intersections, such as across the I-90 eastbound off-ramp, and not all existing facilities meet ADA standards.
- There are few dedicated bicycle accommodations in the study area with no easy way for bicyclists to cross from one side of I-90 to the other side.

The Existing Conditions assessment was primarily completed in late 2022 at the beginning of the study process. Unless otherwise noted, the information provided in this chapter reflects conditions as observed in late 2022 and may not reflect changes that have been implemented since that time.

Safety

A detailed safety review was conducted to identify potential vehicle collision trends and/or roadway deficiencies within the Study Area. The safety review includes a summary of the recent road safety audit (RSA) that was conducted within the Study Area, an analysis of recent crashes at Study Area intersections, a review of MassDOT's Highway Safety Improvement Program (HSIP) database, and a review of MassDOT's risk-based network screening.

Road Safety Audit (RSA)

A road safety audit (RSA) is a formal safety review of a roadway or intersection. Road safety audits are generally conducted at HSIP locations to identify existing safety deficiencies and determine potential enhancements to improve safety at each location. Prior to the start of this study, an RSA was conducted in the Study Area in May 2020 by WSP. The full RSA report can be accessed via the following link: https://gis.massdot.state.ma.us/arcgis/rest/services/Roads/RoadSafetyAudits/MapServer/0/26967/attachments/27718.

The RSA identified several safety issues associated with roadway geometry, traffic signals, pedestrian accommodations, bicycle accommodations, and signage. Key findings of the RSA were part of the basis for alternative development, and included the following:

RSA Key Findings

- The significant number of entrances and exits create several short weaving locations.
- Drivers frequently find themselves in the wrong lane.
- Poor signage makes it difficult for drivers to identify appropriate lanes in advance.
- Some signals are not clearly visible.
- Signals are not correctly coordinated.
- Several crosswalks lack ADA-compliant ramps and inadequate or faded striping.
- Some crosswalks with push button crossings are non-compliant with the Manual on Uniform Traffic Control Devices (MUTCD).
- Drivers face many distractions along the Study Area roadways, resulting in them being less attentive and prepared to react to pedestrians.
- The lack of safe bicycling facilities leads many bicyclists to avoid Newton Corner and instead seek alternate routes across I-90.

These conditions led to many sideswipe and rear-end collisions in the Study Area, and create unsafe conditions for pedestrians and bicyclists, leading many to avoid active transportation in the Study Area.

MassDOT Intersection Crash Data

To identify potential vehicle crash trends in the Study Area, an analysis of vehicular crash data was completed for Study Area intersections, using MassDOT data from 2017-2019. This data represents the most recent three-year period available at the time the safety review was conducted, excluding the year 2020 where data was significantly impacted by the COVID-19 pandemic. The MassDOT database is comprised of crash data from the Massachusetts Registry of Motor Vehicles (RMV) Division. Data files are provided for an entire city or town for an entire year, though it is possible that some crash records may be omitted either due to individual crashes not being reported, or the city crash records not being provided in a compatible format for RMV use. Crash rates are calculated based on the number of crashes at an intersection and the volume of traffic traveling through that intersection daily. Rates that exceed MassDOT's average for crashes at intersections in the MassDOT district in which the town or city is located could indicate safety or geometric issues for a particular intersection.

For this Study Area, the calculated crash rates were compared to MassDOT's District 6 average, as Newton is in District 6. In District 6, the average crash rate is 0.71 per million entering vehicles (MEV) for signalized intersections and 0.52 per MEV for unsignalized intersections. By comparison, the Statewide average crash rate is 0.78 per MEV for signalized intersections and 0.57 per MEV for unsignalized intersections. The crash rate worksheets for the Study Area intersections are included in Appendix E.

The following six intersections have crash rates above the district average of 0.71 for signalized intersections or 0.52 for unsignalized intersections:

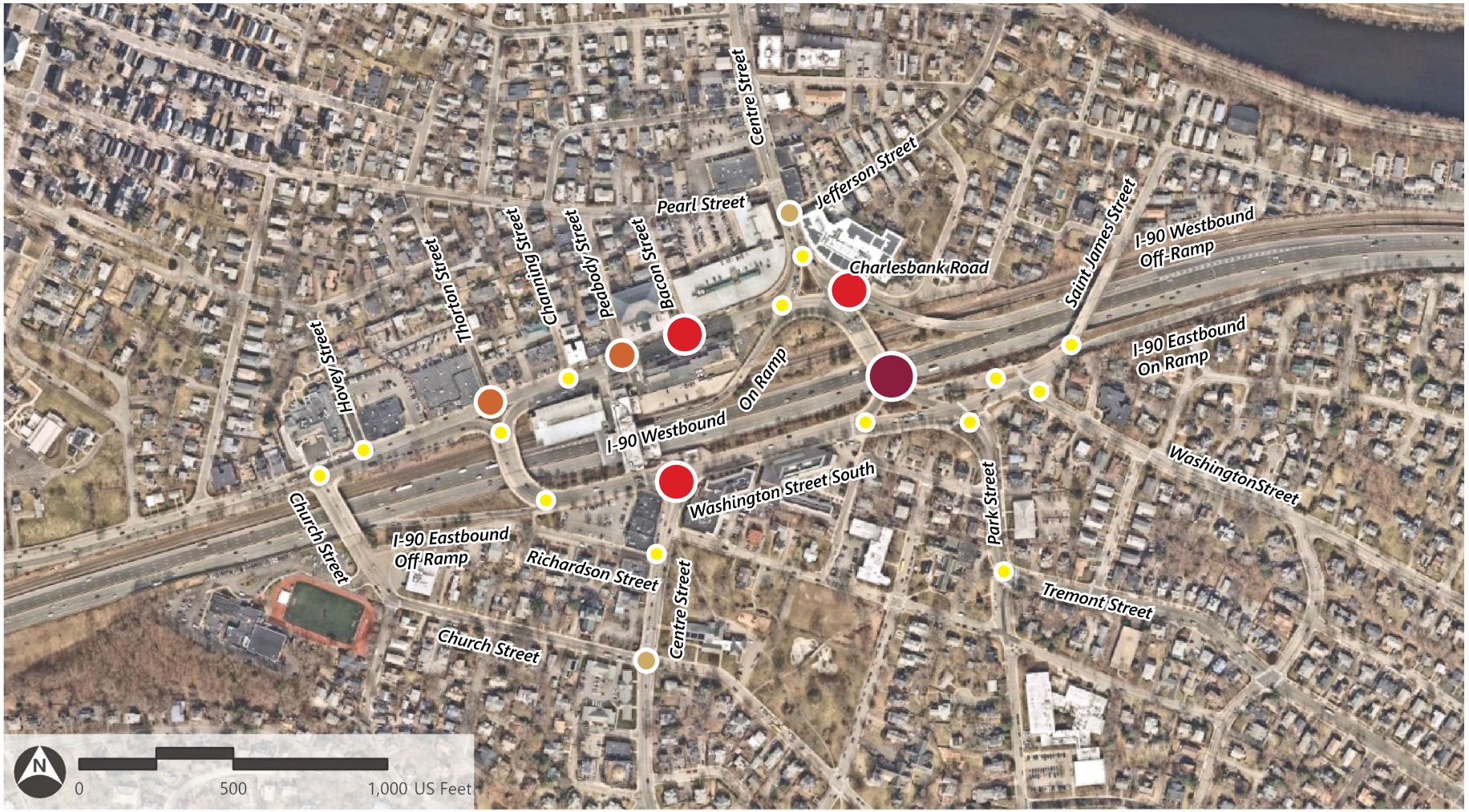
- Washington Street WB at Thornton Street
- Washington Street WB at Peabody Street
- Washington Street WB at Bacon Street
- Washington Street WB at Centre Street NB / I-90 WB Off-Ramp / Charlesbank Road
- Centre Avenue (aka Washington Street EB) at Centre Street
- Washington St EB / Relocated Washington Street WB at Washington St WB Bridge

Most crashes at the Study Area intersections are angle, rear-end, or sideswipe same direction collisions resulting in property damage only. No fatal crashes were reported within the Study Area. Eight crashes involving a non-motorist (a pedestrian or bicyclist) at seven intersections were reported in the Study Area.

A map of the total number of crashes that occurred at each study area intersection between 2017 and 2019 is provided in Figure 2-1. A summary of the study intersections vehicle crash history based on the available MassDOT data and the detailed crash data is provided in Appendix C.

Figure 2-1: Study Area Intersection Crashes

Newton Corner | Newton, Massachusetts



Intersection Crashes, 2017-2019

- 1-9
- 10-12
- 15-24
- 25-59
- >60

Source: Nearmap, MassGIS

Collision Diagrams

In addition to reviewing and summarizing the cash data from the MassDOT Crash Portal, collision diagrams were developed based on local and state police reports. The collision diagrams present the crashes in the Study Area from 2017-2019 and highlight the following trends.

Collision Trends

- Washington Street EB has a high number of sideswipe crashes along the roadway from the I-90 EB Off-Ramp to the I-90 EB On-Ramp.
- There is a high number of rear-end collisions both on the I-90 EB Off-Ramp and on I-90 EB prior to the ramp.
- There is a high number of rear-end collisions on the Centre Street approach of Centre Avenue at Centre Street.
- There is a concentration of rear-end collisions on Washington Street EB just prior to Park Street.
- There is a concentration of both rear-end and sideswipe, same direction collisions on Washington Street WB prior to the Washington Street EB Bridge. On the bridge, there continues to be several sideswipe collisions.
- On the Washington Street WB Bridge prior to the intersection with Washington Street WB, there are a high number of rear-end collisions. Both prior to the intersection and through the intersection there are also a high number of sideswipe crashes.

Most of the collisions in the Study Area take place where there is a lot of weaving and merging that leads to the sideswipe collisions. The weaving also divides drivers' attention leading to the high number of rear-end collisions.

Collision diagrams for the Study Area are included in Appendix C.

2020 Crash Data

A review was conducted comparing 2020 crash data and trends with the data from 2017-2019 reported above. While the 2020 crash data shares the same general trends in location and types of crashes at both the 2015-2017 crashes and the 2017-2019 crashes, there were far fewer crashes in 2020 than the average number of crashes that occurred per year in 2017-2019. Based on a review of local and state police crash reports, there were approximately 55 crashes that occurred within the Study Area in 2020, as compared to an average of 129 crashes that occurred per year within the Study Area between 2017 and 2019. The reduction in the number of crashes that occurred in 2020 as compared to 2017-2019 likely correlates with a reduction in traffic volume in 2020 due to the impacts of the COVID-19 pandemic when schools were closed, and many employees were working remotely.

Most crashes that did occur at the Study Area intersections in 2020 were angle, rear-end, or sideswipe same direction collisions resulting in property damage only, following the same trends as the 2017-2019 crash data. No fatal crashes were reported within the Study Area in 2020 and one

crash involving a non-motorist (a pedestrian or bicyclist) was reported in the Study Area. In addition, the 2020 crashes also share the general time of day trends as the 2017-2019 crash data, except that crashes were nearly twice as likely in 2020 to occur during the weekday evening peak hour than during the weekday morning peak hour while in 2017-2019 crashes were approximately equally likely to occur during the weekday morning or weekday evening peak hour.

Collision diagrams based on 2020 crash data are included in Appendix C to this report.

Comparison to 2015-2017 Crash Data

While the crash data summarized previously and presented in in the collision diagrams is based on 2017-2019 data, the crash data presented in the RSA is based on data from 2015-2017. A comparison of the two sets of data was conducted to determine if the trends documented in the RSA were still applicable to the 2017-2019 data as well.

The 2015-2017 crashes presented in the RSA share the same trends in location and types of crashes as the 2017-2019 data. There is a minor difference in the time of day between the crashes in 2015-2017 and 2017-2019, as the 2015-2017 crashes tend to have the most crashes during the morning commuting hours while the 2017-2019 crashes tend to have more crashes in the evening.

Highway Safety Improvement Program (HSIP)

In addition to calculating the crash rate, Study Area intersections should also be reviewed in MassDOT's Highway Safety Improvement Program (HSIP) database. The HSIP database identifies crash clusters. An HSIP-eligible cluster is one in which the total number of equivalent property damage only[1] (EPDO) crashes in the area is within the top five percent of all clusters in that region. An HSIP-eligible location is eligible for Federal Highway Administration (FHWA) and MassDOT funds to address the identified safety issues at these locations.

As part of this effort, VHB reviewed this database and found that the following intersection is listed as part of 2019-2021 HSIP-eligible crash clusters[2]:

- Centre Avenue eastbound at Centre Street

A review of previous high crash data indicates that two intersections, Washington Street WB at Centre Street NB/I-90 WB Off-Ramp/Charlesbank Road and Washington Street EB/Relocated Washington Street WB at Washington Street WB Bridge, were previously listed as 2017-2019 and 2018-2020 HSIP-eligible crash clusters. These two intersections are no longer designated as top crash locations with the release of the most recent (2021) data, as the list of statewide top crash locations is updated as new crash data is released and as travel patterns and crash trends change.

[1] Equivalent property damage only (EPDO) is a method of combining the number of crashes with the severity of the crashes based on a weighted scale. Crashes involving property damage only are reported at a minimal level of importance, while collisions involving personal injury (or fatalities) are weighted more heavily.

[2] HSIP-eligible crash cluster data reflects the most recent information as of September 2024. The rest of the safety analysis reflects current data at the time the analysis was conducted in late 2022, as agreed upon with MassDOT.

Risk-Based Network Screening

MassDOT's IMPACT Safety Analysis Module was reviewed to identify risk sites within the Study Area and supplement the safety analysis presented above. MassDOT uses risk-based network screening to identify locations that can be improved to help reduce the numbers of fatal and serious injury crashes. The roadway network is screened based on 11 emphasis areas[3] and categorizes roadway segments as primary or secondary risk sites[4]. Risk sites indicate areas where certain types of crashes are likely to have a higher chance of occurring due to road, traffic, and socioeconomic characteristics.

Table 2-1 presents the Study Area roadways identified in the risk-based network screening based on the pedestrian and bicycle emphasis areas, representing the emphasis areas for the most vulnerable roadway users. Those roadway segments identified as risk sites within the Study Area indicate a need for immediate, targeted safety improvements. Improvements for these primary and secondary risk sites are discussed in detail in Chapter 5, *Alternatives Analysis*.

Table 2-1 Risk-Based Network Screening Roadway Segments

Emphasis Area	Primary Risk Site	Secondary Risk Site
Pedestrians	› Centre Street from Jefferson Street to Pearl Street › Washington Street north from Peabody Street to just west of Bacon Street › Washington Street south from Park Street to 400 Centre Street	› Centre Street from Jefferson Street to Washington Street north › Washington Street North from Peabody Street around Washington Street west bridge to 400 Centre Street › Washington Street south at Park Street split (three crosswalks) › Centre Street from Richardson Street to Wesley Street › Church Street from Centre Street to Maple Avenue
Bicyclists	› Washington Street south from 400 Centre Street to Park Street › Centre Street from Richardson Street to Wesley Street	› Centre Street from Pearl Street south to Centre Street southbound split. › Washington Street north from Peabody Street to east of Bacon Street. › Washington Street north from Washington Street bridge west to 400 Centre Street › Washington Street south at Park Street split (three crosswalks) › Centre Street to Richardson Street

[3] The 11 emphasis areas included in MassDOT's risk-based network screening are bicycle crashes, distracted driving, impaired driving, large vehicle crashes, motorcycle crashes, pedestrian crashes, occupant protection (unbelted vehicle occupants), older drivers (65+), rural and urban roadway departures, speeding and aggressive driving, and young drivers (24 and under).

[4] Risk sites are identified by first identifying contributing circumstances in fatal and serious injury crashes for the specific emphasis area (using crash data between 2013 and 2017) and second by assessing the impact of road, traffic, and socioeconomic characteristics on the probability of a fatal or serious injury crash on a given segment of road.

Vehicles

An effective evaluation of existing vehicle conditions throughout the Study Area requires an understanding of current roadway and intersection conditions, vehicle traffic volumes and traffic patterns, and current intersection operations.

Roadways and Intersections

The existing vehicular network Study Area consists of the roadways serving Newton Corner and the intersections that form where the roadways meet. The following sections provide a description of the Study Area roadways and intersections.

Study Area Roadways

The Study Area consists of the roadways leading into Newton Corner, including Washington Street, the I-90 on/off-ramps, Centre Street, Park Street, St. James Street, Charlesbank Road, and other local roadways.

Washington Street serves as a major east-west roadway through the City of Newton connecting the villages of Newton Corner, Newtonville, West Newton, and Lower Falls with Brighton to the east and Wellesley to the west. Within Newton Corner, Washington Street operates as a pair of parallel one-way roadways on either side of the interstate with one-way bridges in each direction connecting the roadways to create a circular traffic pattern.

Centre Street serves as a major north-south roadway through the City of Newton connecting the villages of Newton Corner and Newton Centre with Watertown to the north and Newton Highlands to the south. Within Newton Corner, Centre Street intersects the one-way circulating roadways from the north and south.

Interstate 90 (I-90) is a national interstate that connects Boston in the east with New York state in the west. The roadway is used as a major commuting roadway between Boston and its western suburbs. Within Newton Corner, the interstate travels under the surface level roadways with on/off-ramps for the eastbound and westbound directions at Exit 127 that connect to the local roadway network. Exit 127 serves as the only full-access interchange for an approximately eight-mile stretch between Weston and Allston.

Table 2-2 provides a summary of the Study Area roadway characteristics for roadways approaching Newton Corner and written descriptions of each Study Area roadway are included in Appendix C to this report. The jurisdiction of each roadway is presented in Figure 2-2.

Table 2-2 Study Area Roadways and Characteristics

Roadway	Classification	Jurisdiction	Typical Lane Geometry	Speed Limit[1]	Pedestrian Facilities
I-90	Interstate	MassDOT	3-4 lanes each direction	55-65	None
Washington Street – east of Newton Corner	Principal Arterial	City of Newton	1 lane each direction	25	Sidewalks both sides
Washington Street – west of Newton Corner	Minor Arterial	City of Newton	2 lane each direction	25-35	Sidewalks both sides
Centre Street – north of Newton Corner	Principal Arterial	City of Newton	2 lane each direction	25	Sidewalks both sides
Centre Street – south of Newton Corner	Principal Arterial	City of Newton	1 lane each direction	25	Sidewalks both sides
Park Street	Minor Arterial	City of Newton	1 lane each direction	25	Sidewalks both sides
St James Street	Collector	City of Newton	1 lane each direction	25	Sidewalk north/west side
Charlesbank Road	Collector	City of Newton	1 lane westbound only	20	Sidewalk north side
Church Street	Minor Arterial	City of Newton	1 lane each direction	25	Sidewalk both sides

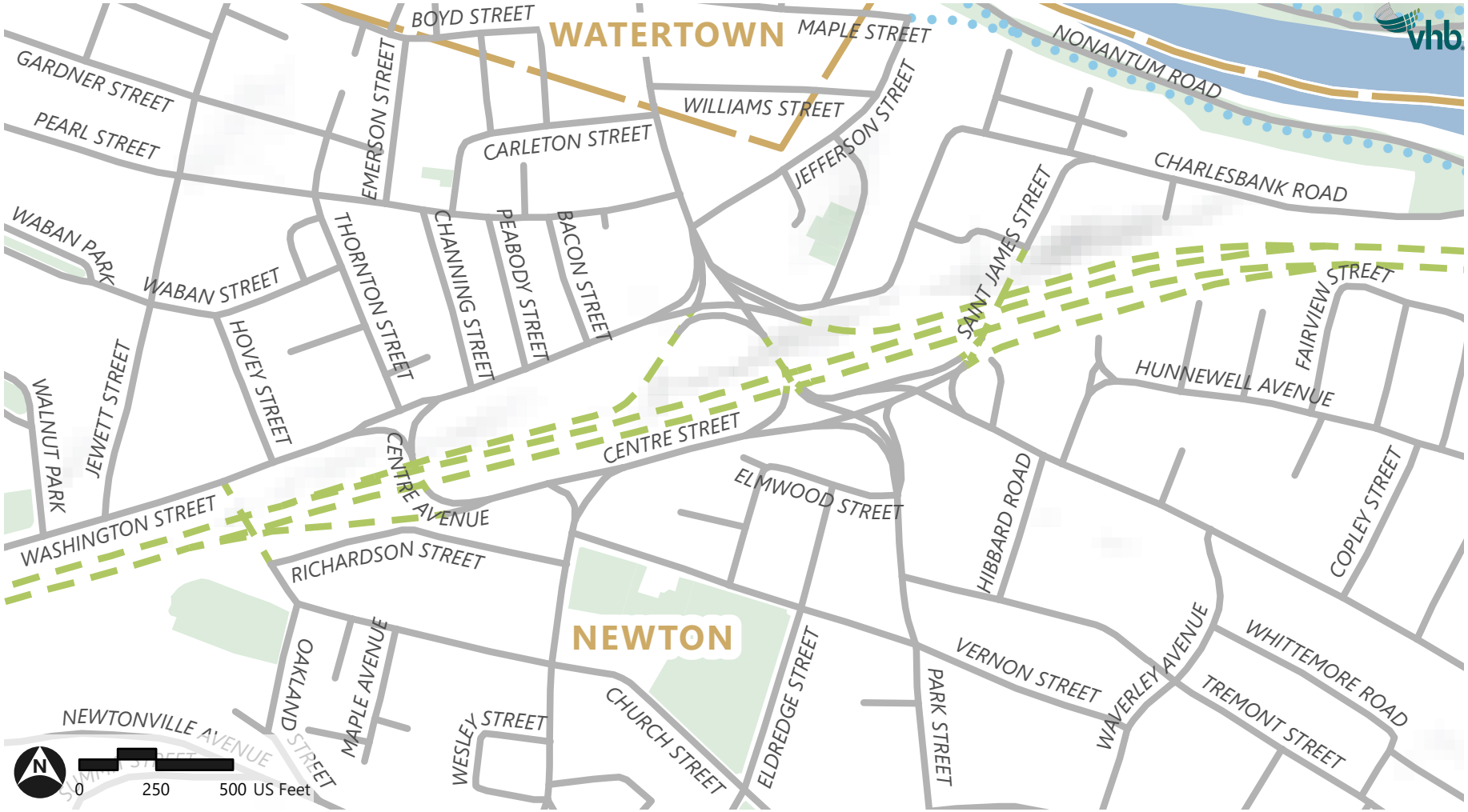
Note: Roadway characteristics for roadways approaching the Newton Corner rotary.

1 Speed limit citywide is 25 miles per hour unless otherwise posted.

Study Area Intersections

The Study Area includes 24 intersections. A list of the 24 intersections and written descriptions for each intersection are included in Appendix C. A map identifying the location of the Study Area intersections is provided in Figure 2-3 and a graphic of the lane use and traffic control at each Study Area intersection is provided in Figure 2-4.

Figure 2-2: Roadway Jurisdiction Map
Newton Corner | Newton, Massachusetts

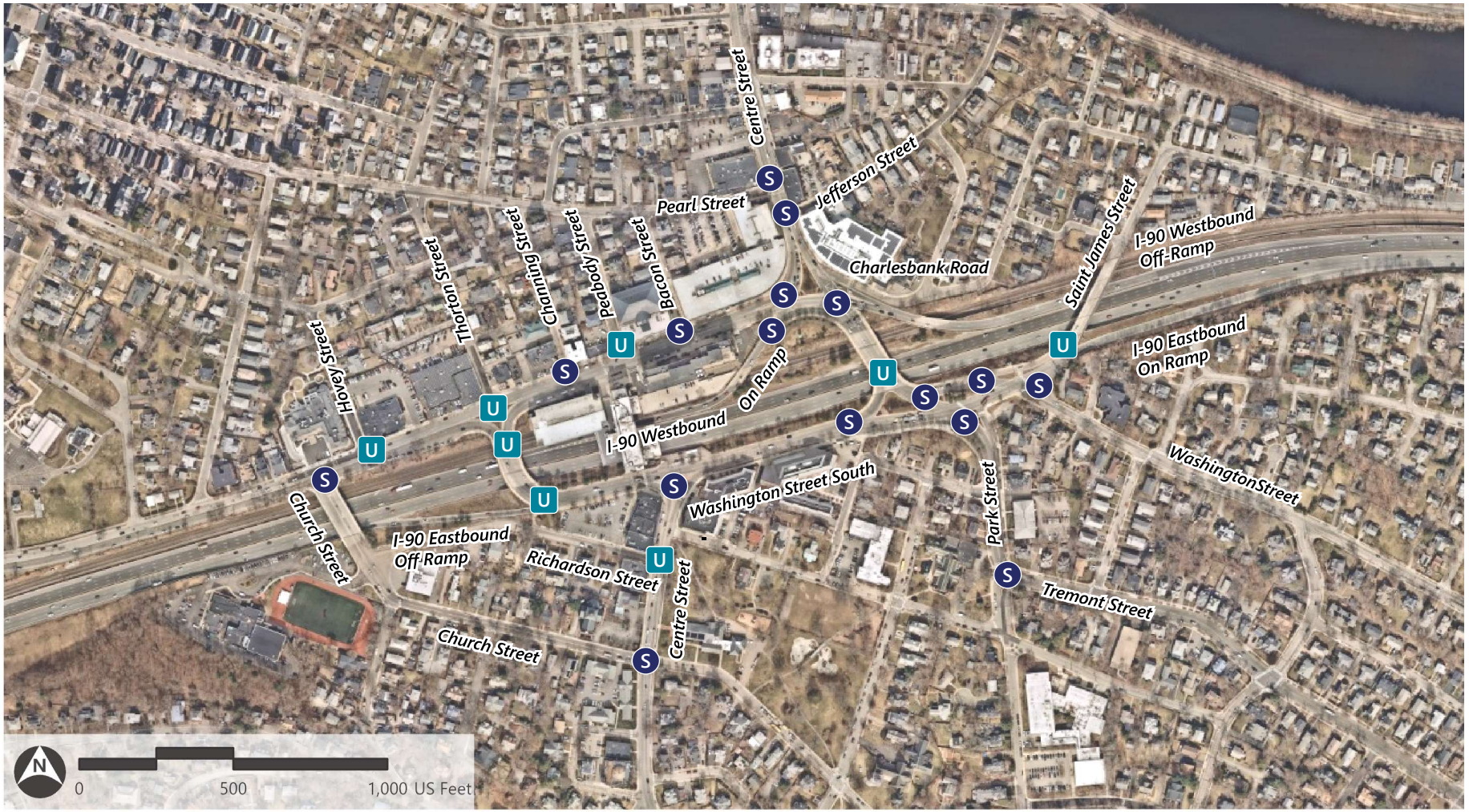


Roadway Inventory

- Massachusetts Department of Transportation
- Department of Conservation and Recreation
- Town or City accepted

Figure 2-3: Study Area Intersections

Newton Corner | Newton, Massachusetts



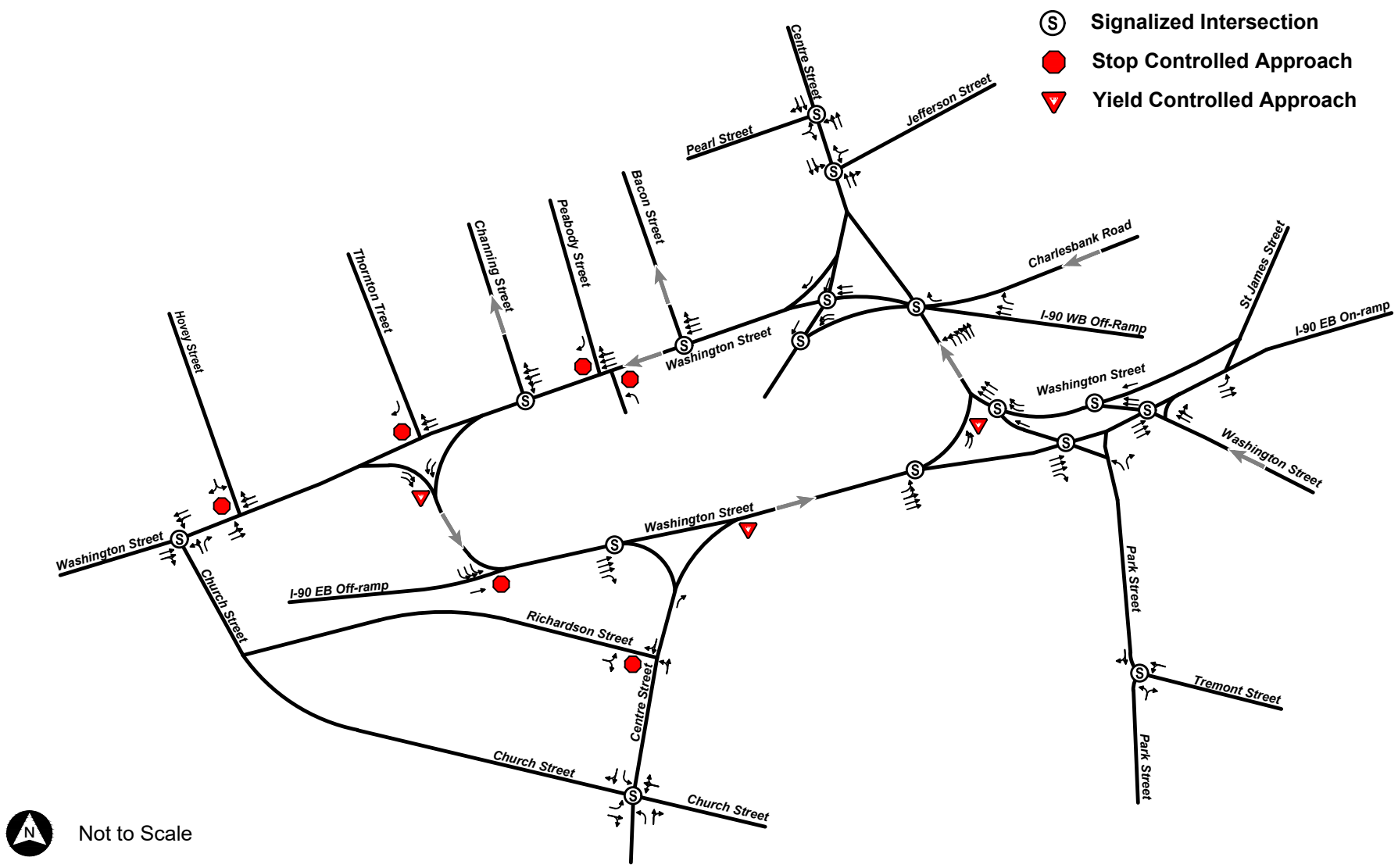
S Signalized Intersection

U Unsignalized Intersection

Source: Nearmap, MassGIS

Figure 2-4: Study Area Intersections Lane Use and Control

Newton Corner | Newton, Massachusetts



Signal Inventory Findings

Traffic signals in the Newton Corner area are under the control of the City of Newton. VHB conducted an inventory and review of all signal equipment in June 2022 and May 2023 to evaluate the condition of the equipment and to document deficiencies and instances where the signals were not operating as intended.

In 2009, the City of Newton installed GPS units to coordinate the operations of three traffic signals, the intersections of Washington Street at Centre Street, the I-90 WB Ramps, and Charlesbank Road, Centre Street at Jefferson Street and Pearl Street, and Washington Street and St James Street at Park Street. The intersection of Washington Street at Centre Street, I-90 WB Ramps, and Charlesbank Road consists of three nodes operated by a single traffic controller and currently operates pre-timed. The intersection of Centre Street at Jefferson Street/Pearl Street consists of two slightly offset intersections operated by a single traffic controller. The intersection of Washington Street/St James Street at Park Street is comprised of several nodes operated by a single traffic controller and currently operates pre-timed.

During field inventories in June 2022 and May 2023, the GPS units for Washington Street at Centre Street/I-90 WB Ramps/Charlesbank Road and Centre Street at Jefferson Street/Pearl Street were not working properly, and the traffic signal's time clock was inaccurate, causing these intersections to not be operating on the same coordination pattern. As a result, the traffic operations for Centre Street SB through onto the I-90 WB On-Ramp fails both during the weekday morning and evening peak hours at the Washington Street westbound at Centre Street southbound intersection. The field inventories found that the GPS unit for Washington Street/St James Street at Park Street was operating correctly, allowing this location to operate the correctly scheduled coordination pattern.

Existing Traffic Volumes

Daily and peak hour traffic volumes were collected on roadways and intersections within the Study Area. It is critical to understand the level of traffic traveling through Newton Corner today when developing potential improvement concepts.

Daily Roadway Traffic Volumes

Daily traffic volumes were counted with automatic traffic recorders (ATR) by MassDOT for a continuous 48-hour period over two typical weekdays in November 2022. These counts were conducted on Washington Street, Centre Avenue, and the I-90 on/off ramps. Table 2-3 provides a summary of the average daily traffic volume, and the traffic count data is included in Appendix E.

Table 2-3 Study Area Daily Roadway Traffic

Roadway	Direction	Weekday ADT [1]	Weekday AM Peak Hour Volume [2]	Weekday AM Peak Hour K-Factor [3]	Weekday PM Peak Hour Volume	Weekday PM Peak Hour K-Factor
Washington Street west of Thornton St	WB	10,500	730	6.9%	895	8.5%
Washington Street west of Thornton St	EB	11,500	1,055	9.2%	945	8.2%
Washington Street east of Thornton St [4]	WB	33,000	2,310	7.0%	2,620	7.9%
Centre Avenue west of I-90 EB Off-Ramp[4]	EB	29,200	2,515	8.6%	2,390	8.2%
I-90 EB Off-Ramp	EB	14,500	1,085	7.5%	1,215	8.4%
I-90 EB On-Ramp	EB	14,600	1,420	9.7%	1,165	8.0%
I-90 WB Off-Ramp	WB	15,200	970	6.4%	1,580	10.4%
I-90 WB On-Ramp	WB	14,300	1,420	9.9%	1,235	8.6%

Source: MassDOT, based on ATR counts conducted in November 2022.
1 Average Daily Traffic (ADT) volumes, expressed in vehicles per day
2 Peak period traffic volumes expressed in vehicles per hour
3 Represents the percent daily traffic which occurs during the peak hour
4 Roadway is one-way in this segment.
Note: Peak hours do not necessarily coincide with the peak hours of turning movement counts.

As shown, Washington Street in the westbound direction carries approximately 10,500-33,000 vehicles per day while Washington Street/Centre Ave in the westbound direction carries approximately 11,500-29,200 vehicles per day. The I-90 on/off-ramps carry approximately 14,300-15,200 vehicles per day with the I-90 westbound off-ramp carrying the highest amount of daily traffic of the four interstate ramps.

Peak Hour Intersection Turning Movement Counts

Data Collection

Existing weekday morning and weekday evening turning movement count data was collected throughout the Study Area as part of a previous planning effort and provided by MassDOT. To leverage the work previously conducted, the existing peak hour turning movement counts collected for that effort were used as the basis for the analyses presented in this report. The turning movement counts for the previous planning study were conducted at all 24 Study Area intersections in June 2018 or October 2019 and the count data is included in Appendix E. It should be noted these traffic counts represent a pre-pandemic condition prior to any long-term impacts on traffic patterns caused by the COVID-19 pandemic.

Based on the turning movement count data, the peak hours of traffic flow through the study area occur in the morning between 7:30 and 8:30 AM and in the evening between 4:00 and 5:00 PM.

COVID-19 Adjustments

To understand the change in traffic patterns since 2018/2019, supplemental traffic counts were conducted at eight of the 24 Study Area intersections by MassDOT in November 2022 concurrent with the ATR counts. A comparison of the two sets of traffic counts indicates that overall peak hour intersection traffic volumes in 2022 range from 16-percent higher to 25-percent lower than peak hour intersection traffic volumes in 2018-2019, with most intersections processing slightly fewer vehicles in 2022 than before the pandemic. MassDOT considers traffic counts conducted after March 1, 2022, to be representative of existing conditions (post-pandemic) without adjustments.

Therefore, 2022 traffic volumes are assumed to represent existing conditions at the eight intersections where supplemental turning movement counts were conducted and volumes at those intersections were not adjusted. At the other Study Area intersections, the 2018/2019 peak hour turning movement counts were manually adjusted to represent post-pandemic conditions. Adjustments were made to volumes throughout the study area to match the 2022 count data at key intersections and along roadway links. A comparison of the 2018/2019 traffic counts and the 2022 traffic counts as well as a list of data sources used for each Study Area intersection is included in Appendix E to this report.

Seasonal Variation

The 2019 MassDOT Statewide Traffic Data Collection Weekday Seasonal Factors were reviewed to quantify the seasonal variation of traffic volumes. 2019 is the most recent year seasonal data is available for. Data shows that, on average, traffic volumes in June, October, and November (the months in which the existing traffic data was collected) are all higher than the average month conditions. To present a conservative analysis, no adjustments were applied to the existing traffic counts to account for seasonal variations. The seasonal adjustment factors are included in Appendix E to this report.

Existing Traffic Volume Networks

To provide an accurate network of traffic volumes through the Study Area, the existing peak hour turning movement counts adjusted to represent 2022 conditions have also been balanced between intersections. The resulting Existing Conditions traffic volume networks for the weekday morning and weekday evening peak hours are presented in Figure 2-5 and 2-6, respectively.

Figure 2-5: 2022 Existing Conditions Traffic Volumes - Weekday Morning Peak Hour

Newton Corner | Newton, Massachusetts

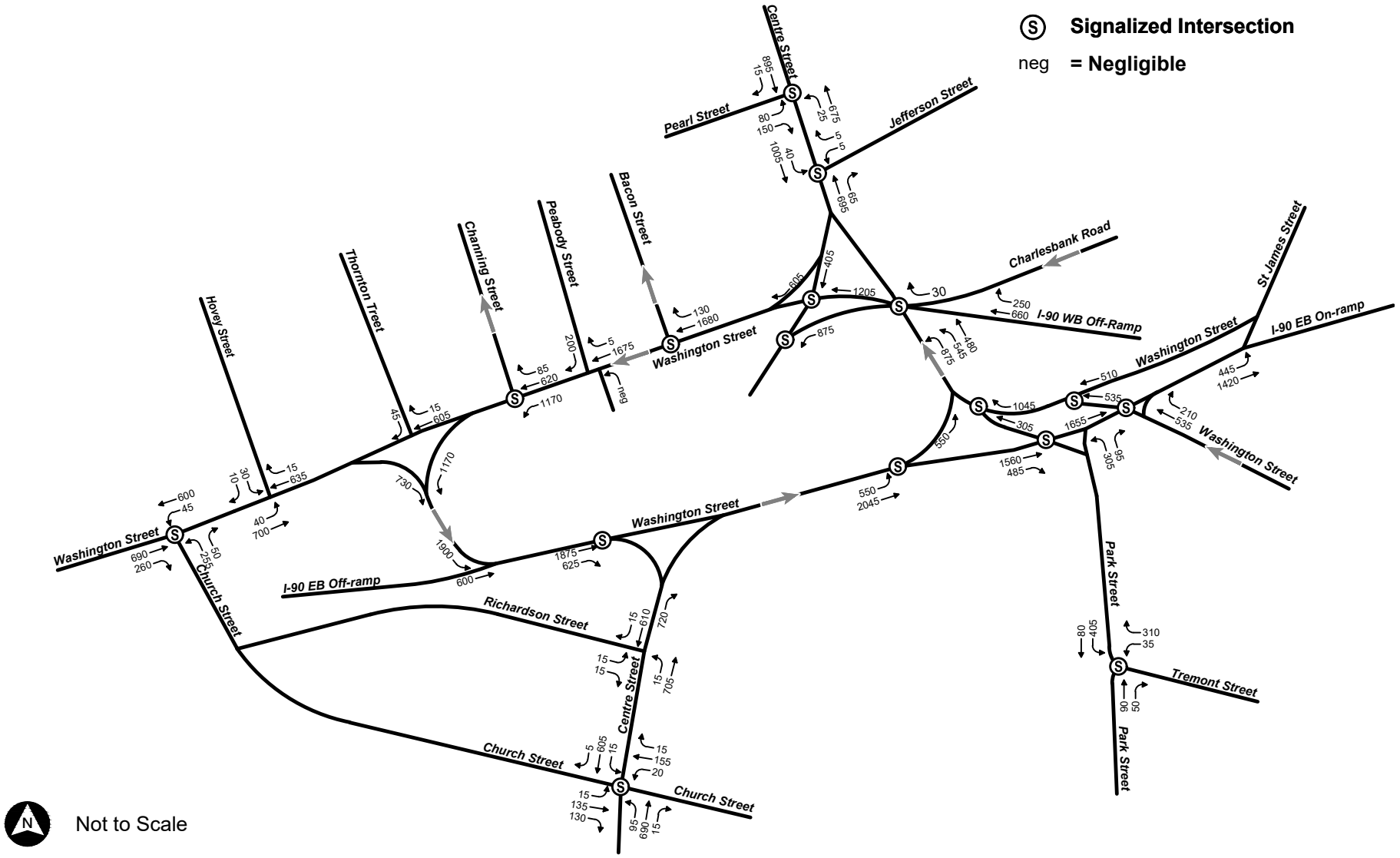
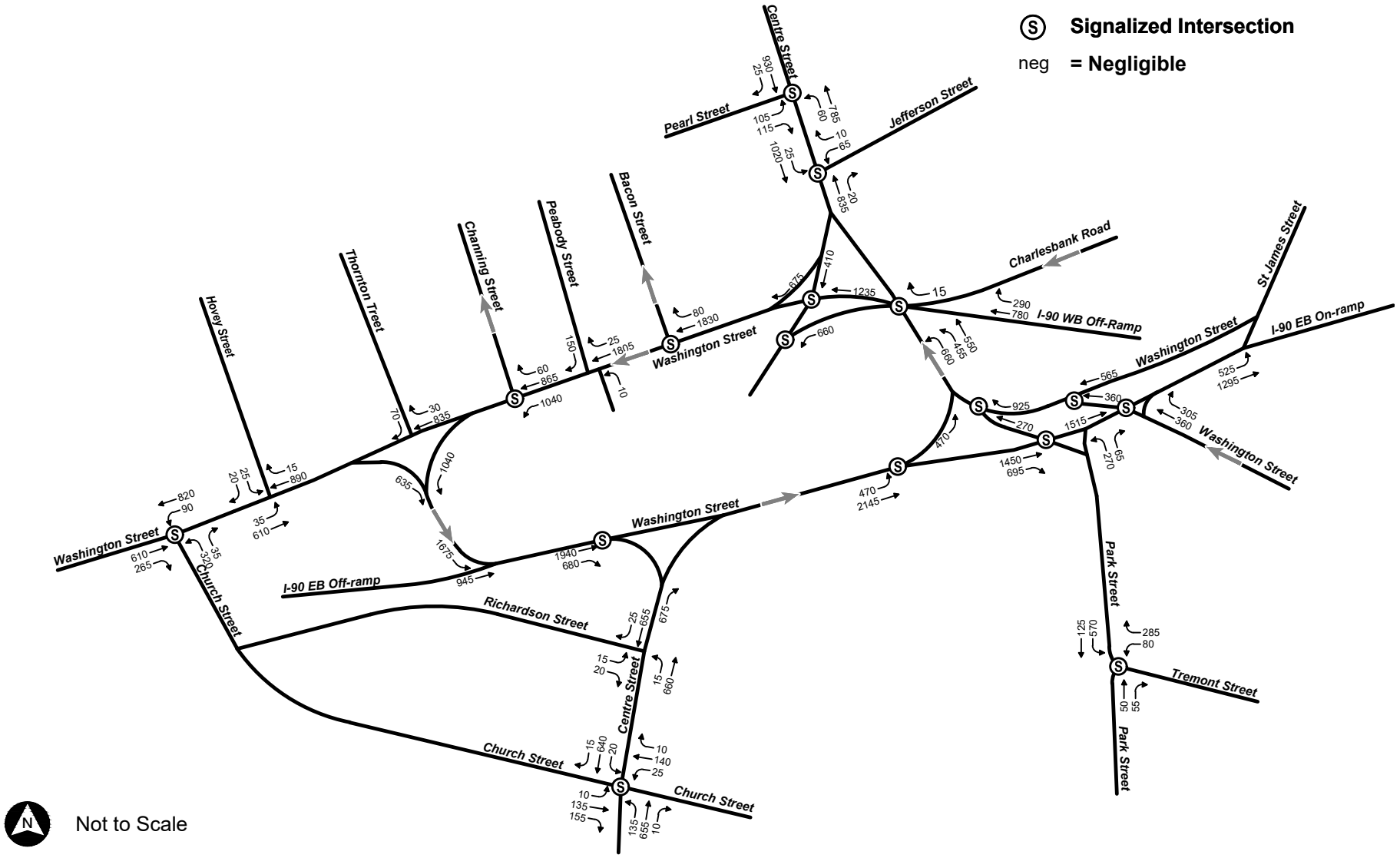


Figure 2-6: 2022 Existing Conditions Traffic Volumes - Weekday Evening Peak Hour

Newton Corner | Newton, Massachusetts



Saturday Traffic Volume Data

As the Newton Corner interchange is a key roadway connection in the region, vehicles travel through the area at all times of day, including on weekdays and weekends. To understand the difference between weekday and Saturday traffic volumes, peak hour TMC data from 2022 and historical daily total ATR data on the interstate ramps from 2018 were analyzed. Table 2-4 provides a comparison of total intersection approach volumes at key intersections during the weekday and Saturday peak hours based on 2022 data and Table 2-5 provides a comparison of total daily weekday and Saturday volumes on the interstate ramps based on historical 2018 data.

Table 2-4 2022 Entering Intersection Approach Volumes Weekday vs Saturday Comparison

Intersection	Weekday AM Peak Hour	Weekday PM Peak Hour	Saturday Peak Hour	Sat vs Wkd AM	Sat vs Wkd PM
Wash. St WB at I-90 WB On-Ramp / Centre St SB	3,090	2,980	2,660	86%	89%
Wash. St WB at I-90 WB Off-Ramp / Centre St NB	2,840	2,750	2,565	90%	93%
Centre Ave EB at I-90 EB Off-Ramp	2,500	2,620	2,430	97%	93%
St. James St at I-90 EB On-Ramp	2,375	2,385	1,850	78%	78%

Note: volumes represent total entering approach volumes at each intersection during the peak hours.

Table 2-5 2018 ATR Weekday vs Saturday Comparison

Roadway	Weekday Daily [1]	Saturday Daily	Saturday vs Weekday
I-90 EB Off-Ramp	13,300	12,100	91%
I-90 EB On-Ramp	16,500	13,100	80%
I-90 WB Off-Ramp	16,200	13,000	80%
I-90 WB On-Ramp	16,200	13,100	81%

Note: volumes represent average daily traffic volumes based on historical data conducted in 2018.

1 Average of Tuesday, Wednesday, and Thursday counts.

As seen in Table 2-4, the weekday AM and PM peak hours tend to see slightly higher volumes than the Saturday midday peak hour. The Saturday peak hour approaching intersection volumes generally range from being approximately 78%-97% of the weekday volumes. The historical ATR data also supports that Saturday volumes tend to be lower than weekday volumes, as the 2018 Saturday daily total volumes on the interstate ramps are roughly 80-90% of the weekday daily volume. It should be noted that Saturday traffic volumes are presented for comparison purposes only and all analyses presented in this report are based on the weekday morning and evening peak hours. As Saturday daily and peak hour traffic volumes are generally lower than weekday traffic volumes, operations on a Saturday are expected to be better than what is reported during the weekday peak hours.

Travel Patterns

Origin-Destination Patterns

Origin and destination data was identified to determine the travel patterns of vehicles traveling through Newton Corner. This data is important to understand where vehicles are coming from and going to, and the data can provide insight on what lanes drivers want to be in and how many vehicles will need to weave at a certain location. Origin and destination data was identified using Inrix, a company that collects travel data based on Bluetooth technology. Data was collected during typical weekdays (Tuesday, Wednesday, and/or Thursday) in June 2018, October 2019, and May 2022 between 7:00 AM and 7:00 PM to understand travel patterns before and after the COVID-19 pandemic.

Table 2-6 and Figures 2-7 and 2-8 present the origin and destination data for key roadway pairs in Newton Corner.

Table 2-6 Key Origin-Destination Pairs

Origin Point (From)	Destination Points (To)	AM Travel Patterns	PM Travel Patterns
I-90 Eastbound Off-Ramp	Centre St to south	10%	10%
	Park St to south	30%	30%
	St. James St to east	30%	30%
	Wash. St to west / Galen St to north	30%	30%
Centre Street from south	Park St to south	25%	25%
	St. James St to east	15%	15%
	I-90 EB On-Ramp	30%	25%
	Wash. St to west / Galen St to north	30%	35%
Galen St from north	I-90 Eastbound On-Ramp	20%	20%
Washington St from west		25%	30%
Centre St from south		20%	20%
Park St / Wash. St from south[1]		35%	30%
Galen St / I-90 WB Off-Ramp	Centre Street to south	65%	70%
Washington St from west		25%	20%
I-90 EB Off-Ramp		10%	10%

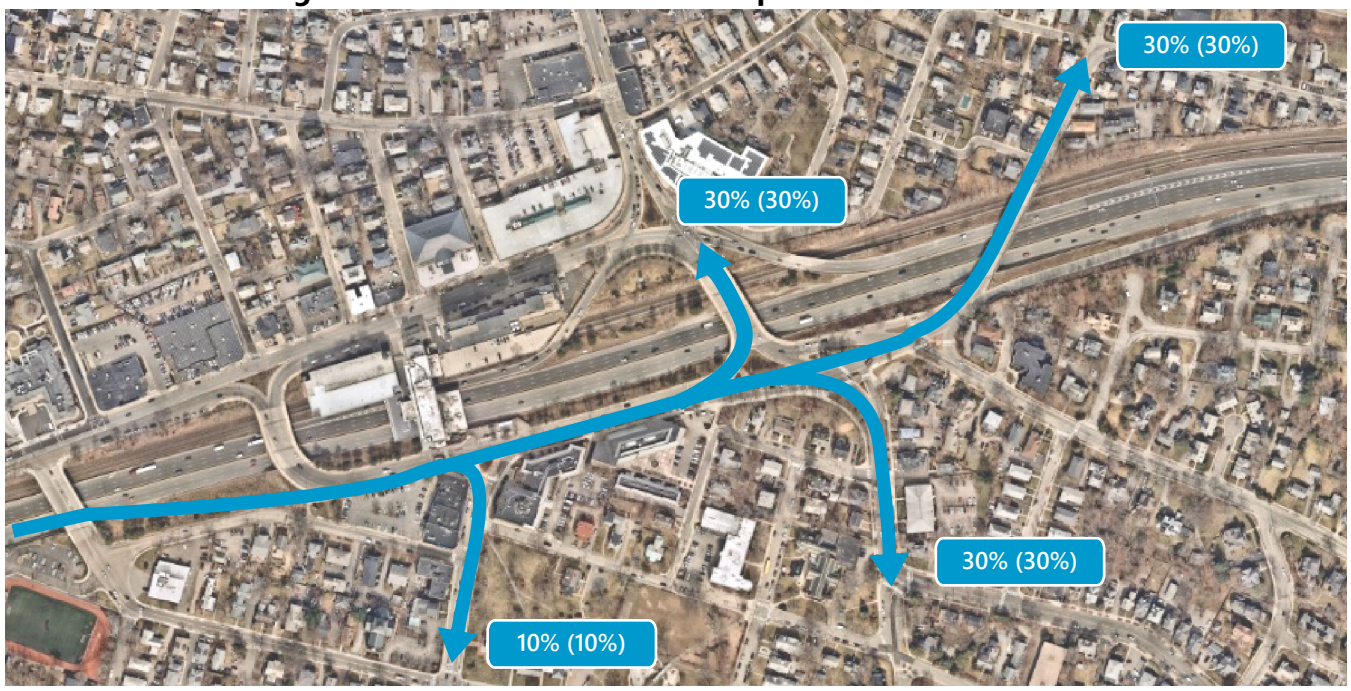
Source: Based on Inrix data collected in May 2022.

1 Percentages on this approach are higher than observed traffic volume data,

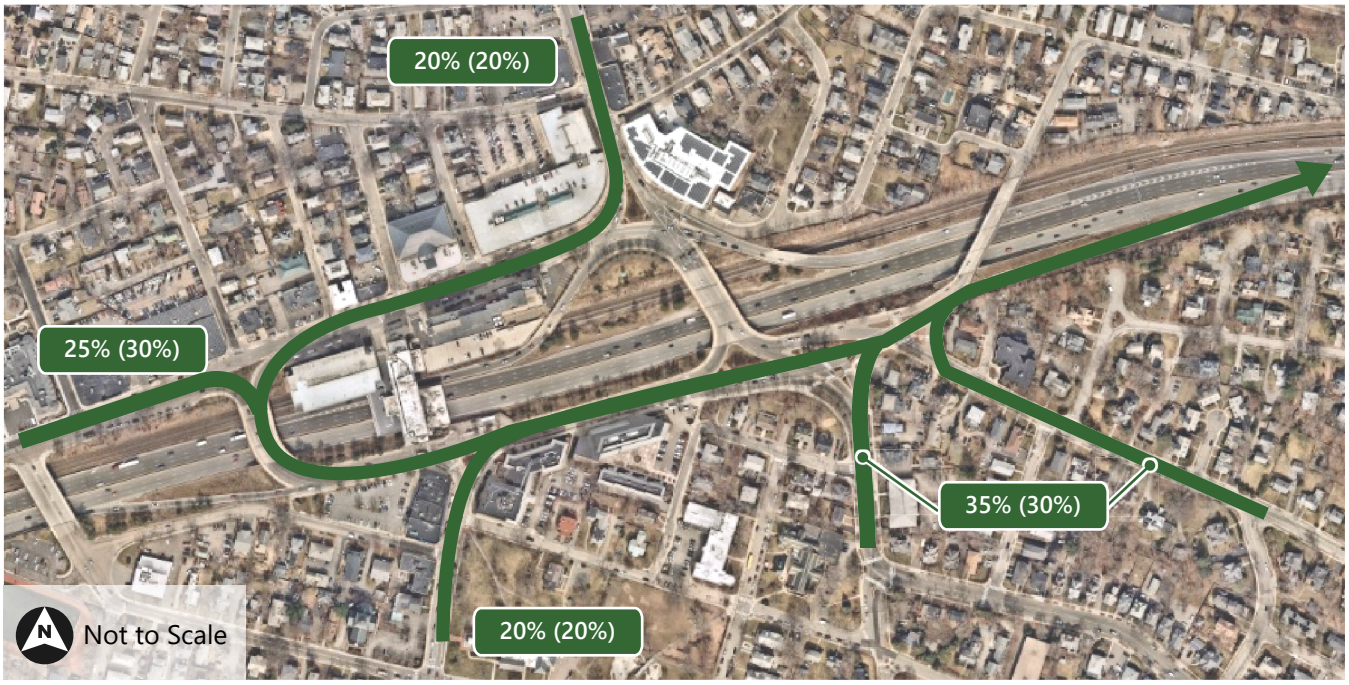
Figure 2-7: Origin-Destination Data to/from I-90 Eastbound

Newton Corner | Newton, MA

Destination Percentages from I-90 Eastbound Off-Ramp



Origin Percentages to I-90 Eastbound On-Ramp



AM % (PM %)

Percentage of Traffic Flow from I-90 Eastbound

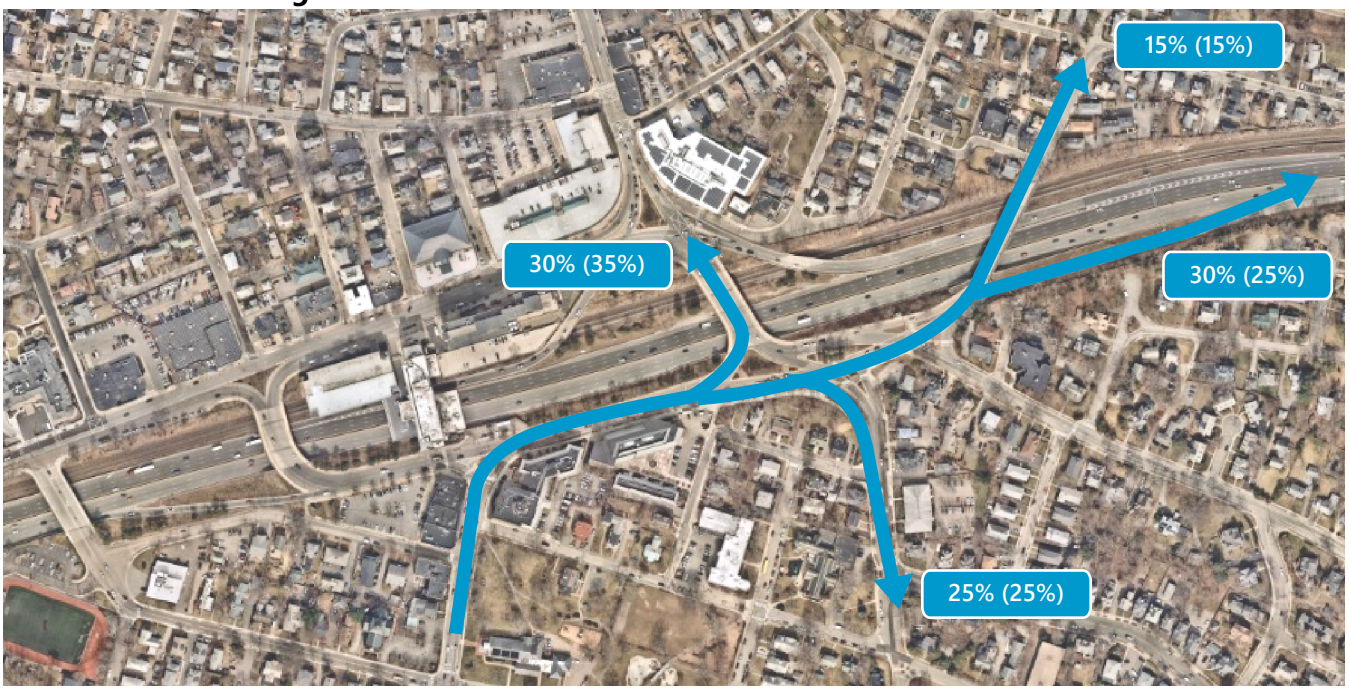
Percentage of Traffic Flow to I-90 Eastbound

Source: Nearmap, MassGIS

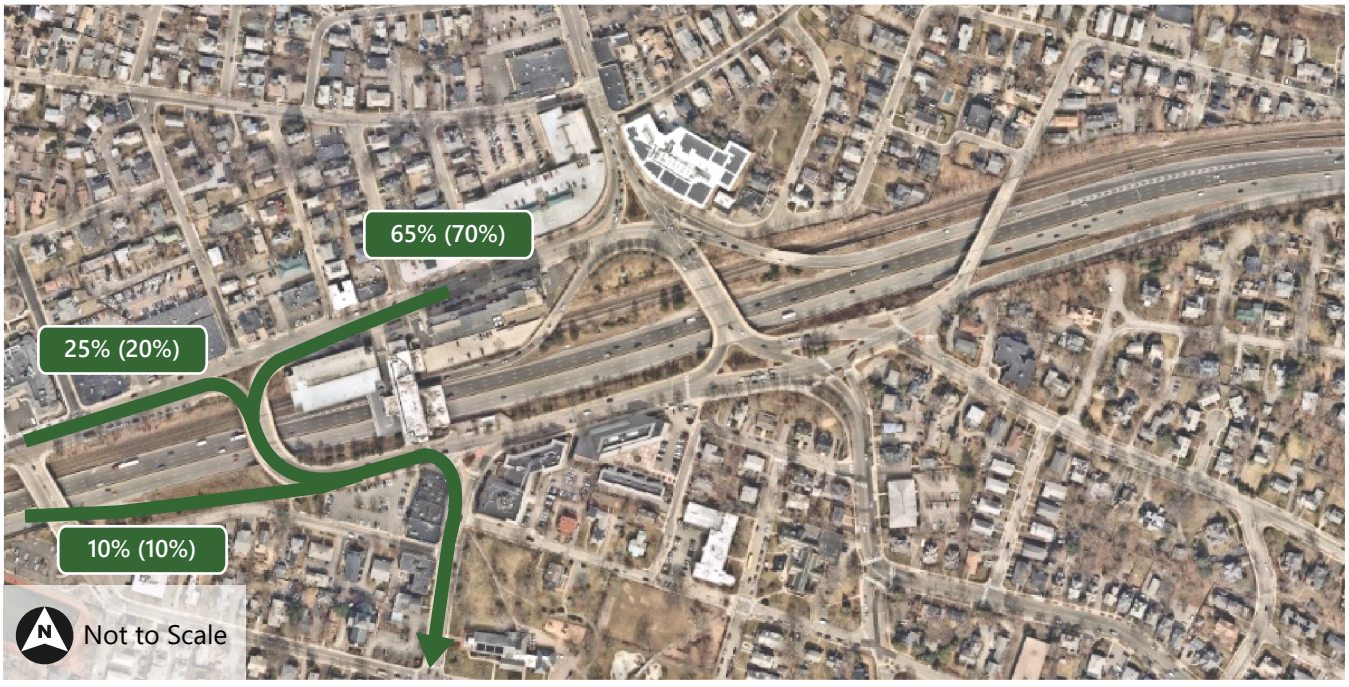
Figure 2-8: Origin-Destination Data to/from Centre Street

Newton Corner | Newton, MA

Destination Percentages from Centre Street South



Origin Percentages to Centre Street South



AM % (PM %)

Percentage of Traffic Flow from Centre Street South

Percentage of Traffic Flow to Centre Street South

Source: Nearmap, MassGIS

Intersection Capacity Analysis

While quantifying existing traffic volumes presents information about the amount of traffic in the Study Area, additional analysis is required to evaluate quality of traffic flow. The Study includes intersection capacity analyses to identify existing conditions related to traffic flow quality within the Study Area. This capacity analyses provides an indication of the adequacy of the roadway facilities to serve the existing traffic demands.

The evaluation criteria used to analyze area intersections in this traffic study are based on the Highway Capacity Manual (HCM)[5]. The term 'Level of Service' (LOS) is used to denote the different operating conditions that occur on a given roadway segment under various traffic volume loads. It is a qualitative measure that considers several factors including roadway geometry, speed, travel delay, and freedom to maneuver. LOS provides an index to the operational qualities of a roadway segment or an intersection. LOS designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. A detailed description of the intersection capacity analysis methodology is included in Appendix. C.

Existing Roadway Conditions Summary

To model LOS operations at Study Area intersections, the Study followed MassDOT guidelines and used Synchro 11 software. Figure 2-9 displays the overall level of service for the Study Area intersections under Existing Conditions for the weekday morning and evening peak hours. Summaries of the operations and measures of effectiveness for each movement at the Study Area intersection are included in Appendix C and capacity analysis worksheets are included in Appendix E.

Siganlized Intersections Key Takeaways

Under Existing Conditions, most signalized intersections operate at a generally acceptable overall LOS of D or better, except for the following three signalized intersections:

- Washington Street WB at the I-90 WB On-Ramp operates at overall LOS E during the weekday morning peak hour and overall LOS F during the weekday evening peak hour.
- Centre Street at Jefferson Street operates at overall LOS F during the weekday evening peak hour.
- Centre Street at Pearl Street operates at overall LOS F during the weekday evening peak hour.

In addition to these intersections operating at overall LOS F, nine intersections also have 95th percentile queues that exceed capacity of the intersections.

[5] Transportation Research Board, Highway Capacity Manual, 7th Edition, Washington, D.C., 2022.

Unsignalized Intersections Key Takeaways

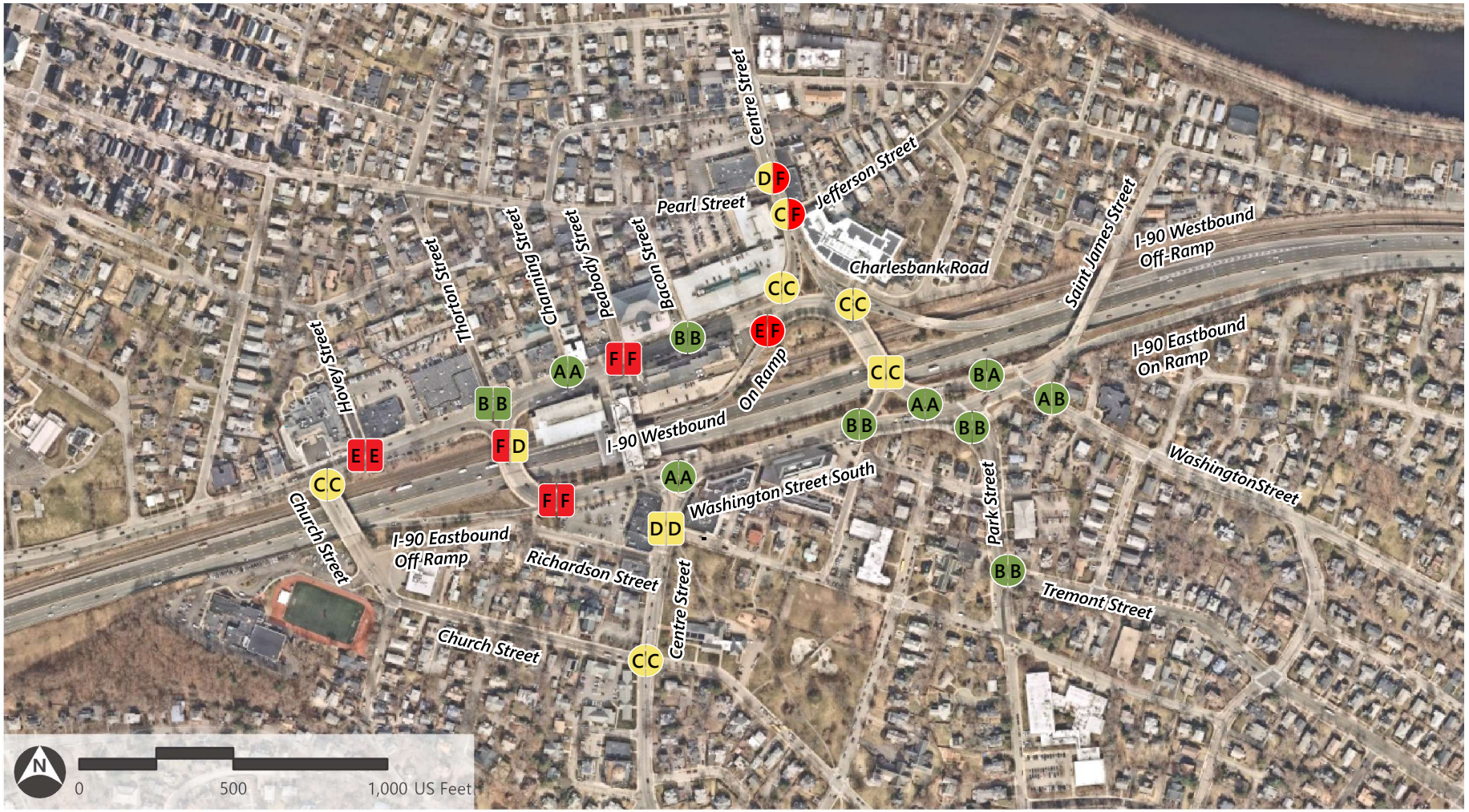
Under existing conditions, three unsignalized intersections also have a movement that operates at LOS F during at least one of the weekday peak hours:

- The unsignalized eastbound right-turn movement from Washington Street EB onto the Washington Street eastbound bridge operates at LOS F during the weekday morning peak hour.
- The unsignalized southbound right-turn movement from Peabody Street onto Washington Street WB operates at LOS F during both weekday peak periods.
- The unsignalized eastbound through movement from the I-90 EB Off-Ramp onto Centre Avenue eastbound operates at LOS F during both weekday peak periods.

As shown in Figure 2-9 these signalized and unsignalized intersections with poor LOS are generally concentrated in the northeast quadrant near the I-90 westbound ramps, and the stretch of Washington Street eastbound on either side of the Washington Street eastbound bridge.

Figure 2-9: 2022 Existing Conditions Intersection Overall Level of Service

Newton Corner | Newton, Massachusetts



Signalized Intersections		Unsignalized Intersections	
LOS AM	LOS PM	LOS AM	LOS PM
A,B	A,B	A,B	A,B
C,D	C,D	C,D	C,D
E,F	E,F	E,F	E,F

Source: Nearmap, MassGIS

Vissim Simulation Model

To supplement the Synchro analysis, a VISSIM simulation model was developed and calibrated to reflect the weekday morning and evening peak hours. While Synchro was utilized to establish the initial operational characteristics of each alternative, a VISSIM model was developed to analyze the preferred alternatives, as VISSIM can accurately model complex intersections and multimodal operations (walking, biking, transit).

VISSIM is a software tool used for transportation planning and operations, which offers advanced visual and analytical representations of traffic operations on roads of different functional classifications. It is a cutting-edge microscopic traffic simulation tool, extensively employed in urban and highway applications. VISSIM can proficiently simulate various transportation modes, including cars, public transportation, and pedestrians, in intricate settings of modern road facilities. This study chose VISSIM due to its powerful ability to simulate traffic operations and tackle transportation challenges in complex networks.

Methodology

The VISSIM model development primarily consists of three steps:

1. Data compilation/network coding
2. Model calibration/validation
3. Model application

Data Compilation & Network Coding

Temporal Limits: Consistent with the project scope, the models are limited to one-hour periods with a seeding period of 30 minutes for each peak period modeled.

Traffic Volumes: VISSIM allows for extremely precise route assignments for each individual vehicle within the simulation area. In the project model, routing decisions were based on the count data collected, as previously described for each intersection and roadway within the study area network. This data was supplemented by the O-D data collected, allowing the team to accurately model the vehicle flows throughout adjacent intersections and ramps. Moreover, roadway speeds were incorporated to determine maximum flow and travel time for each roadway segment. These speeds were primarily based on posted speed limits, with additional input from field observations and count data.

Traffic Signal Timings: Traffic signal timings were obtained from signal inventories conducted for this project and utilized first in the Synchro models and then imported into the VISSIM models.

Bus Inputs: Bus routes were modeled to reflect the current MBTA bus schedules, stops, and an average boarding / alighting time distribution.

Driver behavior settings: The traffic flow model in VISSIM is a discrete, stochastic, time-step-based, microscopic model with driver-vehicle-units as single entities. The model contains a psycho-physical car following model for longitudinal vehicle movement and a rule-based algorithm for lateral movements. The model is based on the continued work of Wiedemann and the two driver behavior models used within VISSIM specifically are:

1. Wiedemann 74 model, which is mainly suitable for urban/arterial traffic conditions
2. Wiedemann 99 model, which is mainly suitable for freeway traffic conditions

As part of the calibration process described below, the default driver behavior parameters were adjusted to reflect an accurate model of the driver behavior observed within the study area.

Model Calibration & Validation

Calibration of the model is commonly achieved by generating an Existing Conditions scenario that reflects current operations, thus ensuring accurate model operations through appropriate driver behavior. Future models are then built based on the calibrated existing conditions model.

After initial coding, multiple runs of the VISSIM model were conducted to introduce variation to vehicle loadings and the nature of vehicle arrivals in the simulation. Calibration of the VISSIM model for each scenario was conducted to ensure accurate and realistic model operations, as compared to anticipated operations. Traffic volume data was collected from each model and compared to the expected traffic volumes based on the static analysis.

Number of Model Runs: The recommended number of simulations runs needed to provide adequate statistical validity will be calculated using FHWA's guidance on calculating the required number of simulations runs outlined in Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software - 2019 Update to the 2004 Version.

FHWA's methodology uses a standard statistical t-test to determine the number of simulations runs required to ensure a 95th percentile confidence level with a 10% tolerance.

$$N = \frac{Z^2 S^2}{E^2}$$

Where: N = number of simulation runs

Z = z-score (1.96 for the 95th percentile)
S = Standard deviation of the sample
E = Tolerance error in terms of the sample mean

Using the above formula on the modeled speeds at four different locations throughout the model, the minimum number of the runs was determined to be 10.

Calibration Data: Peak period traffic operations and vehicle queues were observed by VHB transportation staff through field visits. These field observations along with review of peak period video recordings were used to support calibrating the traffic models.

The existing VISSIM models were calibrated using current traffic volumes, travel-time, and speed data. Calibration thresholds to assess the models' effectiveness were based on FHWA guidelines. The calibrated models were executed multiple times with different "random seed" values for each run during peak periods. The AM/PM peak-hour results were then averaged across all runs to mitigate statistical anomalies.

During model development, animations were visually inspected to identify unusual driving behaviors, irregular network queuing, and any overlooked coding parameters. This visual error-checking process was followed by repeatedly adjusting the models and comparing the movement volumes, queues,

and travel times from VISSIM runs to those from field-collected data. This iterative procedure continued until the calibration targets, as shown in Table 2-7, were met.

Table 2-7 Calibration Targets

Criteria and Measures	Calibration Targets Met
Hourly Flows, Model Versus Observed	
Individual Link Flows	
Within 15%, for 700 – 2700 veh/hr	>85% of cases
Within 100 veh/hr for flow <700 veh/hr	>85% of cases
Within 400 veh/hr for flow >2700 veh/r	>85% of cases
Sum of All Link Flows	Within 5% of sum of all link counts
GEH Statistic <5 for Individual Link Flows	>85% of cases
GEH Statistic for Sum of All Link Flows	GEH <4 for sum of all link counts
Visual Audits	
Individual Link Speeds	
Visually Acceptable Speed-Flow Relationship	To analyst's satisfaction
Bottlenecks	
Visually Acceptable Queuing	To analyst's satisfaction

Model Application

The calibrated model, which considered the latest proposed roadway improvements and future traffic volume projections, was used to simulate the existing, future No-Build and future Improvements conditions. All simulation runs followed the standard practice of a 30-minute seeding period followed by a 60-minute simulation period. Evaluation of the visual output and results presented in this report are solely based on the performance of the roadway facilities within the 60-minute simulation period.

Results

The following section provides an overview of the existing conditions Vissim results. Full summaries of the operations and measures of effectiveness for each movement at each Study Area intersection are included in Appendix C to this report.

Overall Intersections Key Takeaways

Similar to the Synchro analysis results, under Existing Conditions, most intersections operate at a generally acceptable overall LOS of D or better, except for the following two signalized intersections:

- Washington Street WB at the I-90 WB Ramps operates at overall LOS F during the weekday evening peak hour.
- Centre Street at Pearl Street and Jefferson Street operates at overall LOS F during the weekday evening peak hour.

In addition to these intersections operating at overall LOS F, there are individual movements throughout the study area that operate at LOS E or F, including the I-90 Eastbound off-ramp operates at LOS F during both weekday morning and evening peak hours.

Transit

The following section documents the existing public transit conditions in the Study Area including route service descriptions, stop characteristics, and ridership. The existing conditions scenario evaluates pre-pandemic ridership and service data from 2019. Recent bus service changes in effect as of 2022 are also summarized for reference.

Public Transit

MBTA Bus Routes

Newton Corner is currently served by two MBTA local bus routes and six MBTA express bus routes. Operational characteristics, including service patterns and conditions of bus stops, are described below, based on conditions in Fall 2019, reflecting pre-pandemic conditions.

Route 52

Route 52 provides local service between Dedham Mall and Watertown Yard. The route makes stops at Dedham, West Roxbury, Oak Hill, Newton and Watertown. Within the Study Area, this route makes three inbound stops and three outbound stops. Of the two local bus services that serve Newton Corner, Route 52 has the lowest 2019 ridership at 582 average daily weekday boardings.

Route 57

Route 57 provides local service between Watertown Yard and Kenmore Station. The route makes stops at Watertown, Newton, Brighton, Allston, and Fenway. Within the Study Area, this route makes five inbound stops and three outbound stops. Route 57 has the highest average weekday ridership of all the local and express bus routes that serve the Study Area, with over 10,000 average daily weekday boardings in Fall 2019.

Route 501

Route 501 provides express service between Brighton Center and Downtown Boston, serving Newton Corner in the inbound direction in the morning only and the outbound direction in the evening only. The route variation serving Newton Corner makes stops at Brighton, Newton Corner, Back Bay, and Downtown Boston. Within the Study Area, this route makes two inbound stops and four outbound stops and has the highest Fall 2019 ridership of the six express routes, with 1,681 average daily weekday boardings.

Route 504

Route 504 provides express service between Watertown Yard and Downtown Boston. The route makes stops at Watertown, Newton Corner, Allston, Fenway, Back Bay, and Downtown Boston. Within the Study Area, this route makes three inbound stops and three outbound stops. Route 504 has the second highest Fall 2019 ridership of the six express routes with 1,448 average daily weekday boardings.

Route 553

Route 553 provides express service between Roberts and Newton Corner. The route makes stops at Brandeis University, Watertown, West Newton, and Newton Corner. Within the Study Area, this route makes four inbound stops and three outbound stops. Route 553 has the third highest Fall 2019 ridership of the six express routes with 819 average daily weekday boardings.

Route 554

Route 554 provides express service between Waverly Square and Newton Corner. The route makes stops at Waverly, Warrendale, Waltham, West Newton, Newtonville, and Newton Corner. Within the Study Area, this route makes four inbound stops and three outbound stops. Route 554 has the third lowest Fall 2019 ridership of the six express routes with 642 average daily weekday boardings.

Route 556

Route 556 provides express service between Waltham Highlands and Newton Corner. The route makes stops at Waltham, Newtonville, and Newton Corner. Within the Study Area, this route makes four inbound stops and three outbound stops. Route 556 has the second lowest Fall 2019 ridership with 484 average daily weekday boardings.

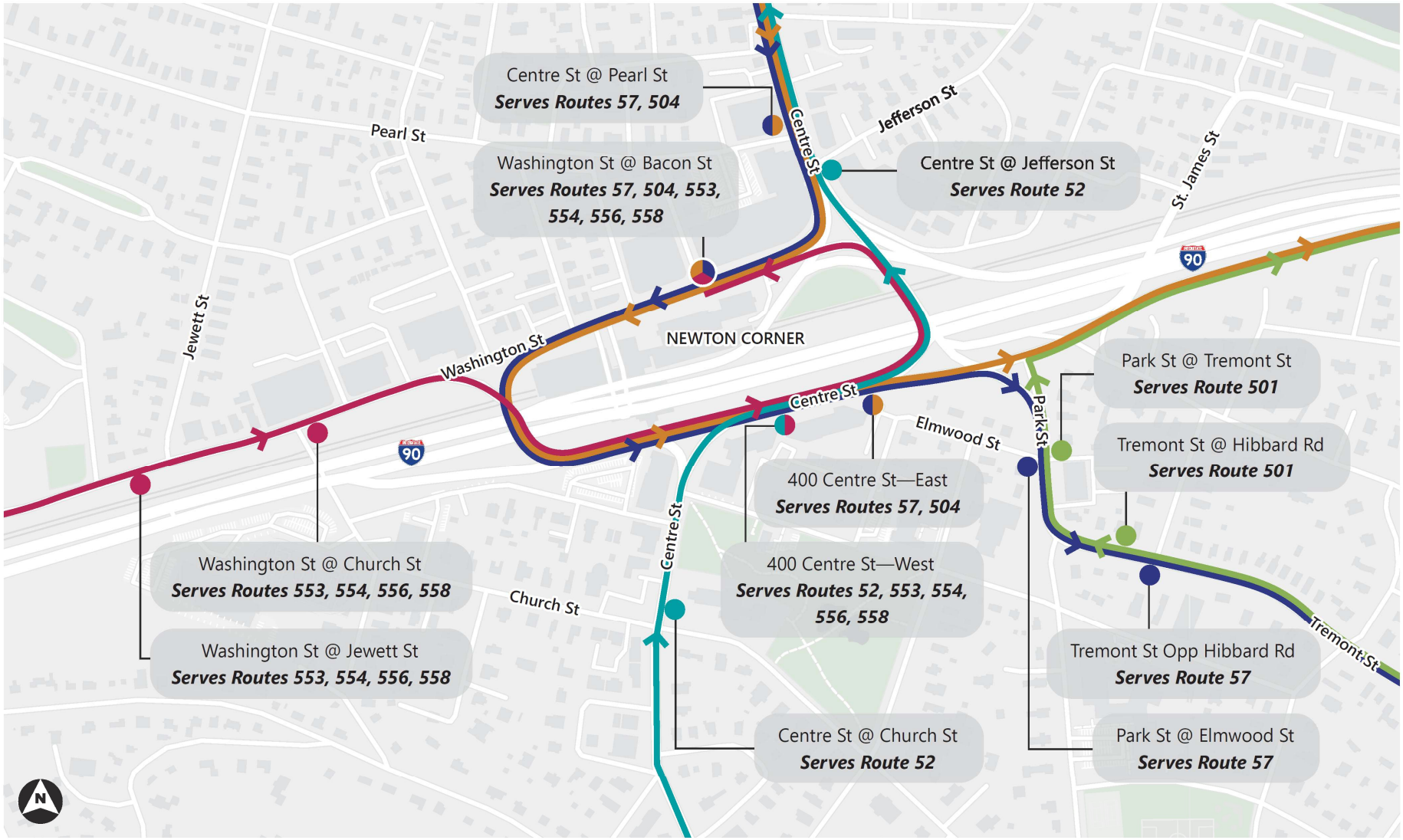
Route 558

Route 558 provides express service between Riverside Station and Newton Corner. The route makes stops at Auburndale, Waltham, Watertown, and Newton Corner. Within the Study Area, this route makes four inbound stops and three outbound stops and has the lowest Fall 2019 ridership with 395 average daily weekday boardings.

Figures 2-10 and 2-11 show the Study Area bus routes in the inbound and outbound directions, respectively. The figures also display the stops served by the routes in each direction.

Figure 2-10: Inbound Bus Routes

Newton Corner | Newton, Massachusetts



Local Routes

- Route 52
- Route 57

Express Routes

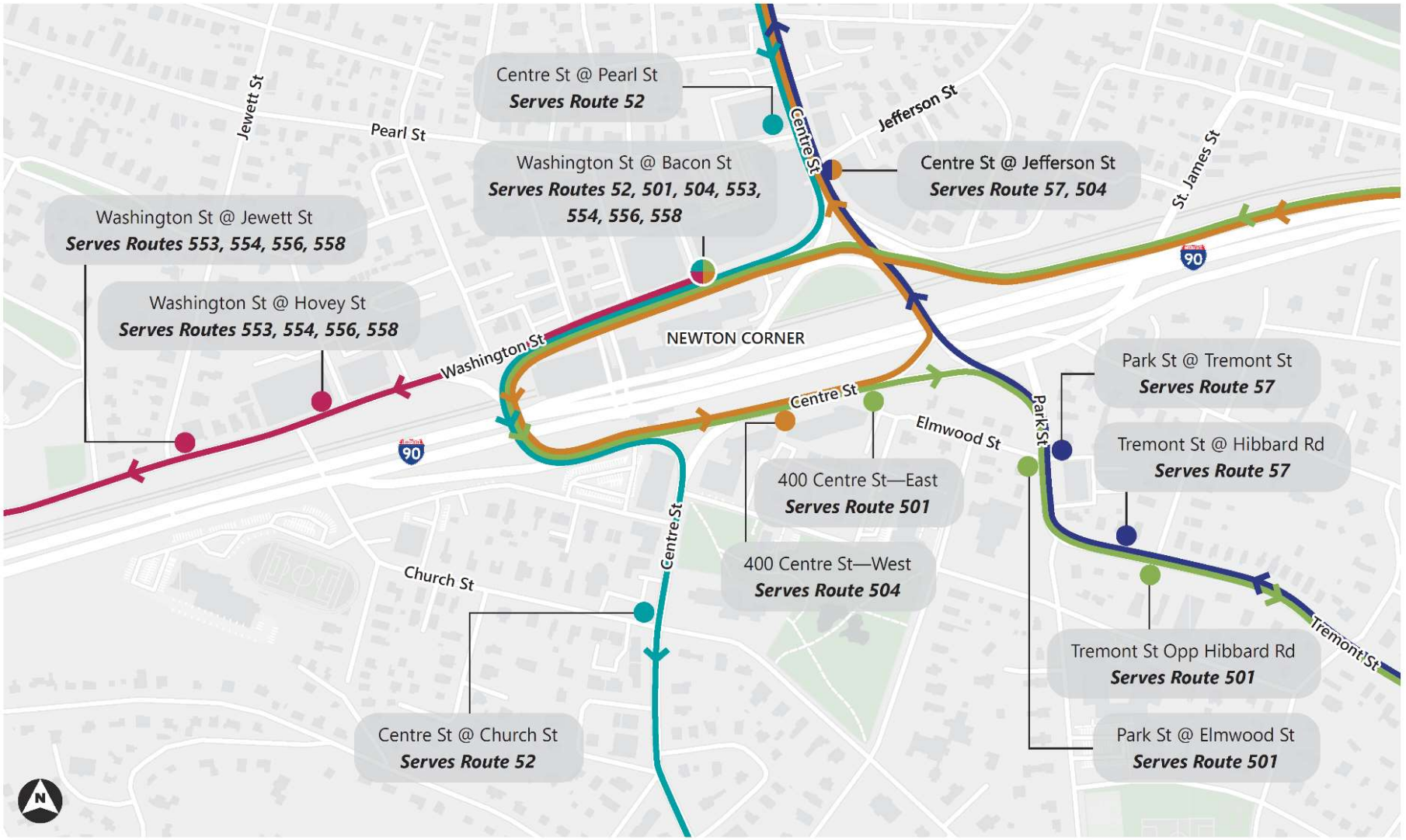
- Route 501
- Route 504

- Routes 553, 554, 556, 558

Source: Esri Community Maps Contributors, City of Boston, City of Newton, MassGIS, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Figure 2-11: Outbound Bus Routes

Newton Corner | Newton, Massachusetts



Local Routes
- Route 52
- Route 57

Express Routes
- Route 501
- Route 504
- Routes 553, 554, 556, 558

Source: Esri Community Maps Contributors, City of Boston, City of Newton, MassGIS, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Study Area Bus Stops

There are 15 MBTA bus stops serving eight bus routes operating through the Study Area. Table 2-8 below provides details about Study Area bus stops including locations, routes served and stop amenities and deficiencies.

Table 2-8 Study Area MBTA Bus Stops

Bus Stop	Bus Routes Served	Bus Stop Amenities	Bus Stop Deficiencies
Washington Street at Jewett Street-Inbound	553, 554, 556, 558	n/a	No shelter or bench
Washington Street at Jewett Street-Outbound	553, 554, 556, 558	n/a	No shelter or bench
Washington Street at Church Street	553, 554, 556, 558	n/a	No shelter or bench
Washington Street at Hovey Street	553, 554, 556, 558	Bus shelter and bench	n/a
Centre Street at Church Street-Inbound	52	n/a	No shelter or bench
Centre Street at Church Street-Outbound	52	n/a	No shelter or bench
Washington Street at Bacon Street	52, 57, 501, 504, 553, 554, 556, 558	Bus shelter and bench	n/a
Centre Street at Jefferson Street	52, 57, 504	n/a	No shelter or bench
Centre Street at Pearl Street	57, 504, 52	Nearby awning for shelter	No shelter or bench
400 Centre Street-West	52, 504, 553, 554, 556, 558	Nearby awning for shelter	No shelter or bench
400 Centre Street-East	52, 501, 504	Bus shelter and bench	n/a
Park Street at Elmwood Street	57, 501	n/a	No shelter or bench
Park Street at Tremont Street	57, 501	n/a	No shelter or bench
Tremont Street opposite Hibbard Road	57, 501	n/a	No shelter or bench
Tremont Street at Hibbard Road	57, 501	n/a	No shelter or bench

Study Area Bus Service Characteristics

Table 2-9 summarizes the Fall 2019 service characteristics of the Study Area bus routes, including headways, average wait times, on-time performance, and span of service.

Table 2-9 Study Area MBTA Bus Service Characteristics

Bus Route	52	57	501	504	553	554	556	558
Bus Headways (minutes)								
AM Peak Hour	30	11	7	10	60	60	30	65
Day	90	10	n/a	30	60	60	60	Limited
PM Peak Hour	35	12	8	12	60	60	30	45
Night	n/a	20	n/a	n/a	Limited	n/a	n/a	n/a
Saturday	n/a	10	n/a	40	60	n/a	n/a	n/a
Sunday	n/a	15	n/a	n/a	n/a	n/a	n/a	n/a
Average Wait Times (minutes)								
AM Peak Hour	15	6	4	5	30	30	15	33
Day	45	5	n/a	15	30	30	30	n/a
PM Peak Hour	18	6	4	6	30	30	15	23
Night	n/a	10	n/a	n/a	n/a	n/a	n/a	n/a
Saturday	n/a	5	n/a	20	30	n/a	n/a	n/a
Sunday	n/a	8	n/a	n/a	n/a	n/a	n/a	n/a
On-Time Performance								
Weekday Peak Period	46%	76%	78%	77%	47%	47%	46%	49%
Weekday Non-Peak Period	58%	76%	75%	71%	47%	44%	65%	59%
Saturday	n/a	72%	n/a	64%	72%	n/a	n/a	n/a
Sunday	n/a	75%	n/a	n/a	n/a	n/a	n/a	n/a
Span of Service								
Weekday	6:15 – 19:57	05:03 – 25:32	06:20 – 20:05	06:20 – 20:12	05:58 – 21:41	05:51 – 20:19	06:40 – 19:55	07:00 – 19:51
Saturday	n/a	05:05 – 25:32	n/a	07:30 – 20:12	06:30 – 19:46	n/a	n/a	n/a
Sunday	n/a	06:00 – 25:32	n/a	n/a	n/a	n/a	n/a	n/a

Source: Headways/Wait Times: MBTA 2019 System Map. https://cdn.mbta.com/sites/default/files/maps/2019-07-01-mbta-system-map-full.pdf.

On-Time Performance: MBTA Bus, Commuter Rail, & Rapid Transit Reliability. Fall, 2019, reflective of pre-Covid conditions. https://mbta-massdot.opendata.arcgis.com/datasets/MassDOT::mbta-bus-commuter-rail-rapid-transit-reliability/explore

Span of Service: VHB MBTA Transit Analysis. Fall, 2019, reflective of pre-Covid conditions. https://vhb-transportation.shinyapps.io/MBTA_Bus_Load_App/

Note: Headways represent typical, approximate headways for each period and may vary. Average wait times are calculated as half of the typical headways. Passenger use of schedules or customer technology (e.g., apps identifying the time of the next trip in real time) may affect average wait times. On-time performance is for the full route and is calculated for the period from September 1, 2019 – December 20, 2019, and excludes holidays (September 2, October 14, November 11, and November 28). Weekday on-time performance is available across peak periods instead of for each peak period individually. Span of service reflects the time the first bus begins service to the time the last bus finishes service. Information is based on pre-COVID schedules (Fall 2019) and current schedule information may differ.

Fall 2022 Service

Per the MBTA's Fall 2022 service schedules, most of the current service characteristics closely match those that existed in 2019. The exception is Route 501, which in 2019 did not serve the Study Area in the outbound direction, instead running between Downtown Boston and Winship Street at Union Street in Jackson Square.

Transit Ridership

Table 2-10 summarizes the ridership of the eight MBTA routes serving the Study Area. Ridership data is presented for weekday, Saturday, and Sunday service where applicable, and includes ridership in both the inbound and outbound directions. Ridership totals are based on the total boardings at all stops along each route in each direction. Route 57 has the highest overall ridership of all the routes serving the Study Area and has been identified by the MBTA as a key bus route.

Table 2-10 MBTA Service Ridership (Boardings)

Express Bus Route	Origin/ Destination	Direction	Weekday	Saturday	Sunday
52	Dedham Mall – Watertown Yard	Inbound	286	n/a	n/a
		Outbound	296	n/a	n/a
		Total	582	n/a	n/a
57	Watertown Yard – Kenmore Station	Inbound	5,078	3,169	2,228
		Outbound	5,420	3,148	2,378
		Total	10,497	6,318	4,605
501	Brighton Center – Federal Street & Franklin Street	Inbound	837	n/a	n/a
		Outbound	845	n/a	n/a
		Total	1,681	n/a	n/a
504	Watertown Yard – Federal Street & Franklin Street	Inbound	821	236	n/a
		Outbound	627	204	n/a
		Total	1,448	440	n/a
553	Roberts – Newton Corner	Inbound	389	166	n/a
		Outbound	430	149	n/a
		Total	819	315	n/a
554	Waverly Square – Newton Corner	Inbound	303	n/a	n/a
		Outbound	339	n/a	n/a
		Total	642	n/a	n/a
556	Waltham Highlands – Newton Corner	Inbound	279	n/a	n/a
		Outbound	205	n/a	n/a
		Total	484	n/a	n/a
558	Riverside Station – Newton Corner	Inbound	203	n/a	n/a
		Outbound	193	n/a	n/a
		Total	395	n/a	n/a

Source: MBTA Bus Ridership by Time Period, Season, Route/Line, and Stop. Fall, 2019, reflective of pre-Covid conditions.

Fall 2019 passenger activity for the fifteen Study Area bus stops is summarized in Figure 2-12. The stops that experience the most weekday boardings and alightings are Washington Street at Bacon Street and Centre Street at Jefferson Street.

Transit Reliability

Table 2-11 summarizes the reliability and on-time performance (OTP) of the MBTA bus routes that serve the Study Area in October 2023. Reliability is measured for frequent bus routes with service every 15 minute or less by the percent of buses that are no more than three minutes late and for infrequent bus routes with service less than every 15 minutes by the percent of buses that depart no more than one minute early and no more than six minutes late. Reliability includes both inbound and outbound directions and is based on all stops along each route.

Table 2-11 MBTA Bus Average Reliability

MBTA Bus Route	Average Reliability (October 2023)
52	40%
57	75%
501	46%
504	55%
553	52%
554	50%
556	25%
558	58%

Source: MBTA Service Reliability: https://www.mbta.com/performance-metrics/service-reliability
Note: Represents overall average on-time performance for the 30-day period ending October 30, 2023.

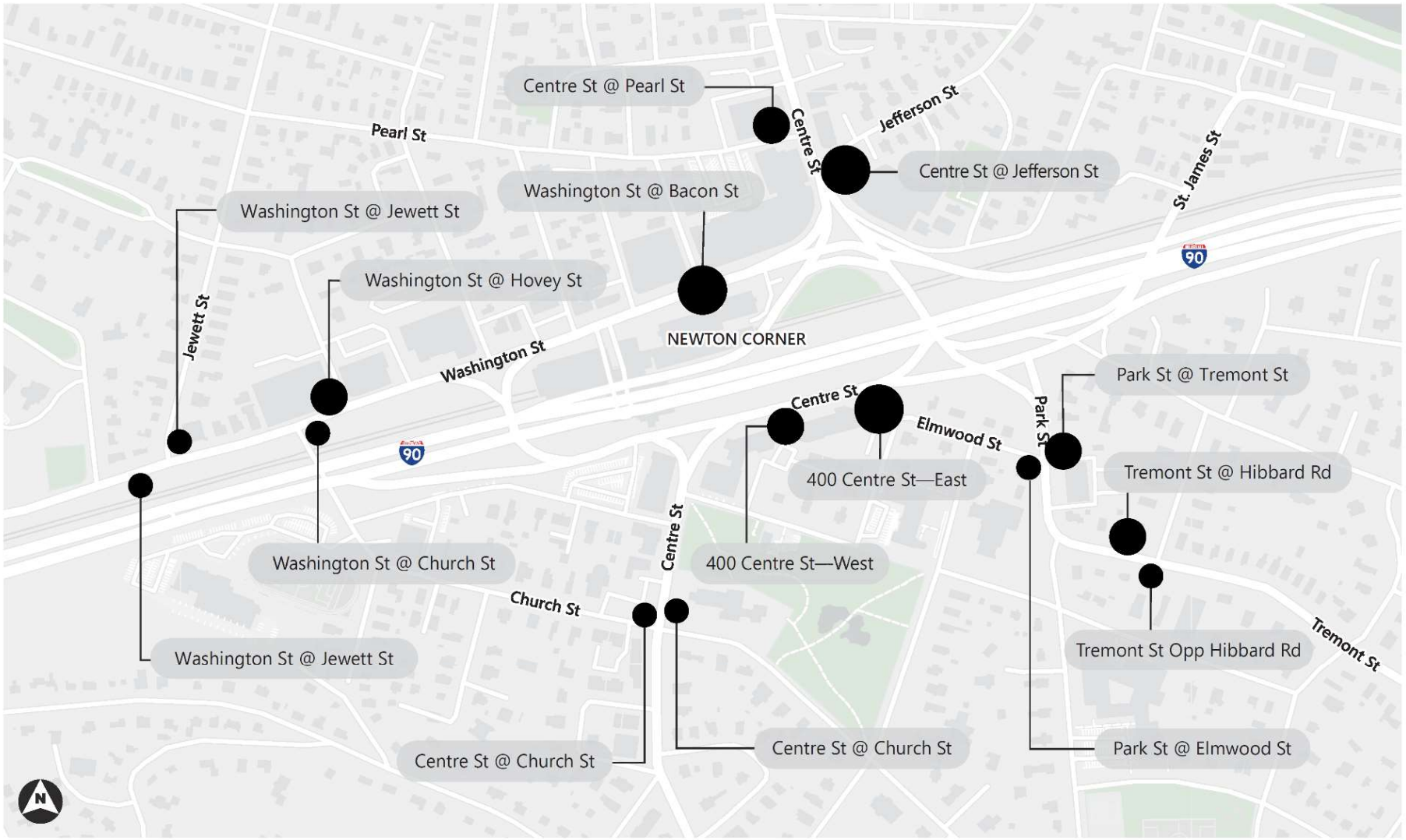
As seen in Table 2-11 there is a wide range of reliability ranging from 25% on Route 556 to 75% on Route 57. Most routes in the Study Area are not reliable, with the most common OTP ranging from about 45%-55%.

Private Transportation/Shuttles

As Newton Corner is a key roadway link in the regional transportation network, it is likely that private shuttles travel through the Exit 127 interchange to access local businesses and residences in Newton, Watertown, and Brighton. However, a review of the local business and residential complexes near the interchange indicates that there are no private transportation shuttles that start or end in the vicinity of Newton Corner.

Figure 2-12: Passenger Activity at Project Area Bus Stops

Newton Corner | Newton, Massachusetts



Passenger Activity 0-20 20-200 200+

Passenger Activity defined as total number of boardings and alightings at a bus stop.

Source: Esri Community Maps Contributors, City of Boston, City of Newton, MassGIS, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Pedestrians and Bicyclists

The following section describes the existing infrastructure for pedestrians and bicyclists (also known as active transportation). This section also documents the existing volumes of pedestrians and bicyclists that currently travel through the Study Area.

Active Transportation Facilities

Pedestrian Facilities

Sidewalks are provided on both sides of all roadways within the Study Area with the exceptions of I-90 and its ramps, the south side of Charlesbank Road next to the I-90 WB Off-Ramp, and the east side of St James Street on the bridge over I-90. Most of the sidewalks are wide enough to provide a furniture zone adjacent to the edge of curb that includes space for poles, trees, trash cans, and other street furniture items.

Crosswalks are provided at all signalized intersections and at several unsignalized intersections. There are four crosswalks located at pedestrian-activated traffic signals where a red light only appears for vehicles when the push-button at the crosswalk is activated by a pedestrian. These four crosswalks all provide pedestrian access to the center of the Newton Corner Rotary, with two located on the north side of the interstate (east of Bacon Street and west of Peabody Street) and two located on the south side of the interstate (west of Centre Street and west of the Washington Street westbound bridge). Within the Study Area, some of the crosswalk curb ramps do not meet current Americans with Disability (ADA) Act accessibility standards, as some curb ramps do not provide sufficient landings and others are missing tactile warning strips. Curb ramps were not evaluated for slope and cross-slope compliance, but all locations proposed to be reconstructed as part of the project will be evaluated as the design progresses and designed to ADA standards.

The locations of all existing sidewalks and crosswalks are presented in Figure 2-13.

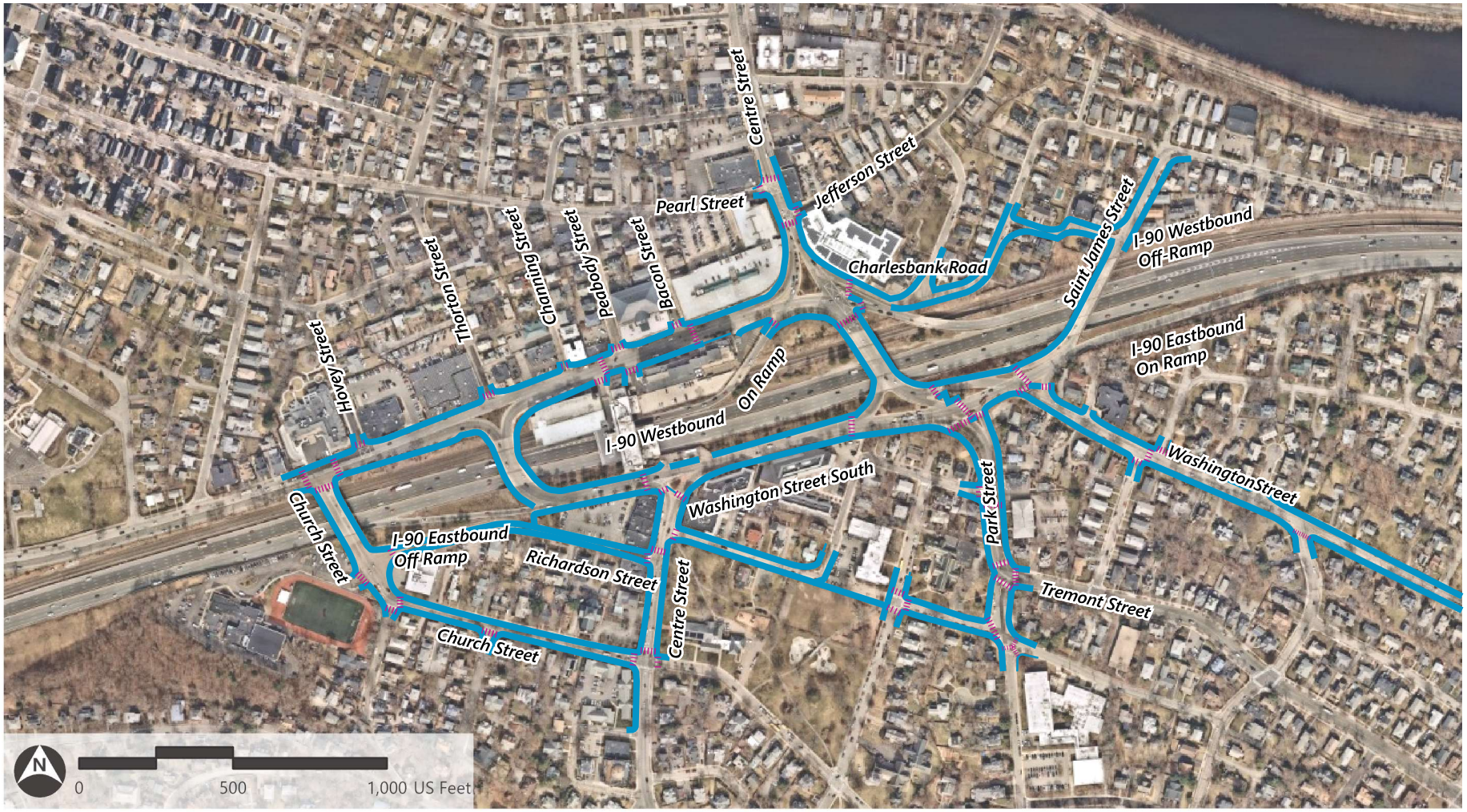
Gaps in the Pedestrian Network

There are several notable gaps in the pedestrian network through Newton Corner, including:

- **Lack of crosswalk facilities at key intersections:** There is no crosswalk across the I-90 EB off-ramp, leaving pedestrians on the west side sidewalk of the Washington Street eastbound bridge without a safe way to cross the roadway. The northwest corner of the intersection of Washington Street westbound at Centre Street northbound / I-90 westbound off-ramp / Charlesbank Road also lacks crosswalks, requiring pedestrians to walk approximately 200 feet north to cross Centre Street at Jefferson Street or approximately 300 feet to the west to cross Washington Street westbound at Bacon Street. The intersection of Washington Street at Thornton Street on the north side of the Washington Street eastbound bridge is also missing crosswalk facilities.
- **Lack of accessible pedestrian connections through the Newton Corner Rotary:** While there is a pedestrian connection across the center of the Newton Corner Rotary through the Four Points by Sheraton hotel property, the passageway is not accessible as there is a staircase connecting to the sidewalk along Centre Avenue.

Figure 2-13: Existing Pedestrian Facilities

Newton Corner | Newton, Massachusetts



Sidewalks

Crosswalks

Source: Nearmap, MassGIS

Bicycle Facilities

There are currently minimal dedicated bicycle accommodations within the Study Area. Dedicated on-road bicycle lanes without buffers or separation from vehicular traffic are provided in the following two locations on the south side of Newton Corner:

- Centre Street south of Church Street in both directions
- Washington Street east of St James Street in the eastbound direction and east of Hubbard Road in the westbound direction.

In addition, sharrows are provided on Centre Street in both directions between Church Street and Richardson Street and on Washington Street in the westbound direction between St James Street and Hubbard Road. The location of all dedicated bicycle accommodations within the Study Area is presented in Figure 2-14.

There are no dedicated bicycle facilities anywhere else in the Newton Corner area, including on the circulating one-way roads comprising the Newton Corner Rotary. Since bicyclists must travel on-road with mixed vehicle traffic through most of the Study Area, there is a significant safety risk for bicyclists interacting with fast moving vehicle traffic.

Bluebikes

Bikeshare in the Boston area is provided by the Bluebikes system. Bluebikes allows riders to pick up a bicycle at any Bluebikes station within Newton, Boston, Watertown and ten additional surrounding communities and then return the bicycle at any other station. Bicycles are unlocked via a mobile app and can be picked up or returned at over 400 stations. There are two existing Bluebikes stations within the Newton Corner area, one on each side of the interstate. The northern Bluebikes station is located on the northeast corner of Washington Street westbound at Bacon Street and the southern Bluebikes station is located on the southwest corner of Centre Avenue at Centre Street. Both stations contain 11 bicycle docks. The location of each Bluebikes station is illustrated in Figure 2-14.

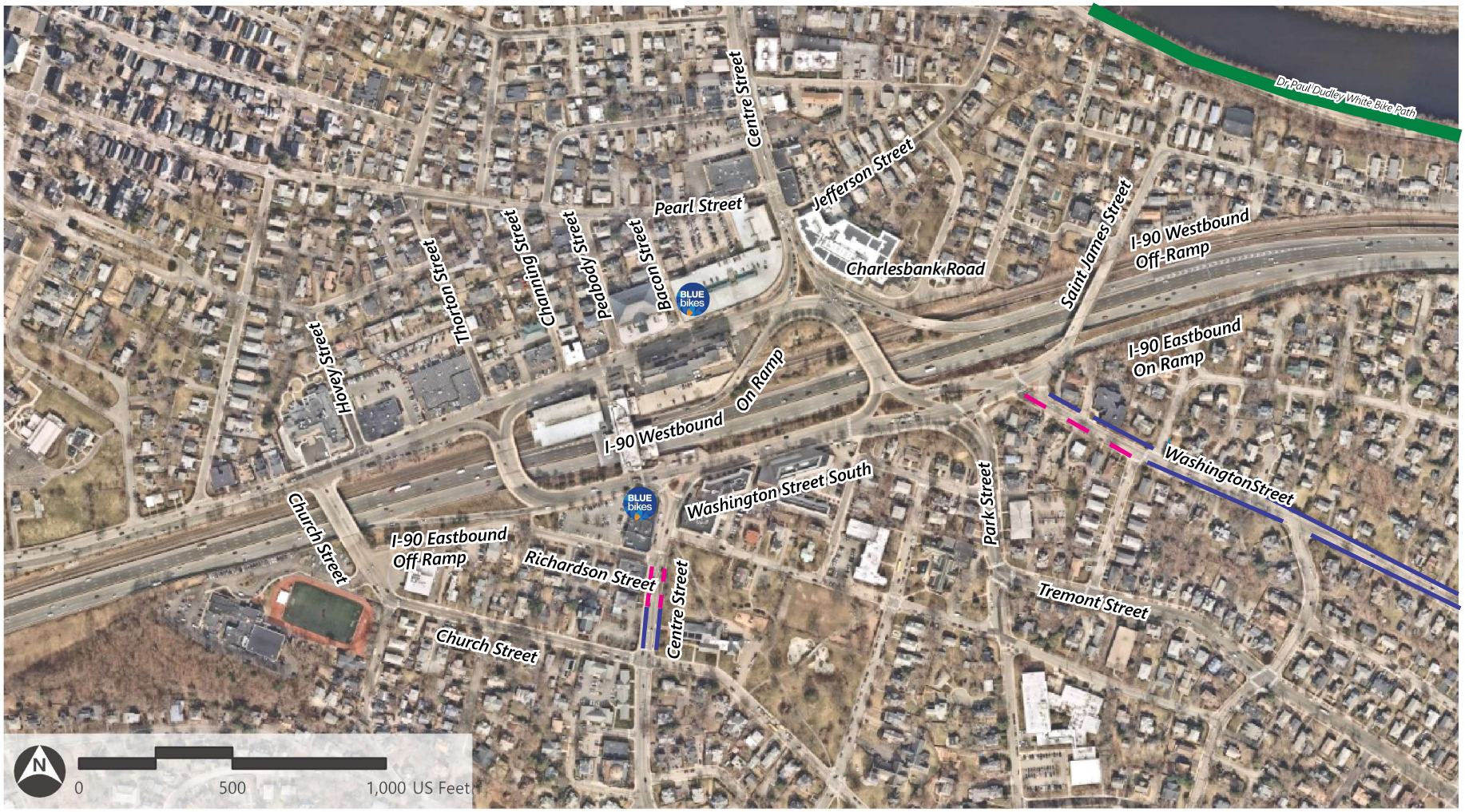
Gaps in the Bicycle Network

As there are no bicycle facilities provided for bicyclists traveling north-south or east-west through Newton Corner, the area presents a gap in the regional bicycle network for Newton and beyond. North of Newton Corner, the Dr. Paul Dudley White Bike Path and the Charles River Greenway are located on either side of the Charles River and provide a continuous off-road bicycle connection between Boston and Cambridge to the east and Waltham to the west. While the Charles River pathways are located less than half a mile north of Newton Corner, there is currently no way to access these paths safely through the Newton Corner roadway network.

A map of the regional bicycle accommodations and the network gap through the Newton Corner area is illustrated in Figure 2-15.

Figure 2-14: Existing Bicycle Facilities

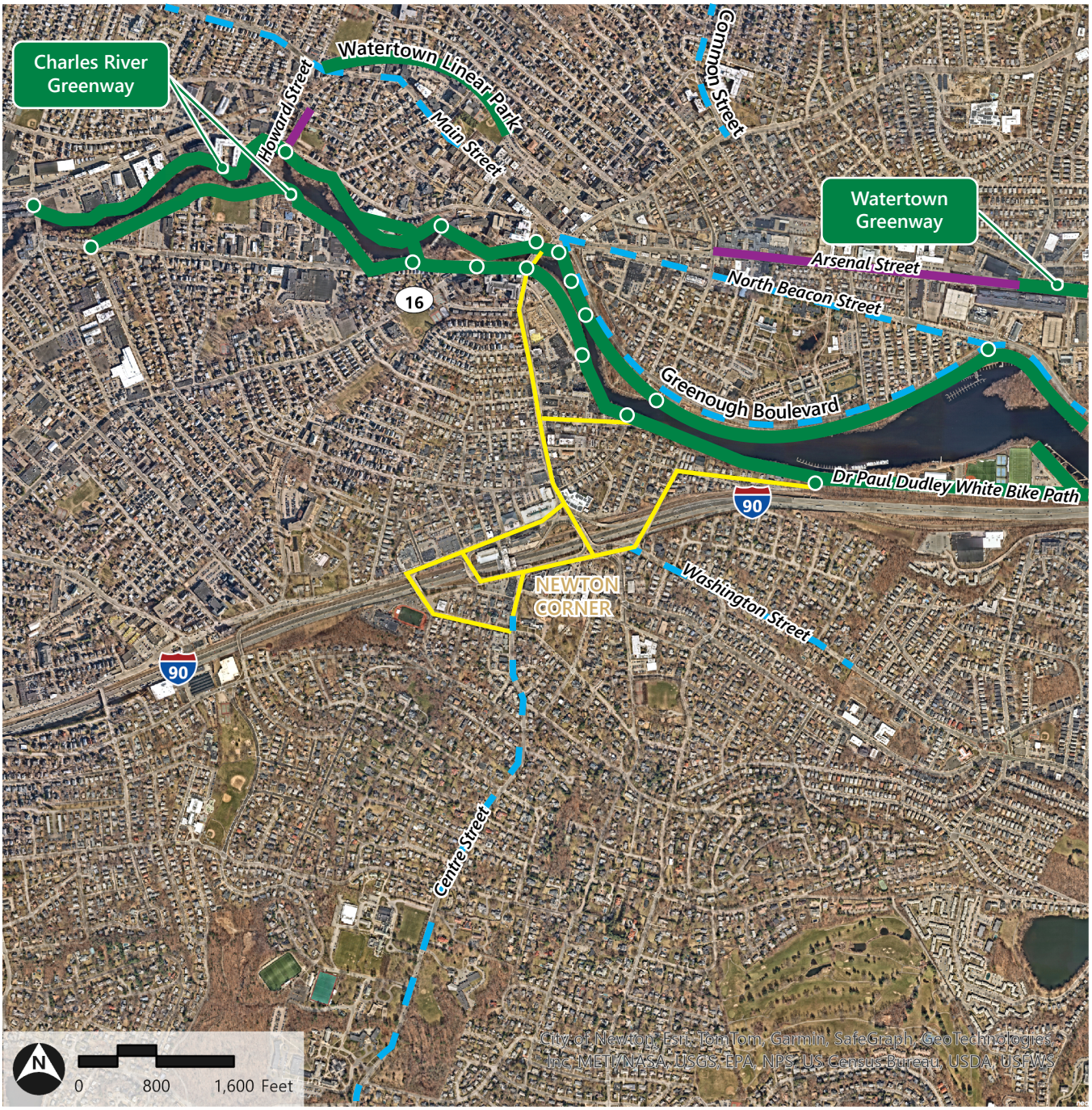
Newton Corner | Newton, Massachusetts



Source: Nearmap, MassGIS

Figure 2-15: Existing Bicycle Accommodations and Network Gaps

Newton Corner | Newton, Massachusetts



Existing Bicycle Facilities

- Shared Use Path
- Bike Lane
- Separated Bike Lane
- Access Point - Shared Use Path

Proposed Bicycle Facilities

- Bicycle Network Gap

Potential For Everyday Walking and Biking

MassDOT has conducted analyses for of the potential for everyday biking and walkable trips on non-interstate roadways in the commonwealth. The analyses present the potential for people to bike and walk for everyday trips if adequate accommodations are provided. A review of these two databases indicates that all non-interstate roadways within the Study Area have a medium potential for everyday biking and medium potential for walkable trips.

Active Transportation Demands

Pedestrian and bicycle volumes at Study Area intersections were counted as part of the traffic data collection effort conducted as part of a previous planning effort in the Newton Corner area and provided by MassDOT. The counts represent observed activity in a typical weekday (non-holiday) in a period when schools were in session.

Existing Pedestrian Volumes

The Existing Conditions pedestrian volumes for the weekday morning and weekday evening peak hours are presented in Figures 2-16 and 2-17, respectively. Pedestrian activity within the Study Area varies based on the immediate land uses, with the highest pedestrian activity seen on the north side of the Study Area along Washington Street westbound and Centre Street north of Washington Street, where the adjacent land use is mostly commercial including several ground-level shops and restaurants. During the weekday morning and weekday evening peak hours, over 100 pedestrians were observed to be walking along the sidewalk on the north side of Washington Street westbound in the vicinity of Bacon Street and Peabody Street.

As noted previously, there are four crosswalks located at pedestrian-activated traffic signals. Table 2-12 summarizes the peak hour pedestrian demand at these crosswalks.

Table 2-12 Peak Hour Volumes at Pedestrian-Activated Signalized Crosswalks

Crosswalk Location	Weekday AM Peak Hour	Weekday PM Peak Hour
Across Washington Street WB – east of Bacon Street	39	35
Across Washington Street WB – west of Peabody Street	73	59
Across Centre Avenue EB – east of Centre Street	14	6
Across Washington Street EB – west of Wash. St WB Bridge	0	6

Note: Peak hours pedestrian demands using the pedestrian-activated crosswalks in either direction.

Existing Bicycle Volumes

Bicycle activity within the Study Area is generally lower than vehicle and pedestrian activity due to the lack of dedicated bicycle accommodations. Based on the existing counts, all the roadways within the Study Area carry fewer than 10 bicyclists during the weekday morning and weekday evening peak hours. Existing bicycle volumes for the weekday morning and weekday evening peak hours are presented in Figures 2-18 and 2-19, respectively.

Figure 2-16: 2022 Existing Conditions Pedestrian Volumes - Weekday Morning Peak Hour

Newton Corner | Newton, Massachusetts

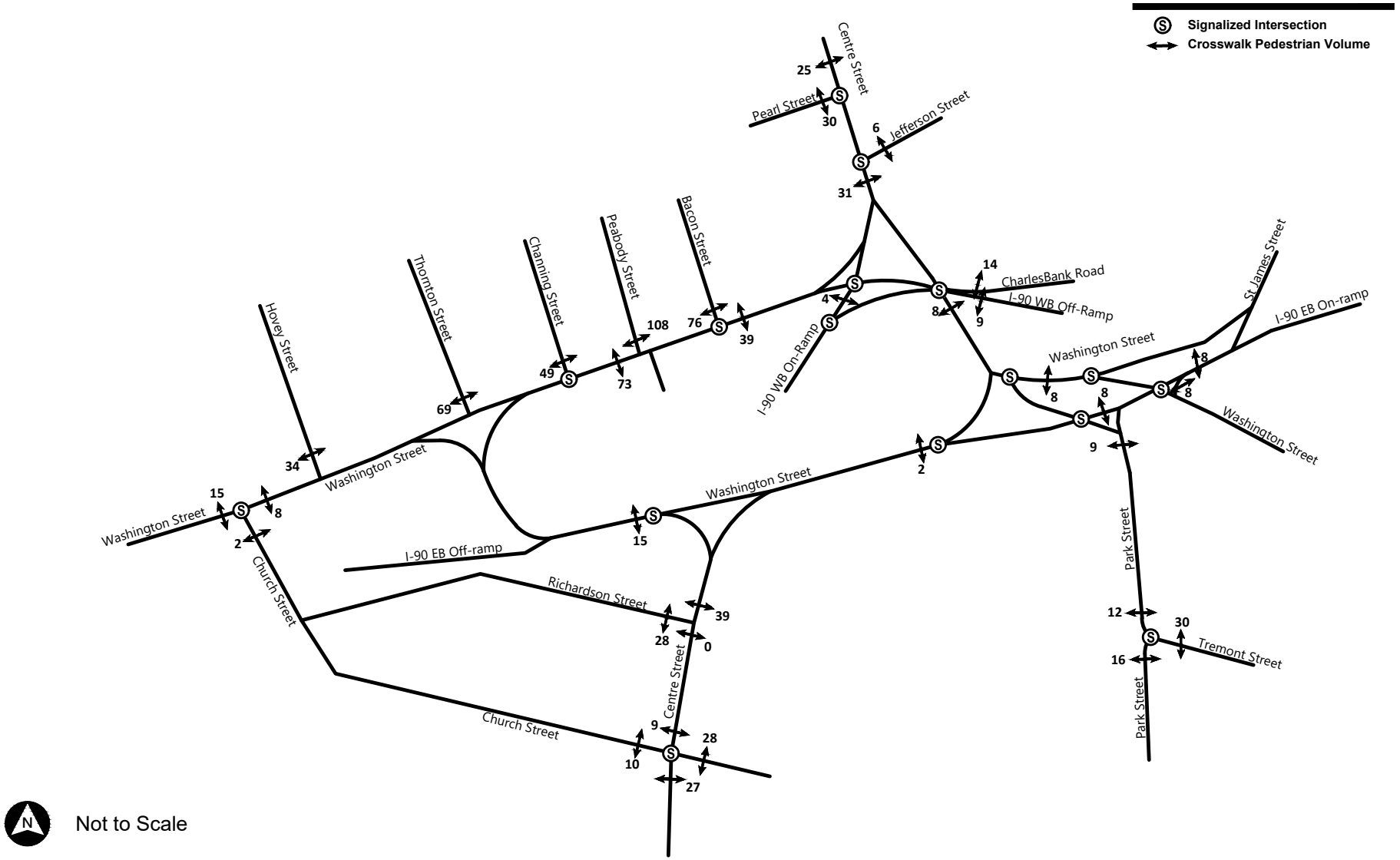


Figure 2-17: 2022 Existing Conditions Pedestrian Volumes - Weekday Evening Peak Hour

Newton Corner | Newton, Massachusetts

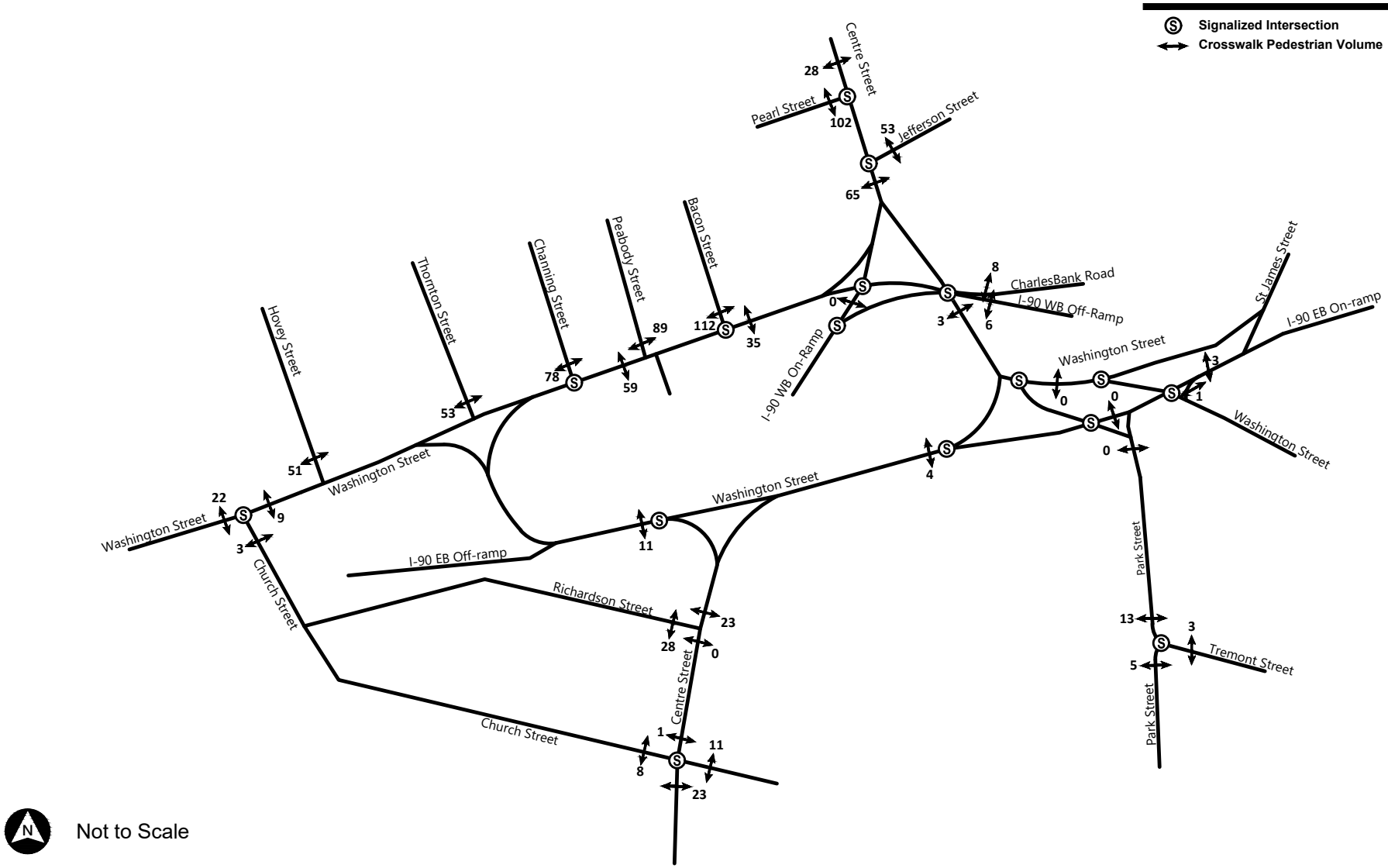


Figure 2-18: 2022 Existing Conditions Bicycle Volumes - Weekday Morning Peak Hour

Newton Corner | Newton, Massachusetts

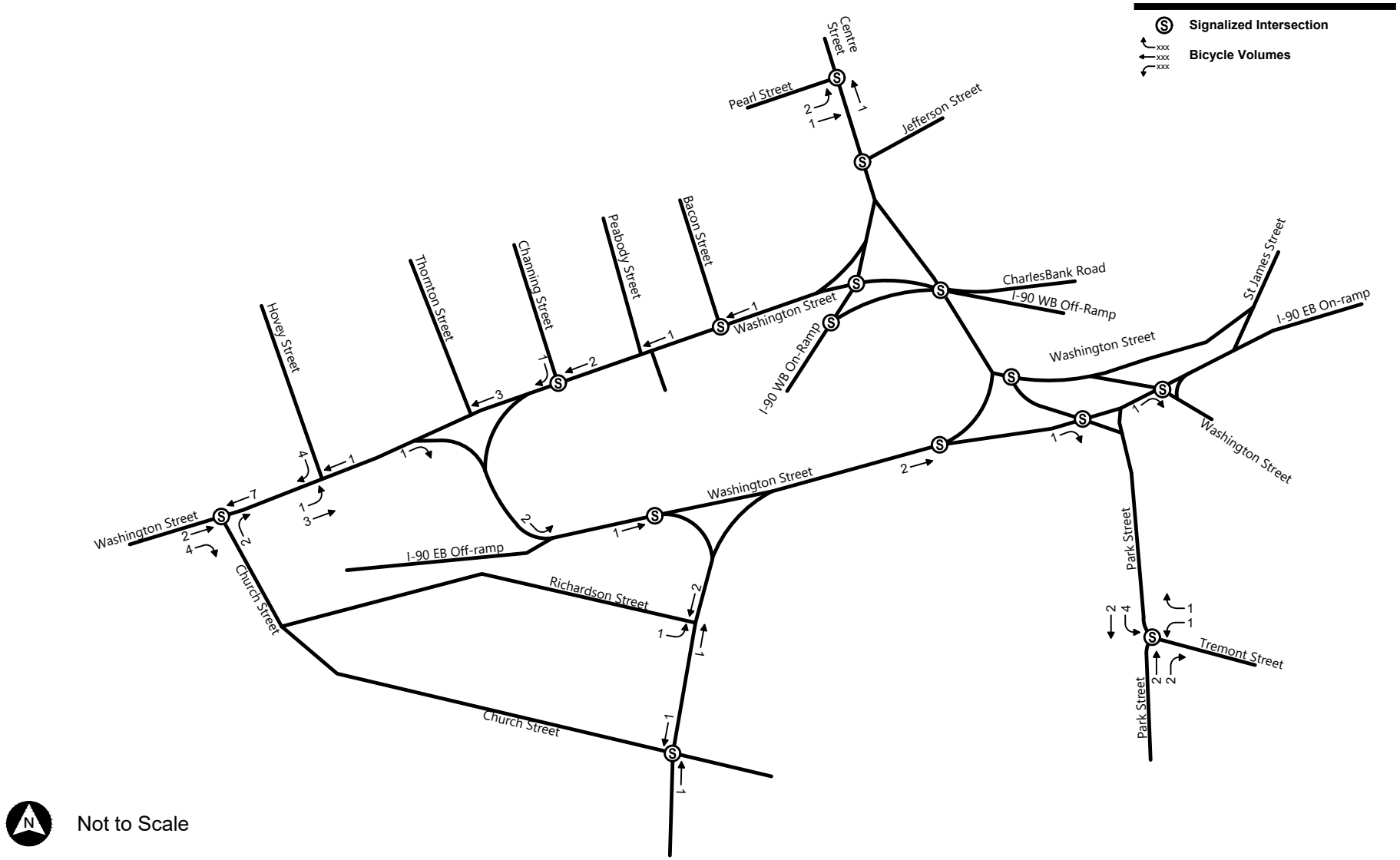
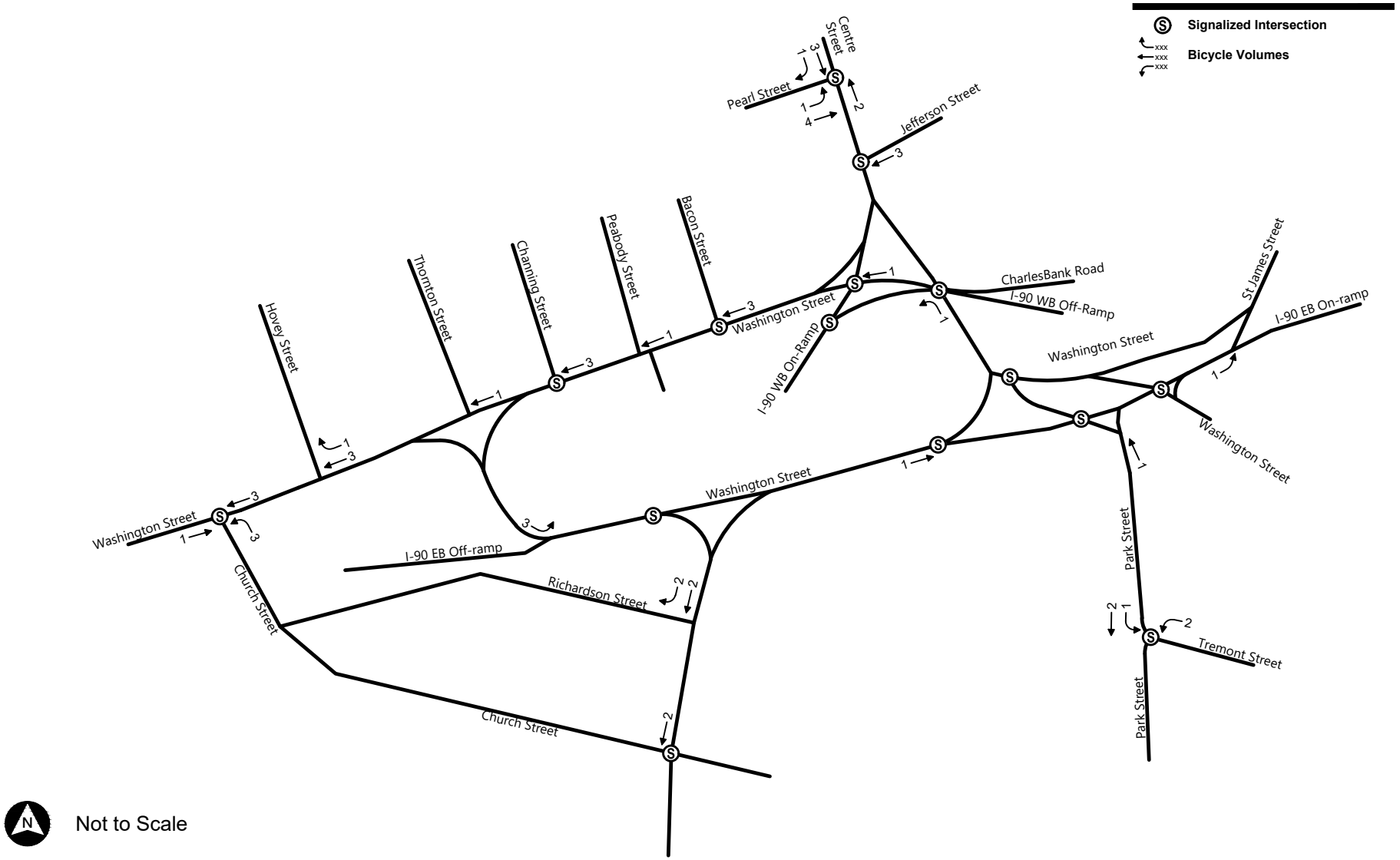


Figure 2-19: 2022 Existing Conditions Bicycle Volumes - Weekday Evening Peak Hour

Newton Corner | Newton, Massachusetts



Active Transportation Level of Traffic Stress Analysis

Bicycle and pedestrian level of traffic stress evaluations were completed along each Study Area roadway segment and intersection to understand the existing conditions for pedestrians and bicyclists traveling through the Study Area as it relates to comfort when using active transportation. The analyses were conducted using standard Bicycle Level of Traffic Stress (BLTS) and Pedestrian Level of Traffic Stress (PLTS) methodology[6].

Bicycle Level of Traffic Stress

BLTS analyses were conducted in 2022 with respect to street segments, unsignalized intersection crossings, and signalized intersection crossings within the Study Area. For BLTS analyses, each street segment or unsignalized intersection crossing is given a BLTS score 1 through 4. BLTS 1 indicates favorable conditions for bicycling suitable for all types of bicyclists, where the bicyclists are physically separated or among low speed, low volume traffic. In contrast, BLTS 4 indicates highly stressful conditions suitable for experienced bicyclists, where bicyclists are not sufficiently separated from high-speed traffic.

The BLTS analysis along street segments is presented below while the BLTS analyses through unsignalized street crossings and through signalized intersections are included in Appendix C.

BLTS along Street Segments

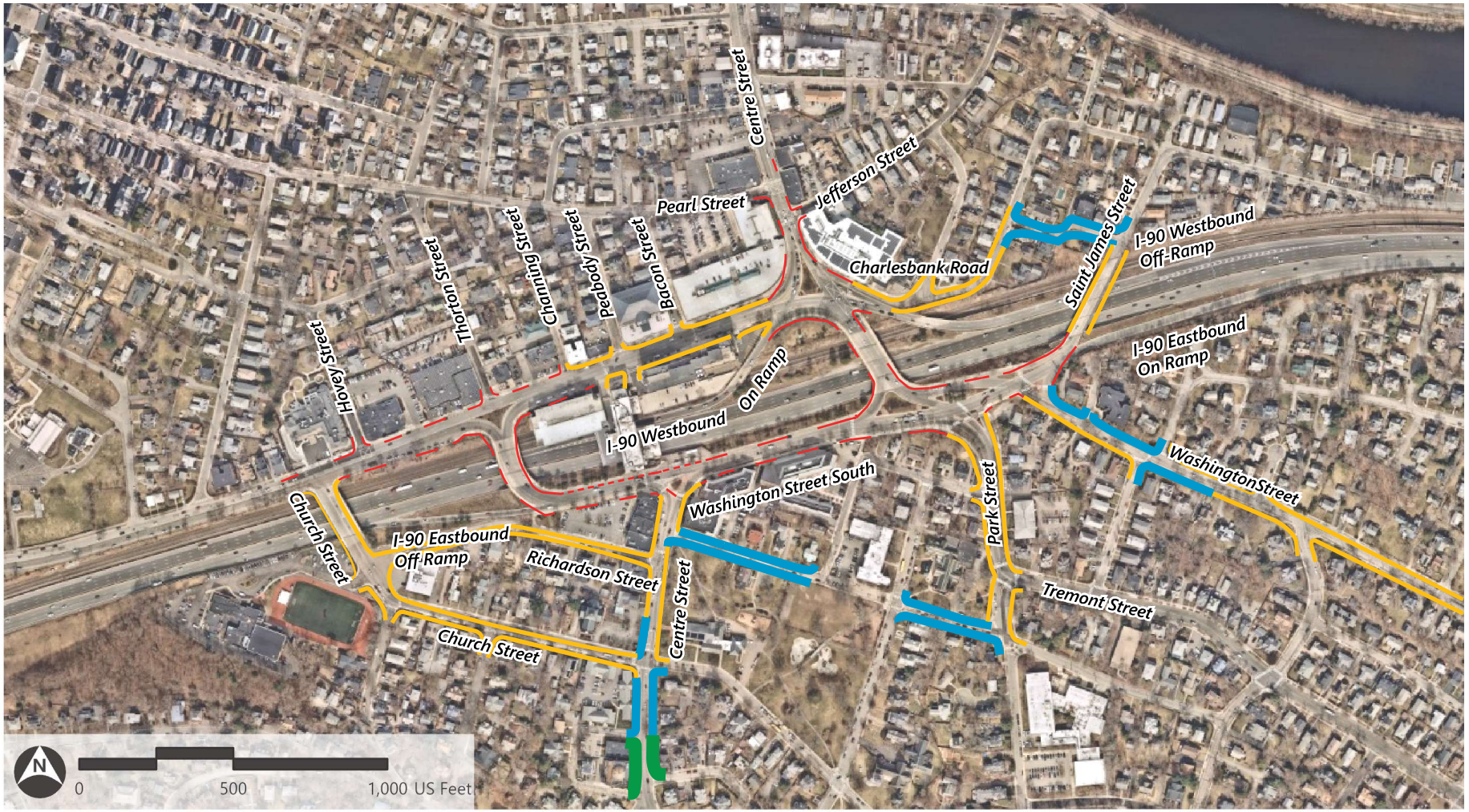
The analysis of bicycle facilities along street segments considers factors such as street width (through lanes per direction), bike lane plus parking lane width, speed limit or prevailing speed, and bike lane blockage. The results of the BLTS along street segments analysis for 2022 existing conditions is shown in Figure 2-20 with color-coded segments.

Under existing conditions, nearly all roadways within the Study Area are assigned as BLTS 3 or 4 indicating that the roadways represent stressful conditions suitable for experienced bicyclists only. BLTS 1 and 2 are only assigned to side streets in the Study Area with minimal traffic volumes and to certain segments of roadways where on-street bicycle lanes are provided (such as portions of Centre Street and Washington Street south of Newton Corner).

[6] BLTS and PLTS evaluations consistent with those used in the City of Somerville, based on methodologies set forth in the Mineta Transportation Institute (MTI) Report 11-19; Low-Stress Bicycling and Network Connectivity; Maaza Mekuria, Peter Furth, and Hilary Nixon; May 2012.

Figure 2-20: 2022 Existing Conditions - Bicycle Level of Traffic Stress

Newton Corner | Newton, Massachusetts



BLTS 1

BLTS 2

BLTS 3

BLTS 4

Source: Nearmap, MassGIS

Pedestrian Level of Traffic Stress

PLTS analyses were conducted in 2022 with respect to street segments and unsignalized street crossings within the Study Area. Each street segment or intersection crossing is given a PLTS score 1 through 4. PLTS 1 indicates favorable conditions for walking with wide and separated sidewalks. In contrast, PLTS 4 indicates high stress conditions where pedestrians are not sufficiently separated from high-speed traffic and/or are provided a sidewalk which is narrow or in poor condition.

The PLTS analysis along street segments is presented below while the PLTS analyses through unsignalized street crossings is included in Appendix C.

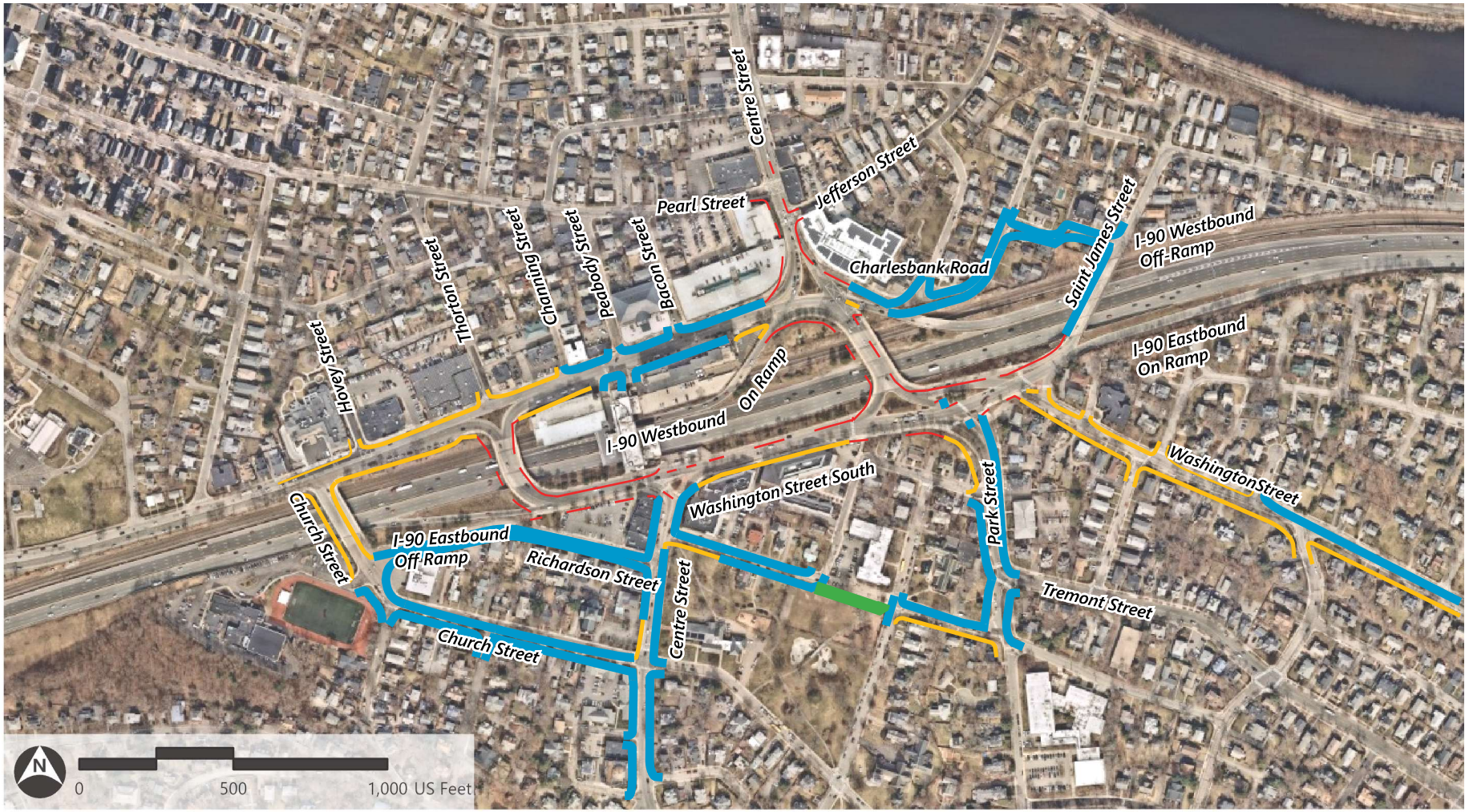
PLTS Along Street Segments

The analysis of pedestrian facilities along street segments considers factors such as sidewalk width and condition as well as buffer type and buffer width compared to the speed of adjacent traffic and width of the street. Under existing conditions, sidewalks within the Study Area range from an assigned PLTS 1 to PLTS 4. The sidewalks assigned the lowest levels of stress, PLTS 1 or PLTS 2, are generally located along side streets with lower traffic volumes (such as Charlesbank Road, Richardson Road, and Vernon Street) or along roadways with wide sidewalk widths and buffers (such as Park Street and Washington Street westbound between Centre Street and Channing Street). The sidewalks assigned the highest levels of stress, PLTS 3 or PLTS 4, are generally located along roadways with high traffic volumes and narrower sidewalks (such as Centre Avenue / Washington Street eastbound, Washington Street west of Thornton Street, and Centre Street north of Washington Street).

The results of the PLTS along street segments analysis for 2022 Existing conditions is shown in Figure 2-21 with color-coded segments.

Figure 2-21: 2022 Existing Conditions - Pedestrian Level of Traffic Stress

Newton Corner | Newton, Massachusetts



PLTS 1

PLTS 2

PLTS 3

PLTS 4

Source: Nearmap, MassGIS

Environmental

A review of environmental conditions was conducted to understand the existing environmental constraints of the project area. The assessment is based on a desktop review of known resources using available geospatial data from the State of Massachusetts (MassGIS) and aerials of the Project limits. The assessment includes a review of existing environmental resources within/proximate to the study area, the anticipated environmental permitting requirements for the proposed improvement project, and any potential impacts the recommended alternatives will have on the environmental resources. A memorandum detailing the environmental assessment is included in Appendix C to this report.

Provided below is a summary of the existing environmental resources review:

- No federal or state regulated wetland areas were identified within the limits of or in any area proximal to the project limits. No permits will need to be filed with the Newton Conservation Commission or the Massachusetts Department of Environmental Protection (DEP).
- Two open space parcels that are jurisdictional under Article 97 are present within the project limits.
- A review of the 2017 Massachusetts Natural Heritage Atlas has shown there are no areas of state-regulated Priority or Estimated Habitat, or Certified or Potential Vernal Pools within the project limits. The U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Conservation (IPaC) lists potential habitat for northern long-eared bat, requiring coordination with USFWS under the Endangered Species Act.
- While no portions of the project limits are within an identified Environmental Justice (EJ) community, there are fifteen census block groups located within a one-mile radius of the study area.
- The Project will require coordination with the MassDOT Environmental Services Cultural Resources Unit (CRU) with the anticipated impacts to the adjacent historic districts and to ensure other areas are avoided.
- If federal funding is received, the Project will need to undergo National Environmental Policy Act (NEPA) review. The Project likely qualifies for a Programmatic Categorical Exclusion (CE).

3

Future Conditions

This chapter provides an assessment of Future Conditions within the Study Area prior to implementation of the alternative changes, including future traffic volumes, transit services and operations, and pedestrian and bicycle accommodations. To determine future roadway operations, traffic volumes in the Study Area were projected ten years into the future, to the year 2032. Designing for a ten-year design horizon provides a medium-term outlook of future demands within the study area and ensures that the proposed design of the roadways will be sustainable beyond the immediate future.

Future Conditions Key Takeaways

- Traffic volumes are expected to grow, and congestion is expected to increase over the next ten years as several new developments in Newton, Watertown, and Brighton are constructed and occupied.
- The Newton Corner area will continue to be a bus transit hub serving the neighborhood after the MBTA implements the Bus Network Redesign plan between 2024 and 2029, consolidating the current eight bus routes down to six.
- There are no current plans beyond this study to improve pedestrian and bicycle connectivity through the Newton Corner area, even though this desire will continue to grow as new developments are constructed.

Future Traffic Growth

Traffic volumes on the roadway network under future conditions are assumed to include all existing traffic, any new traffic due to regional and area background traffic growth, and traffic related to any specific nearby development projects expected to be completed by the 2032 future horizon year. Roadway and transit improvements proposed within the boundaries of the Study Area were also considered and incorporated where appropriate.

Methodology

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in local and regional demographics. To calculate future traffic growth, analysis commonly involves estimating historic annual percentage increases in traffic volumes and applying this percentage to study area traffic volumes. Additional analysis methods involve estimating traffic expected to be generated by specific planned major developments that would affect traffic volumes on the Study Area roadways. For this assessment, both methods were used to present a conservative, balanced analysis.

Regional Traffic Growth

Historic count data in the region was reviewed to establish a rate at which traffic volumes can be expected to grow. Table 3-1 provides a review of the annual change in average annual daily traffic (AADT) volumes on I-90 east and west of the Exit 127 interchange between 2018 and 2022.

Table 3-1 Annual Change in Daily Traffic Volumes

Year	I-90 west of Newton Corner [1]	I-90 east of Newton Corner [2]
2017 to 2018	+ 1%	+ 1%
2018 to 2019	+ 1%	+ 2%
2019 to 2020	- 34%	- 35%
2020 to 2021	+ 24%	+ 25%
2021 to 2022	+ 8%	+ 9%
Average Annual Change	**+ 0.0%**	**+ 0.4%**

1 Data from MassDOT Permanent Count Station AET 11 located on I-90 west of the Exit 127 interchange.
2 Data from MassDOT Permanent Count Station AET 12 located on I-90 east of the Exit 127 interchange.

As shown, traffic volumes on I-90 east of the Exit 127 interchange have increased by an annual rate 0.4 percent over the last five years while volumes west of Exit 127 Interchange remain unchanged. This includes a large decrease in traffic in 2020 due to the impacts of the COVID-19 pandemic as well as a significant increase in traffic in 2021 and 2022 as traffic volumes rebounded. Based on this research, to present a conservative analysis, a growth rate 0.5 percent per year for ten years has been assumed for this study to grow the existing traffic volumes from 2022 to 2032.

Site-Specific Growth

The project team also reviewed current and proposed development projects in the City of Newton as well as in nearby Boston and Watertown to develop a comprehensive list of development projects that should be considered in traffic growth projections for planned or approved developments in and around Newton Corner. Projected traffic volumes expected to be generated by each development were obtained from the published traffic studies associated with each development or projected by the project team based on the Institute of Transportation Engineers' (ITE) *Trip Generation Manual*. Some smaller developments identified in each community were assumed to be included in the analysis as part of the regional background growth.

Based on a review of nearby planned/approved developments, 24 planned development projects were identified within the vicinity of the Study Area that should be considered as part of the background development. These 24 development projects are identified in Figure 3-1 and are described in more detail in Appendix C.

Future Traffic Volumes

The resulting 2032 Future Conditions traffic volume networks for the weekday morning and weekday evening peak hours are presented in Figures 3-2 and 3-3, respectively.

Figure 3-1: Background Development Projects

Newton Corner | Newton, MA

Legend

- Background Development
- Study Area

Planned/Approved Developments

1. 36-48 Crafts Street
2. 1151-1185 Washington Street
3. 1314 Washington Street
4. West Newton Armory Redevelopment
5. 15 Riverdale Avenue
6. 46-68 Austin Street
7. 967 Washington Street
8. 386 Watertown Street
9. 75 Tremont Street
10. 66 Galen Street
11. 148 Waltham Street
12. 85 Walnut Street
13. 705 Mt Auburn Street
14. 23 Elm Street
15. 99 Coolidge Avenue
16. Arsenal Yards
17. One Arsenal Marketplace
18. Arsenal on the Charles expansion
19. 202 Arsenal Street
20. 313 Pleasant Street
21. 560 Pleasant Street
22. Watertown Mall Redevelopment
23. 104-126 Main Street
24. 64 Pleasant Street

Source: Nearmap

Figure 3-2: 2032 Future Conditions Traffic Volumes - Weekday Morning Peak Hour

Newton Corner | Newton, Massachusetts

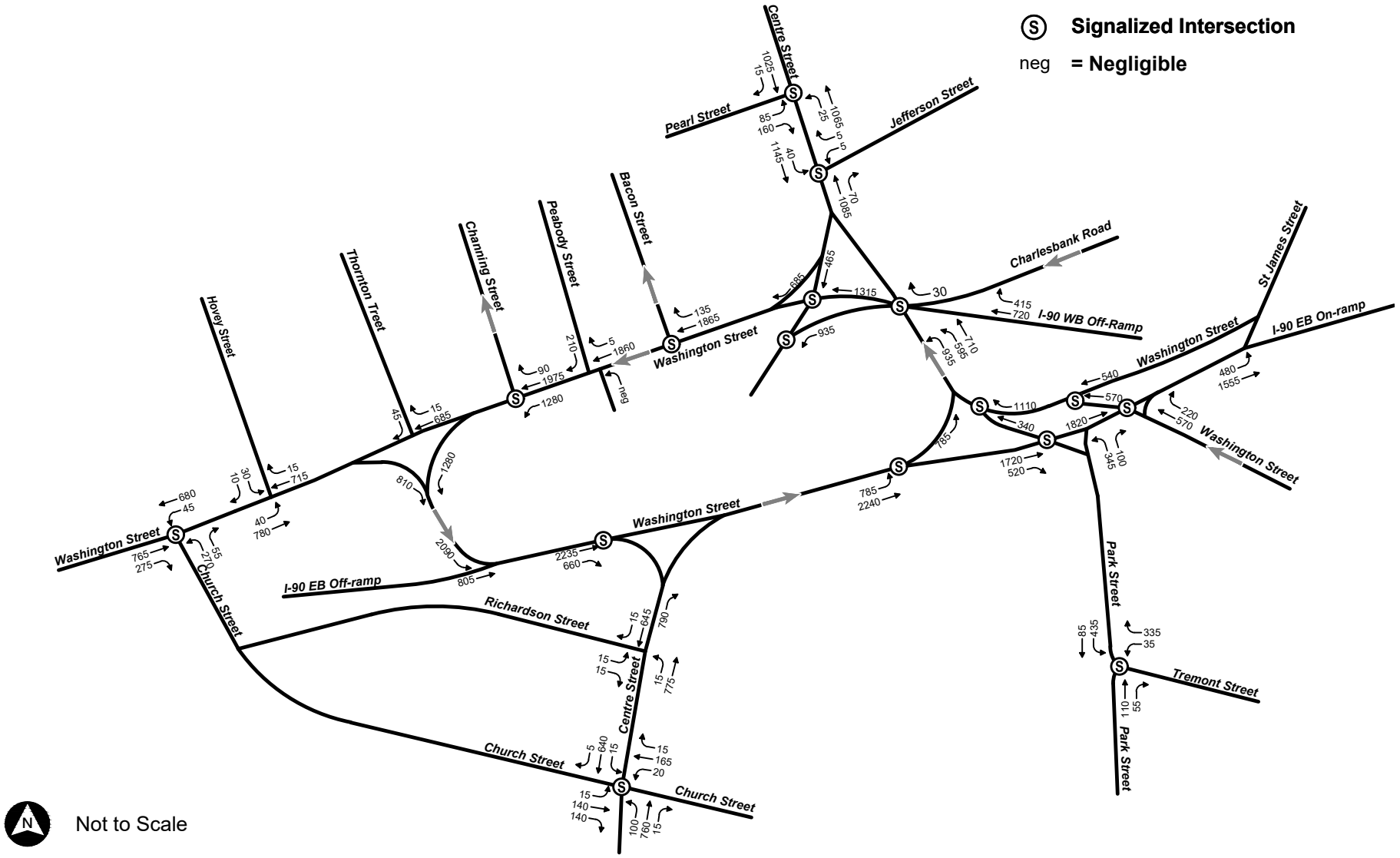
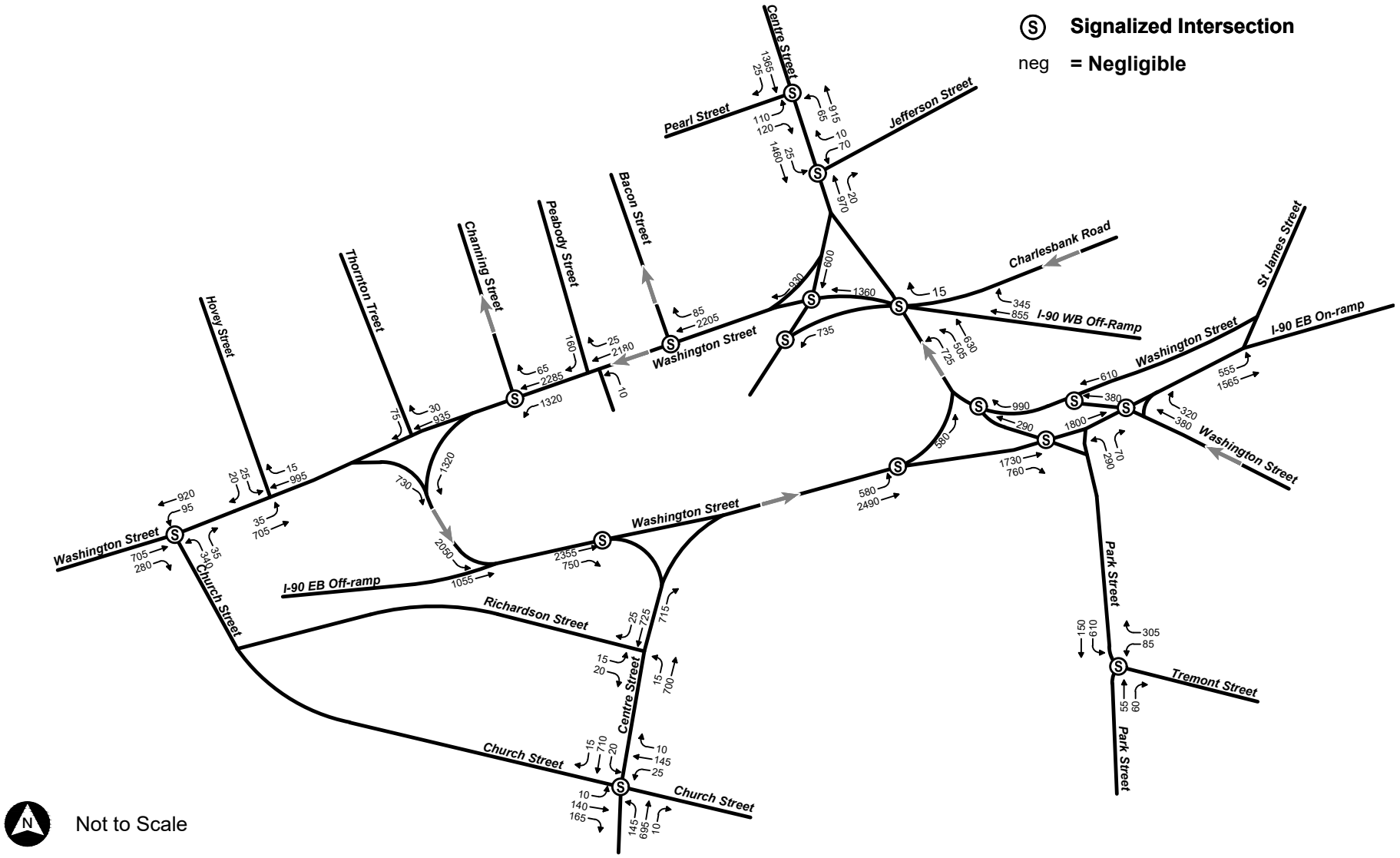


Figure 3-3: 2032 Future Conditions Traffic Volumes - Weekday Evening Peak Hour

Newton Corner | Newton, Massachusetts



Future Transportation Network

The following sections describe the proposed future changes to the vehicle, transit, and active transportation networks independent the Newton Corner Improvements Project.

Roadway Improvements

In assessing future traffic conditions, proposed roadway improvements within the Study Area were considered. Based on information available from MassDOT and the City of Newton, there are no additional projects planned that are expected to impact the roadway network in the vicinity of Newton Corner. The City of Newton is currently undergoing design of a Washington Street Pilot, a pilot road diet of the Washington Street corridor, consistent with the City's Washington Street Vision Plan. The limits of the pilot project are outside of the study area for this mid-term planning study, and therefore, not reflected in future conditions.

As part of this study, several short-term alternatives were identified and reviewed, and the recommended short-term alternatives were implemented in Fall 2024. It should be noted that these short-term improvements are not included in the Future No Build Conditions, as they were not planned or in design at the time this analysis was conducted. A summary of the short-term alternative development is described in Chapter 4, *Alternatives Development*.

Transit Improvements

In addition to roadway improvements, the study team also reviewed proposed and planned public transit improvements in the Study Area. Based on information available from MBTA and the City of Newton, the following transit improvement is expected to be in place by 2040.

MBTA Bus Network Redesign

The MBTA's Bus Network Redesign is an initiative to update MBTA bus service and routing to better match the shifting demographics and travel patterns in Greater Boston. The plan is designed to prioritize transit-critical communities while responding to the changing needs of the region.

In November 2022, the MBTA released an updated Bus Network Redesign based on feedback from MBTA riders. In the proposed plan, Routes 52, 57, and 501 service remain relatively unchanged, though Route 57 is to be named Route T57. Route 504 is proposed to travel a different path in the outbound direction, no longer making a full loop around the Newton Corner interchange but instead continuing from the turnpike straight on to Galen Street. Proposed Routes 56 and 58 are to pass through the Study Area, both providing service between Market Place Drive in Waltham and Watertown. These routes will provide service to the west from Newton Corner to balance the proposed removal of service Routes 553, 554, 556, and 558.

The MBTA Board of Directors approved the final proposal for the Bus Network Redesign in Winter 2022 and the final report was published in Spring 2023. Implementation is expected to occur in several phases from 2024 to 2029. Phase 1 will begin in December 2024 but will not impact any bus routes within the Study Area. The future conditions modeling reflects the proposed bus routes and headway times in Bus Network Redesign.

Pedestrian/Bicycle Improvements

In assessing future traffic conditions, proposed pedestrian and bicycle infrastructure improvements within the Study Area were considered. Based on information available from MassDOT and the City of Newton, there are no additional proposed or planned projects expected to impact the pedestrian and bicycle network in the vicinity of Newton Corner.

Future Transportation Analyses

The following sections discuss the future conditions transportation analyses, including intersection capacity analyses, Vissim simulation analyses, and traffic signal warrant evaluation analyses. The same methodology as described in Chapter 2, *Existing Conditions*, was used to conduct the intersection capacity analyses and Vissim simulation analyses and the signal warrant evaluation methodology is presented later in this section.

Intersection Capacity Analysis

Capacity analyses were conducted at the Study Area intersections to assess operations under the future conditions for 2032. Like the Existing Conditions analyses, these analyses were conducted using Synchro 11 software consistent with MassDOT guidelines. Full summaries of the operations and measures of effectiveness for each movement at each Study Area intersection are included in Appendix C and the capacity analysis worksheets are included in Appendix E.

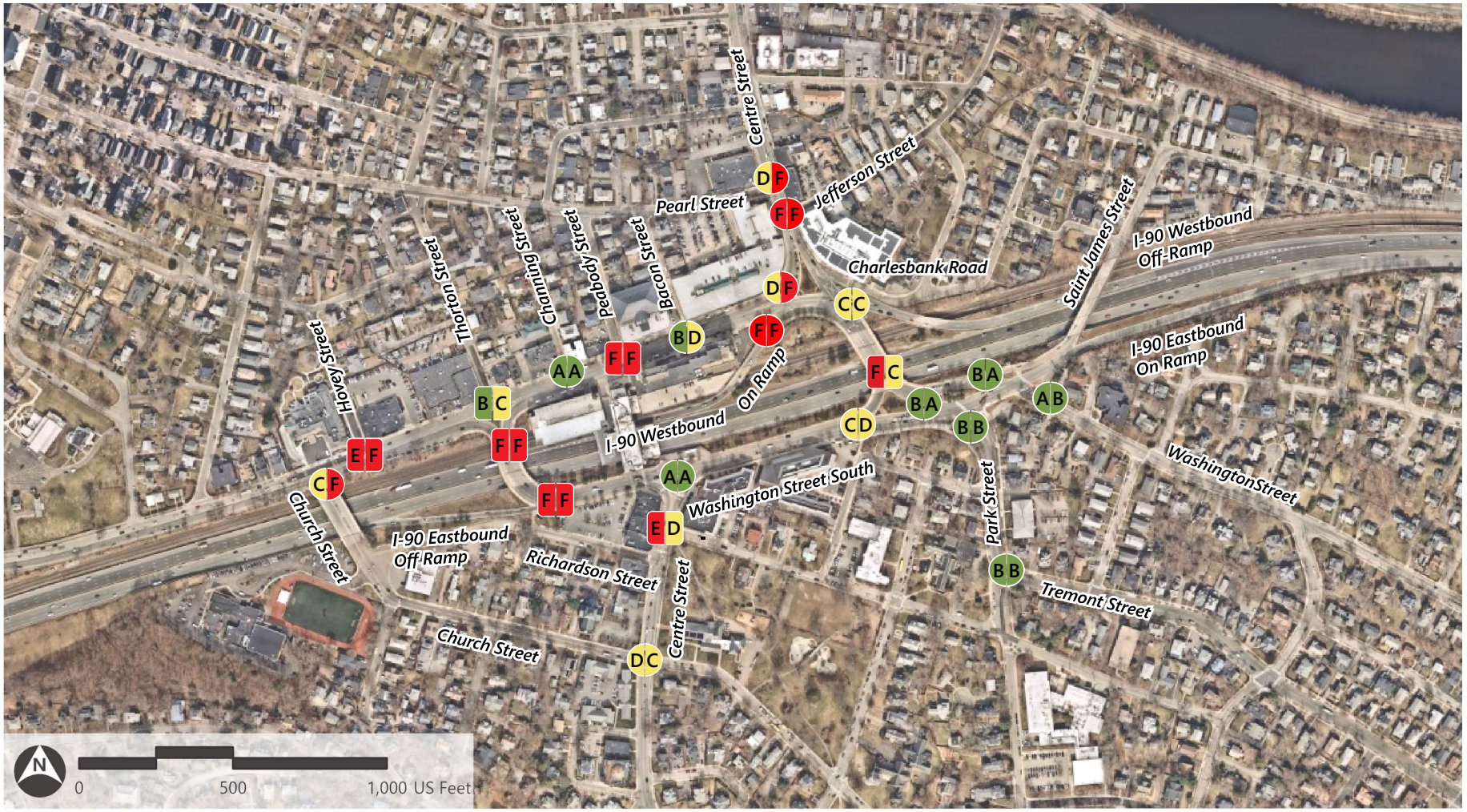
Level of Service

Figure 3-4 summarizes the overall level of service for the Study Area intersections under future conditions for the weekday morning and weekday evening peak hours. The overall LOS of intersections are expected to generally be lower under future conditions than under existing conditions due to the general growth in traffic volumes traveling through Newton Corner. The primary difference between existing and future conditions is that the following four intersections will degrade to LOS F during at least one weekday peak hour period by 2032:

- The signalized intersection of Washington Street at Church Street is expected to drop from overall LOS C to LOS F during the weekday evening peak hour.
- The signalized intersection of Washington Street WB at Centre Street SB is expected to drop from overall LOS C to LOS F during the weekday evening peak hour.
- The unsignalized southbound right/left-turn movement from Hovey Street onto Washington Street is expected to drop from LOS E to LOS F during the weekday evening peak hour.
- The unsignalized eastbound left-turn movement from Washington Street eastbound onto the Washington Street westbound bridge is expected to drop from LOS C to LOS F during the weekday morning peak hour.

Figure 3-4: Future Conditions Intersection Overall Level of Service

Newton Corner | Newton, Massachusetts



Signalized Intersections		Unsignalized Intersections	
LOS AM	LOS PM	LOS AM	LOS PM
A,B	A,B	A,B	A,B
C,D	C,D	C,D	C,D
E,F	E,F	E,F	E,F

Source: Nearmap, MassGIS

Vissim Simulation Analysis

The Vissim model update was completed for the Study Area to assess operations under the future no-build conditions for 2032, prior to the implementation of alternatives discussed and evaluated in future chapters. The vehicular volumes and patterns were updated to reflect future 2032 conditions. Full summaries of the operations and measures of effectiveness for each movement at each Study Area intersection and the capacity analysis worksheets are included in Appendix C.

Similar to the results of the intersection capacity analysis, overall LOS of intersections are expected to generally be lower under future conditions than under existing conditions due to the general growth in traffic volumes traveling through Newton Corner. The primary difference between existing and future conditions is that the following four intersections will degrade to LOS F during at least one weekday peak hour period by 2032:

- The signalized intersections of Washington Street at Church Street is expected to drop from overall LOS C to LOS F during the weekday evening peak hour.
- The signalized intersection of Washington Street WB at Centre Street SB is expected to drop from overall LOS C to LOS F during the weekday evening peak hour.
- The unsignalized southbound right/left-turn movement from Hovey Street onto Washington Street is expected to drop from LOS E to LOS F during the weekday evening peak hour.
- The unsignalized eastbound left-turn movement from Washington Street eastbound onto the Washington Street westbound bridge is expected to drop from LOS C to LOS F during the weekday morning peak hour.

Pedestrian and Bicycle Level of Traffic Stress

As noted previously, there are no proposed improvements to the pedestrian and bicycle network from the existing conditions independent from this project. Therefore, the levels of traffic stress for pedestrians and bicyclists are not expected to improve from the levels reported under the Existing Conditions presented in Chapter 2, *Existing Conditions*.

4

Alternatives Development

This chapter details the development of alternatives to address the issues and deficiencies identified in previous chapters and meet the goals and objectives of the Study.

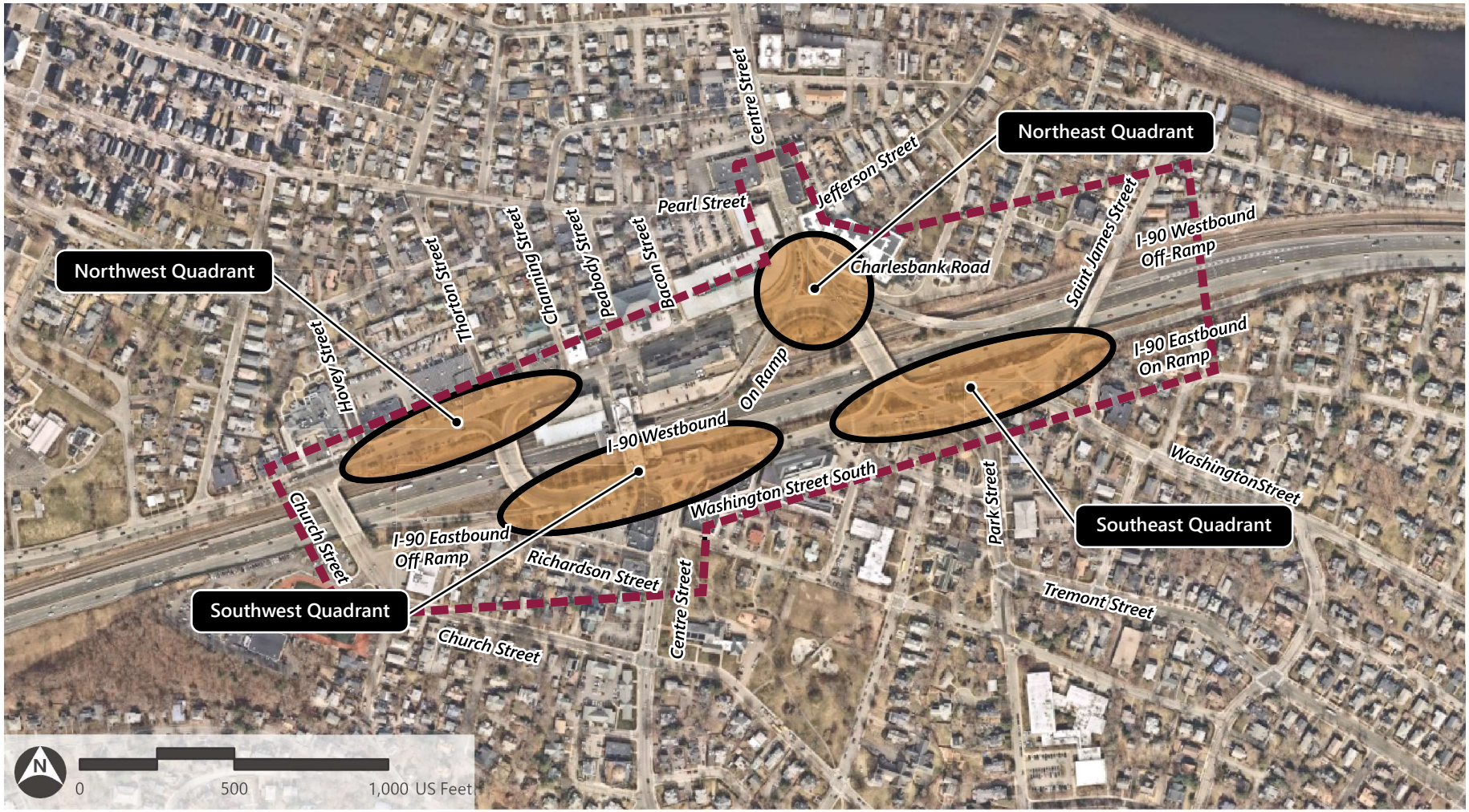
Alternatives Development Key Takeaways

- Alternatives generally fell into two categories: Short-term improvements achievable within one or two years, and mid-term improvements achievable within five to ten years.
- A total of **7 short-term alternatives** were identified and evaluated. As the need became apparent for immediate solutions to improve safety, the short-term improvements project was separated from this study as an independent project through MassDOT District 6 with improvements being implemented in Fall 2024.
- A total of **35 mid-term alternatives** were identified and evaluated during the Alternatives Development phase, with significant input from key stakeholders, including members of the public. Cut sheets for each of these alternatives are provided in Appendix A.
- Mid-term alternatives were screened and evaluated based on a set of key evaluation criteria, which included alignment with Study goals and objectives and technical design control and evaluation criteria.
- In total, 11 mid-term alternatives across the four Study Area quadrants were advanced to the Alternatives Analysis phase.

Prior to the development of any alternatives, the Study Area was broken up into four quadrants, as shown in Figure 4-1. Each of these quadrants is comprised of a major intersection within the study area and its adjacent roadways and intersections. Alternatives were developed independently for each quadrant.

Figure 4-1: Study Area Quadrants

Newton Corner | Newton, Massachusetts



Study Area

Source: Nearmap, MassGIS

Alternatives generally fell into two categories: short-term and mid-term improvements. Short-term alternatives were generally considered to be low cost, quickly implementable solutions to enhance mobility, accessibility, operations and/or safety. Examples of short-term alternatives include traffic signal timing adjustments and optimization and striping and signage modifications. The results of the RSA were used to help develop the potential short-term alternatives. Short-term alternatives were generally considered to be improvements that would be constructed within the next 1-2 years.

Mid-term alternatives were generally considered to include more complex safety and operational considerations such as potential geometric and traffic control modifications, advanced signal systems, lighting and landscaping, enhanced pedestrian, bicycle, and transit accommodations, and modifications to abutter access and egress. Mid-term alternatives would likely be constructed within the next 5-10 years.

This study does not include the development of high-impact/long-term alternatives, such as those that could include significant modification or potential elimination of connections to I-90, major right-of-way modifications (including the acquisition of full parcels and/or buildings), or major modifications to, or new bridge structures over, I-90. As previously stated, a separate planning study is being led by the MassDOT Office of Transportation Planning that considers long-term changes to improve safety, congestion, mobility, and access along the I-90 corridor between West Newton and Brighton.

Short-Term Alternatives

As the short-term alternatives concepts were developed, it became clear that a major issue impacting safety and operations in Newton Corner is the queue on the I-90 Eastbound Off-Ramp. The queue frequently extends back onto the I-90 mainline, creating a major operational and safety issue. Early on in this study process MassDOT expressed their desire for short-term alternatives that would help to alleviate this issue. The short-term alternatives were pulled out of this study to be further developed through MassDOT District 6 and were recently implemented.

Alternatives Development

As part of alternatives development, 5 distinct short-term alternatives were created focusing on the I-90 Eastbound Off-Ramp in the Southwest Quadrant. Preliminary drawings of each alternative are provided in Appendix D:

- **Alternative 1A:** Extend the I-90 Eastbound Off-Ramp to the signalized intersection of Centre Avenue at Centre Street, with the existing Centre Avenue four-lane cross-section converted to two-lanes for the Centre Avenue approach and two-lanes for the I-90 Eastbound Off-Ramp approach with a median dividing the two approaches, as illustrated in Figure 4-2. **This alternative was chosen to advance** as it would improve safety and operations on the I-90 Eastbound Off-Ramp by eliminating a weaving segment on Centre Avenue and reducing the queue on the off-ramp and thereby limiting the frequency in which the queue extends back onto the I-90 mainline.

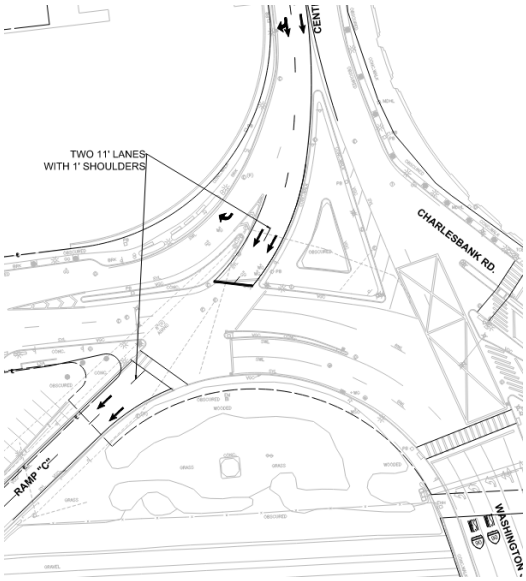
Figure 4-2 Southeast Quadrant Short-Term Alternative 1A Concept Plan

- **Alternative 1B**: Add yield markings at the end of the I-90 Eastbound Off-Ramp. **This alternative was discarded** as it would not improve safety or operations on the off-ramp and would not help with the issue of the queue on the off-ramp extending back onto the I-90 mainline.
- **Alternative 1C:** Restripe the Washington Street eastbound bridge as two lanes and add yield markings at the end of the I-90 Eastbound Off-Ramp. **This alternative was discarded** as it would not improve safety or operations on the off-ramp and would not help with the issue of the queue on the off-ramp extending back onto the I-90 mainline.
- **Alternative 1D**: Shift the stop bar forward at the end of the I-90 Eastbound Off-Ramp. **This alternative was discarded** as it would not improve safety or operations on the off-ramp and would not help with the issue of the queue on the off-ramp extending back onto the I-90 mainline.
- **Alternative 1E**: Add yield markings at the end of the I-90 Eastbound Off-Ramp and restripe the Centre Street northbound approach as two lanes. **This alternative was discarded** as it would not improve safety or operations on the off-ramp and would not help with the issue of the queue on the off-ramp extending back onto the I-90 mainline.

Two additional short-term concepts were also developed focused on "low-hanging fruit" that could easily be completed to improve safety and operations in other areas of Newton Corner:

- In the Southeast Quadrant of Newton Corner, restripe the pavement marking and update the traffic signal equipment. **This alternative was chosen to advance** as it can relatively easily be implemented in tandem with Alternative 1A listed above with minimal impacts.
- In the Northeast Quadrant of Newton Corner, restripe the Centre Street southbound approach as two lanes heading onto the I-90 Westbound On-Ramp and update the traffic signal equipment, as illustrated in Figure 4-3. **This alternative was chosen to advance** as it can relatively easily be implemented in tandem with Alternative 1A listed above with minimal impacts.

Figure 4-3 Northeast Quadrant Short-Term Alternative Concept Plan



In addition to the alternatives presented above, the short-term improvements include signal equipment upgrades, signal timing and/or coordination adjustments, and installing backplates on signals for better visibility throughout the Newton Corner interchange.

Short-Term Immediate Safety Improvements

From the alternative development, a preferred short-term safety and improvement plan was identified that incorporates Alternative 1A for the Southwest Quadrant with the identified improvements for the Southeast and Northeast Quadrants. As the need became apparent for immediate solutions to improve safety, these short-term improvements were separated from this study to become an independent project that could be implemented prior to the completion of this report. In 2023, the Newton Corner Immediate Safety Improvement project was initiated by MassDOT District 6. As part of the independent project, a traffic operations memo was developed documenting the operational improvements associated with the immediate safety improvements, which is included in Appendix D.

The Newton Corner Immediate Safety improvements were implemented in Fall 2024 by MassDOT District 6 using maintenance funds. As the short-term improvements have been designed and implemented as a separate effort, the rest of this report focuses exclusively on potential mid-term alternatives.

Mid-Term Alternatives Screening Process

The analysis of existing and future conditions and the identification of issues, opportunities, and constraints led the project team to identify a range of improvements in the Study Area that are referred to as 'alternatives'. Improvements were first suggested during internal discussions with MassDOT and City of Newton staff and later presented to the public through public outreach. Feedback was collected from MassDOT, City of Newton staff, and members of the public to screen alternatives and identify those that best aligned with Study goals and objectives and were within the proposed project scope. The alternatives ultimately recommended for advancement were developed into preferred concepts.

Evaluation Criteria

Based on the established Study goals, evaluation criteria were developed for scoring and ranking how the improvements and alternatives are addressing the six goals & objectives for the Study. Evaluation criteria are presented in Table 4-1 below.

Table 4-1 Study Goals and Evaluation Criteria

Goal	Evaluation Criteria
Enhance Safety	Potential for crash reductions
Improve Traffic Operations & Reduce Congestion	Improved vehicle travel times & operations
Improve Transit	Improved transit travel times & operations Improved bus stop quality & location
Expand Multimodal Infrastructure	Improved connectivity / access for pedestrians Improved connectivity / access for bicyclists
Property Access & Parking	Minimize impacts to businesses
Land Use / Placemaking	Improves connections to local land use Provides opportunities for placemaking

Alternatives Development Process

The development of alternatives followed the following three-step process:

- **Idea Generation:** From the outset of the study, MassDOT and the study team solicited feedback on improving Newton Corner from the public and stakeholders. The first public meeting held on September 28, 2022, included breakout sessions where project team members collected feedback from members of the public through an online Mural board identifying existing deficiencies in the Study Area and presenting potential ideas to improve mobility and safety. Additional feedback and ideas from the public were collected via subsequent public meetings and email throughout the course of the Study.

- **Idea Synthesis:** The project team combined this feedback with the analysis of existing and future conditions to generate 7 unique short-term improvement ideas and 35 unique mid-term improvement ideas.
- **Idea Vetting:** Working collaboratively with MassDOT, MBTA, and City of Newton staff, the project team conducted an initial screening of improvement ideas to eliminate options that are outside of the scope of work (e.g., outside the Study Area, had significant right-of-way impacts, etc.), do not address the Study's goals or objectives, or are infeasible.
  - The 7 short-term improvement ideas were narrowed down to 1 improvement option. As the need became apparent for immediate solutions to improve safety, the short-term project was separated from this study as an independent project through MassDOT District 6 with improvements being implemented in Fall 2024 through maintenance funds.
  - 24 mid-term improvement ideas were eliminated from consideration in this study. As appropriate, some of these improvement ideas could be revisited as part of the Long-Term Newton Corner Study to determine if further evaluation is warranted.
  - 11 mid-term improvement ideas were advanced as study alternatives for further analysis and public input, as discussed further in this chapter. The following sections present the alternatives and discusses why each alternative was either discarded or advanced.

Mid-Term Alternatives

Mid-term alternatives were developed independently for each of the four study area quadrants. The preferred alternatives were modeled together in a later stage to identify design considerations as the projects moves forward. Table 4-2 presents the number of mid-term alternatives developed for each quadrant and how many alternatives for each quadrant were selected to be advanced to the alternative stage and how many were eliminated. The initial alternatives were developed as high-level concepts to determine the feasibility of each idea. The alternatives were not designed to a detailed engineering-level that would be ready for construction, and future design processes will ensure that all proposed concepts meet Federal, MassDOT and City of Newton design and accessibility standards.

Table 4-2 Mid-Term Alternatives Development Summary by Quadrant

Quadrant	Total Alternatives Developed	Alternatives Advanced	Alternatives Discarded
Northeast Quadrant	6	3	3
Northwest Quadrant	5	2	3
Southwest Quadrant	9	2	7
Southeast Quadrant	15	4	11
Total	35	11	24

The following sections present the key challenges and deficiencies and summarize the different alternatives developed for each quadrant. Common themes across the four Study Area Quadrants include:

- Inadequate pedestrian and bicycle facilities;
- Existing roadway geometry that creates weaving conflicts;
- Inadequate storage capacity on roadways that creates congestion and backups; and
- Signal and signage issues.

Additional details for each alternative developed for each quadrant are provided in Appendix A. Detailed explanations of the alternatives selected for further alternatives analysis are presented in Chapter 5, *Alternatives Analysis*.

Northeast Quadrant

Challenges and Deficiencies

The northeast quadrant is centered on the intersections of Washington Street westbound at Centre Street and the I-90 Westbound Ramps. Under existing conditions, all approaches in the quadrant are under signalized control. Current deficiencies within this quadrant are focused on vehicle congestion and a lack of pedestrian and bicycle accommodations. The Centre Street southbound approach frequently experiences long queues at this quadrant, part of which is due to backups on the I-90 Westbound on-ramp when the I-90 westbound mainline is congested. While the current Centre Street southbound approach to the I-90 Westbound on-ramp currently consists of a single lane, drivers are frequently observed treating this as a two-lane approach.

Photo 4.1: Vehicles traveling northbound from Washington Street westbound onto Centre Street (view looking north)

As with the other quadrants in the Study Area, pedestrian and bicycle facilities are deficient. Bicycle facilities do not exist. There are currently no crosswalks connecting to the northwest corner of the quadrant, requiring pedestrians to either cross to the west at Bacon Street or to the north at Jefferson Street. There are also no pedestrian crosswalks connecting to the traffic island separating the Centre Street northbound and southbound directions. In addition, some of the crosswalk curb ramps do not meet current ADA accessibility standards, as some curb ramps do not provide sufficient landings and others are missing tactile warning strips.

A critical challenge in this quadrant is identifying improvements that work within the existing limited right-of-way without adversely impacting existing buildings and still maintain sufficient vehicle capacity and improve conditions for bicyclists and pedestrians. This limited right-of-way, combined with the fact that the quadrant is already fully signalized, lead to fewer opportunities for mid-term improvements in the Northeast Quadrant as compared to the other quadrants in the Study Area.

Alternatives

In the Northeast Quadrant, **six** alternatives were developed. Some of the ideas included in the different alternatives included:

- Formalizing two southbound through lanes on the Centre Street approach and onto the I-90 Westbound on-ramp.
- Improving the geometry of the existing crosswalks across the I-90 Westbound off-ramp.
- Closing Charlesbank Road to create a pedestrian plaza and improve the intersection geometry.
- Installing additional crosswalks at the intersection, including across the Centre Street southbound through and right-turn movements.
- Creating a dedicated bus lane for the Centre Street southbound right-turn movement onto Washington Street westbound.
- Extending the median between the Washington Street westbound through movements and left-turn movements towards the I-90 Westbound On-Ramp to create a new pedestrian refuge.
- Developing a southbound contraflow travel lane through the quadrant and onto the Washington Street westbound bridge, either for transit only or all general traffic.

After conducting an initial review of the concepts, **three** alternatives were advanced to the Alternatives Analysis stage:

1. **Alternative A:** Intersection Improvements
2. **Alternative B:** Intersection Improvements with SB Right-Turn Bus Lane
3. **Alternative C:** Intersection Improvements with Washington Street Bus Lane & SB Right-Turn Crosswalk

Detailed descriptions of the advanced alternatives are presented in Chapter 5, *Alternatives Analysis*.

Northwest Quadrant

Challenges and Deficiencies

The northwest quadrant is centered on the intersection of Washington Street eastbound/westbound at Washington Street eastbound bridge and the intersections to the east and west, north of I-90. Under existing conditions, the westbound Washington Street approach to the bridge is free-flow and the eastbound approach is under yield control with two lanes on each approach. While the eastbound approach is under yield control, the rightmost lane leads into its own third lane on the bridge. Existing geometry indicates that a yield is not necessary, creating significant weaving on the bridge with drivers switching lanes ahead of the merge with the I-90 Eastbound Off-Ramp.

Bicycle and pedestrian accommodations in the Northwest Quadrant are insufficient under existing conditions. There are no bicycle accommodations, and pedestrian accommodations are disconnected as there are no crosswalks connecting the sidewalks on the north and south sides of Washington Street. In addition, some of the crosswalk curb ramps do not meet current ADA accessibility standards, as some curb ramps do not provide sufficient landings and others are missing tactile warning strips.

Photo 4.2: Lack of pedestrian crosswalk across Washington Street westbound at Thornton Street (view looking East)

Key challenges in this area for improvements include maintaining sufficient vehicle capacity while also improving safety and balancing the needs of all roadway users within the current right-of-way. The existing Washington Street westbound bridge is also a constraint, as all alternatives must be accommodated on the existing bridge without impacting the load distribution on the structure.

Alternatives

In the Northwest Quadrant, **five** alternatives were developed. Some of the ideas included in the different alternatives included:

- Maintaining the existing yield control for the intersection of Washington Street eastbound/ westbound at the Washington Street eastbound bridge.
- Placing all movements at the intersection of Washington Street eastbound/westbound at the Washington Street eastbound bridge under signal control.
- Reducing the width of the Washington Street eastbound approach to the bridge to a single lane.
- Reducing the cross-section of the Washington Street eastbound bridge to two lanes and installing a shared use path on the west side of the Washington Street eastbound bridge.
- Installing new crosswalks at the intersection of Washington Street eastbound/westbound at the Washington Street eastbound bridge.
- Revising geometry at the intersection of Washington Street at Church Street and Washington Street at Hovey Street to accommodate one through lane eastbound.
- Separating traffic on the Washington Street eastbound bridge with a raised median based on their destinations downstream of the bridge.

After conducting an initial review of the concepts, **two** alternatives were advanced to the Alternatives Analysis stage.

4. **Alternative A:** Signal Control with One-Lane Eastbound
5. **Alternative B:** Signal Control with Two-Lanes Eastbound

Detailed descriptions of the advanced alternatives are presented in Chapter 5, *Alternatives Analysis*.

Southwest Quadrant

Challenges and Deficiencies

The southwest quadrant is centered on the intersections of Centre Avenue (also known as Washington Street westbound) at the I-90 Eastbound Off-Ramp and Centre Avenue at Centre Street. Under existing conditions, the I-90 Eastbound Off-Ramp consists of a single lane under stop-control leading into four lanes on Centre Avenue. While the off-ramp is only wide enough to have a single lane striped, it was noted by the public that drivers used to occasionally form two lanes on the ramp, especially prior to the COVID-19 pandemic, and a frequent comment heard from the public during this study was the desire to have two lanes striped on the off-ramp.

The distance on the off-ramp between the I-90 mainline and the meeting point on Centre Avenue is approximately 600 feet. The queue on the off-ramp frequently extends past the 600 feet of storage and backs up onto the I-90 mainline, creating a safety issue. In addition, the distance between the off-ramp and the intersection with Centre Street is less than 300 feet. This creates a situation where vehicles wishing to continue straight on Centre Street must weave around those trying to turn onto Centre Street.

Photo 4.3: Vehicles stopped at the end of the I-90 Eastbound Off-Ramp (view looking west)

This quadrant also lacks adequate pedestrian and bicycle accommodations. There are no bicycle accommodations, and pedestrian accommodations are disconnected as there is no crosswalk across the I-90 Eastbound Off-Ramp for pedestrians who are walking on the sidewalk on the west side of the Washington Street eastbound bridge. In addition, some of the pedestrian accommodations do not meet current ADA accessibility standards, notably the crosswalk across Centre Avenue leads to a staircase by the Four Points by Sheraton hotel that cannot be used by someone with mobility issues or someone in a wheelchair.

Key challenges in this area for improvements include providing enough storage space for vehicles on the I-90 Eastbound Off-Ramp while staying within the existing right-of-way and balancing the needs of all roadway users within the existing roadway space.

Alternatives

In the Southwest Quadrant, **nine** alternatives were developed. Some of the elements included in the different alternatives included:

- Extending the I-90 Eastbound Off-Ramp to the existing signalized intersection of Centre Avenue at Centre Street by installing a median on Centre Avenue west of Centre Street.
- Installing a traffic signal at the intersection of Centre Avenue eastbound at the I-90 Eastbound Off-Ramp with new signalized crosswalks across each approach.
- Widening the I-90 Eastbound off-ramp to provide additional queuing storage area.
- Providing a new crosswalk across the I-90 Eastbound Off-Ramp to link to a new shared use path connection to Richardson Street.
- Installing a new shared use path on the south side of Centre Avenue and reducing Centre Avenue to three lanes.
- Relocating the existing crosswalk across Centre Avenue at Centre Street to connect to the traffic island between the Centre Street northbound and southbound approaches.
- Placing the Centre Street northbound approach under full signal control to eliminate the weaving condition between vehicles coming from Centre Street northbound and continuing straight on Centre Avenue eastbound.
- Eliminating all weaving conditions on Centre Avenue by having separate phases for all movements at the intersection of Centre Avenue at Centre Street.
- Installing a two-way bicycle lane east of Centre Street that is vertically separated from vehicular traffic.

After conducting an initial review of the concepts, **two** alternatives were advanced to the Alternatives Analysis stage:

1. **Alternative A:** Off-Ramp Divided to Signal at Centre Street
2. **Alternative B:** Two-Lane Off-Ramp with Signal Control

Detailed descriptions of the advanced alternatives are presented in Chapter 5, *Alternatives Analysis*.

Southeast Quadrant

Challenges and Deficiencies

The southeast quadrant is centered on the intersections at the southern end of the Washington Street westbound bridge, including the intersections of Washington Street at Park Street and Washington Street at St James Street. Under existing conditions, Washington Street eastbound, relocated Washington Street westbound, and Park Street northbound merge together at the foot of the Washington Street westbound bridge, creating a difficult weaving segment on the bridge as vehicles compete to get into the correct lanes upstream of the signalized intersections in the northeast quadrant. Also in the quadrant, Washington Street / St. James Street eastbound carry three-to-four lanes of traffic in the eastbound direction across the signalized intersections at Park Street and Washington Street northbound before providing access to the I-90 Eastbound On-Ramp.

Similar to conditions in the Southwest Quadrant, bicycle and pedestrian accommodations in this quadrant are also inadequate. There are no bicycle accommodations, and pedestrian accommodations do not always align with desire lines, as there is no direct north-south pedestrian path between Park Street and the Washington Street westbound bridge. In addition, some of the crosswalk curb ramps do not meet current ADA accessibility standards, as some curb ramps do not provide sufficient landings and others are missing tactile warning strips.

Key challenges in this area for improvements include reducing the weaving conditions for vehicles on Washington Street eastbound approaching the quadrant and on the Washington Street westbound bridge and include improving pedestrian desire lines while staying within the existing right-of-way and balancing the needs of all roadway users within the existing roadway space.

Photo 4.4: Overhead directional signs indicating different destination points traveling eastbound on Washington Street east of Centre Street (view looking east)

Alternatives

In the Southeast Quadrant, **fifteen** alternatives were developed. Some of the ideas included in the different alternatives included:

- Signalizing all movements at the foot of the Washington Street westbound bridge to eliminate or reduce weaving conditions.
- Dividing the Washington Street eastbound left-turn movements into two vertically median separated lanes with the lane to Centre Street northbound and Washington Street eastbound under signal control and the lane to the I-90 Westbound On-Ramp under free flow.
- Modifying the Park Street northbound approach to straighten the alignment and eliminate the traffic island dividing the northbound through and right-turn lanes.
- Installing roundabouts at the intersections of Washington Street at Park Street and Washington Street at St. James Street.
- Allowing left-turning and u-turning traffic from St. James Street westbound onto Park Street and Washington Street eastbound via a new roundabout.
- Installing new crosswalks across Washington Street eastbound that more closely aligns with pedestrian desire lines.
- Constructing a new shared use path on the south side of Washington Street eastbound.

After conducting an initial review of the concepts, **four** alternatives were advanced to the Alternatives Analysis stage:

1. **Alternative A1:** Signal Control with Divided Eastbound Left-Turns
2. **Alternative A2:** Signal Control with Combined Eastbound Left-Turns
3. **Alternative B1:** Roundabouts with Two Lanes Westbound
4. **Alternative B2:** Roundabouts with One Lane Westbound

Detailed descriptions of the advanced alternatives are presented in Chapter 5, *Alternatives Analysis*.

Future Signal Warrant Evaluation

As part of the development of potential alternatives (discussed in Chapter 4, *Alternatives Development*), there are two locations that are currently unsignalized that could be signalized under proposed conditions. These two locations include the intersections of Washington Street eastbound/westbound at Washington Street eastbound bridge and Centre Avenue (Washington Street eastbound) at the I-90 eastbound off-ramp. Prior to developing any alternatives, signal warrant analyses were conducted to determine if these locations warrant traffic signals based on existing and future volumes.

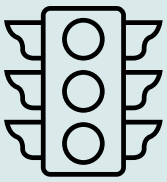
Signal Warrant Methodology

The Manual on Uniform Traffic Control Devices (MUTCD) lists specific criteria, or warrants, for the consideration of installation of a traffic signal at an intersection[7]. The MUTCD also notes that, "the satisfaction of a traffic signal warrant or warrants shall not, in itself, require the installation of a traffic control signal." However, failure to meet at least one of the traffic signal warrants precludes the installation of a traffic signal at a given location. The traffic signal warrant analysis provides guidance as to locations where signals would not be appropriate and locations where they could be considered further. The Massachusetts Amendments to the MUTCD[8] specifies that generally Warrant 1 (Eight-Hour Vehicular Volume) shall be met prior to the consideration of any new traffic control signal on State Highway.

There are nine warrants defined in the MUTCD. The warrants consider the roadway geometry, traffic volume entering the intersection, travel speeds, pedestrian activity, and special considerations such as proximity to schools and active railroad grade crossings. Even if these warrants are satisfied, other considerations such as traffic flow progression, sight distance, and physical constraints must be considered before pursuing traffic signal control. Based on the available count information and locations being considered, only three of the nine warrants were evaluated, ash shown below.

Study Area MUTCD Signal Warrant Evaluation

- **Warrant 1**: 8-Hour Vehicle Volume
- **Warrant 2**: 4- Hour Vehicle Volume
- **Warrant 4:** Pedestrian Volume



Vehicle traffic volumes used for the warrant analyses are based on ATR counts conducted in November 2022 on Washington Street east and west of Thornton Street, on Centre Avenue north of the I-90 eastbound off-ramp, and on the I-90 eastbound off-ramp. Pedestrian volumes used for the Warrant 4 analysis are based on TMCs conducted at the two Study Area intersections.

[7] Manual on Uniform Traffic Control Devices; U.S. Department of Transportation Federal Highway Administration, Washington DC, December 2009.

[8] The Massachusetts Amendments to the 2009 Manual on uniform Traffic Control Devices for Streets and Highways; Massachusetts Department of Transportation Highway Division, November 2022.

Signal Warrant Analysis Summary

The results of the volume-based signal warrant analyses are presented in Table 4-3. The signal warrant analysis worksheets are included in Appendix E.

Location	Volume Condition	Warrant 1: Eight Hour	Warrant 2: Four Hour	Warrant 4: Pedestrian
Washington Street EB/WB at Washington Street EB Bridge	Existing	Yes	Yes	No
	Future	Yes	Yes	No
Centre Avenue at I-90 EB Off-Ramp	Existing	Yes	Yes	No
	Future	Yes	Yes	No

As shown in Table 4-3, the eight-hour (Warrant 1) and the four-hour (Warrant 2) vehicle volume-based warrants have both been met based on the existing and future conditions vehicle volumes at the intersections of Washington Street eastbound/westbound at Washington Street eastbound bridge and Centre Avenue at the I-90 eastbound off-ramp. The pedestrian (Warrant 4) warrants have not been met at either intersection due to the low volume of existing pedestrians counted in the Study Area.

5

Alternatives Analysis

This chapter outlines the advanced mid-term alternatives and summarizes analyses to determine the preferred concepts for each Study Area quadrant that align with the Study's goals and objectives.

Alternatives Analysis Key Takeaways

- 11 mid-term alternatives progressed beyond the development stage and went through a further analysis.
- Alternatives evaluated based on the six Study goals:
  - Enhance Safety
  - Improve Traffic Operations and Reduce Congestion
  - Expand Multimodal Infrastructure
  - Improve Transit
  - Improve Land Use/Placemaking
  - Maintain or improve property access and parking issues
- Four mid-term alternatives (one for each quadrant) are advanced as recommendations of this Study.

As discussed in Chapter 4, *Alternatives Development,* during the development of this Study it became clear that there was an immediate need to implement short-term safety improvements. Therefore, a short-term improvements project was separated from this Study in 2023 as an independent project funded through MassDOT District 6 maintenance funds, and the rest of this report focuses exclusively on potential mid-term alternatives.

Evaluation Methodology

Chapter 4, *Alternatives Development*, presented a preliminary screening of the alternatives that were identified as having the potential to address transportation issues and opportunities within the Study Area. The collaborative screening process with the MassDOT and consultant teams identified **11 alternatives** that were carried forward into the alternatives analysis stage. The options carried forward from the initial screening were further refined and one preferred alternative was selected for each quadrant. The public input received on the alternatives analysis demonstrating support is also summarized in this chapter.

The 11 alternatives were evaluated to determine one preliminary preferred alternative for each quadrant that can progress to the design stage. A scoring matrix was developed based on the project goals and objectives and was used to compare the different options for each quadrant.

Study Goals

Each alternative was evaluated against the six Study Area goals and objectives, presented in Table 5-1, below. Chapter 1, *Study Process and Framework,* includes a detailed discussion of these goals and objectives.

Public Input

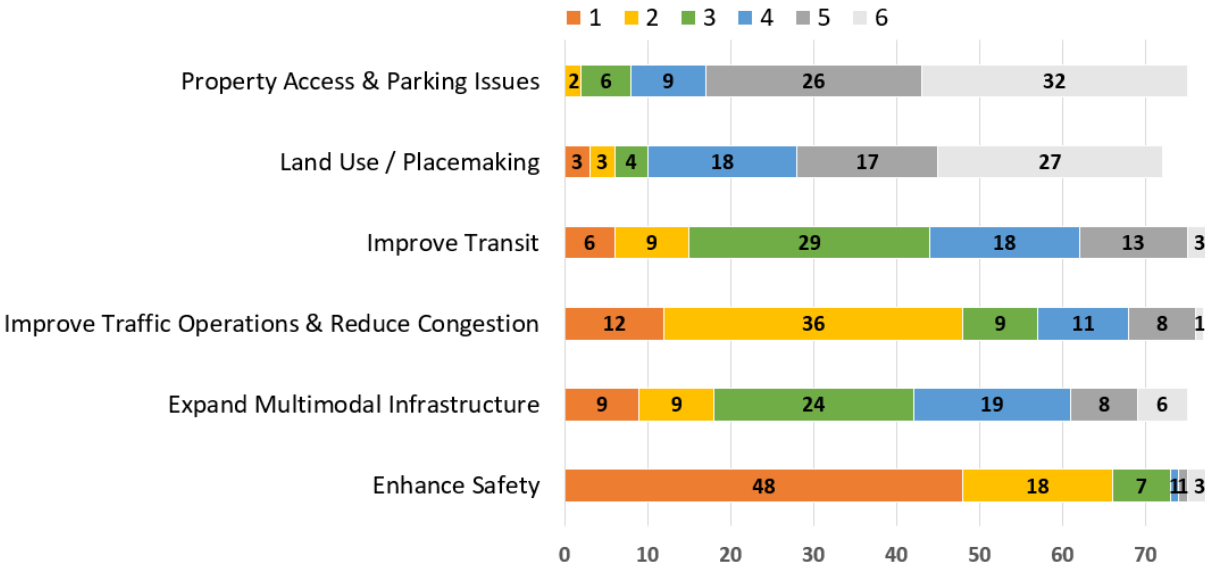
Public involvement was critical to developing these goals and objectives. At Public Meeting #2 on March 1, 2023, the public was asked to rank the six Study Area goals in order of importance from most important to least important. Approximately 78 people responded live in the meeting with each member individually ranking the six goals. The results of this feedback were used when evaluating alternatives to determine which goals were the most important for the public.

The public rankings of the goals from Public Meeting #2 are presented below in Figure 5-1.

Table 5-1 Alternatives Analysis Study Area Goals

Goal
Enhance Safety
Improve Traffic Operations and Reduce Congestion
Expand Multimodal Infrastructure
Improve Transit
Land Use / Placemaking
Property Access and Parking Issues

Figure 5-1 Public Feedback Ranking of Study Goals



Note: Goals Ranked in Order of Importance: Most Important (1) to Least Important (6).
Source: From live poll conducted at Public Meeting #2 on March 1, 2023.

As shown in Figure 5-1, the public overwhelmingly ranked 'enhance safety' as the top goal with the most popular second place option being 'Improve Traffic Operations and Reduce Congestion'. The goals that were generally ranked as the least important were 'Property Access and Parking Issues' and 'Land Use / Placemaking'.

Public Support for Alternatives

The 11 alternatives and the resulting analyses were presented to the public at Public Meeting #3 on October 24, 2023. At that meeting, members of the public were able to respond live to a poll to select which concepts they thought best met the goals of the project. The poll was also available on the project website in the weeks after the meeting between November 6, 2023, and November 19, 2023. Approximately 60 members of the public responded live in the meeting and an additional 73 people responded to the online poll that was available in the weeks following the meeting. The results of the polling were used to gauge public support for the different alternatives.

The results of the public input for each quadrant are provided in the following sections.

Scoring Matrix

Each of the 11 mid-term alternatives were evaluated to determine potential impacts in relation to each of the six Study Area goals and objectives. Impacts were defined as positive, neutral/no impact, or negative. The alternatives within each quadrant were compared against each other to determine which quadrant alternative should be progressed forward. If one alternative was likely to have more significant positive impacts than another, the scoring matrix noted this to provide a more thorough analysis.

The results of these scoring matrices were presented at Public Meeting #3 on October 24, 2023, where members of the public were able to provide their feedback. A summary of each scoring matrix is provided in subsequent sections within this chapter.

Alternatives Analysis

The following subsections present the alternatives by quadrant and the results of the scoring matrices and public feedback. Based on these results, alternatives selected to progress to the preferred concept stage for each quadrant are also presented.

Intersection Capacity Analyses

For each of the 11 mid-term alternatives, intersection capacity analyses were conducted with respect to the Existing and No Build Conditions to understand the expected traffic operations. This analysis consisted of Synchro modeling for 2023 conditions, as discussed in Chapter 2, *Existing Conditions*, and Chapter 3, *Future Conditions*, respectively. The results of the intersection capacity analyses are presented in Appendix D. The results of the intersection capacity analyses were used to help evaluate the feasibility of each alternative. Following the identification of a recommended alternative, the alternative was modeled in Vissim to further evaluate traffic operations. The results of the Vissim simulation analysis are presented in Chapter 6, *Preferred Alternative*.

Northeast Quadrant

Three alternatives were advanced to the analysis stage in the Northeast Quadrant, referred to as Concepts A, B, and C.

Concept A: Intersection Improvements

Concept A includes the following elements:

Signal Improvements

- The existing signals will be updated and modernized.

Geometry Modifications

- The Centre Street southbound approach will be formalized as two through lanes onto the I-90 Westbound On-Ramp, with two lanes continuing onto the on-ramp, merging into one lane approximately 150 feet downstream of the signalized intersection. Two lanes cannot be carried farther downstream on the on-ramp, as the width of the existing bridge carrying the ramp over the train tracks is not sufficient to be striped as two lanes.
- The I-90 Westbound Off-Ramp right-turn slip lane will be pulled closer into the intersection, creating a pedestrian refuge between the slip-lane and Charlesbank Road. The crosswalk across the I-90 Westbound Off-Ramp will be modified to provide a one-stage crossing across both the through lane and the right-turn lane into the new pedestrian refuge island.
- The median splitter island between the Washington Street through lanes and the left-turn lanes onto the I-90 Westbound On-Ramp will be extended, providing additional separation between through and left-turning vehicles and reducing the opportunity for drivers to change lanes at the last minute.

Bicycle and Pedestrian Accommodations

- Charlesbank Road will remain open with a new raised crosswalk across the roadway, approximately 70 feet east of the existing crosswalk.
- The splitter island between the Washington Street through lanes and the left-turn lanes onto the I-90 Westbound On-Ramp will be expanded and converted into a new pedestrian refuge island. The crosswalk across the I-90 Westbound Off-Ramp will be replaced with two new crosswalks connecting to the pedestrian refuge island, allowing pedestrian movements to occur concurrently with parallel vehicular movements.
- New crosswalks will be installed connecting the traffic island that separates the Centre Street northbound and southbound directions with the sidewalk to the east and to the south.

A graphic of Concept A is provided in Figure 5-2.

Figure 5-2: Northeast Quadrant - Concept A

Traffic Signal and Safety Improvements at Interchange 127 | Newton, MA

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Concept B: Intersection Improvements with SB Right-Turn Bus Lane

Concept B includes the following element:

Signal Improvements

- Like Concept A, the existing signals will be updated and modernized.

Geometry Modifications

- The same geometry modifications are proposed in Concept B as presented under Concept A, except for:
  - The roadway width will be expanded to provide a right-turn bus only lane that extends into the bus stop on Washington Street westbound, east of Bacon Street.
  - To fit the bus lane in, the sidewalk will be narrowed, eliminating most of the existing planting strip.

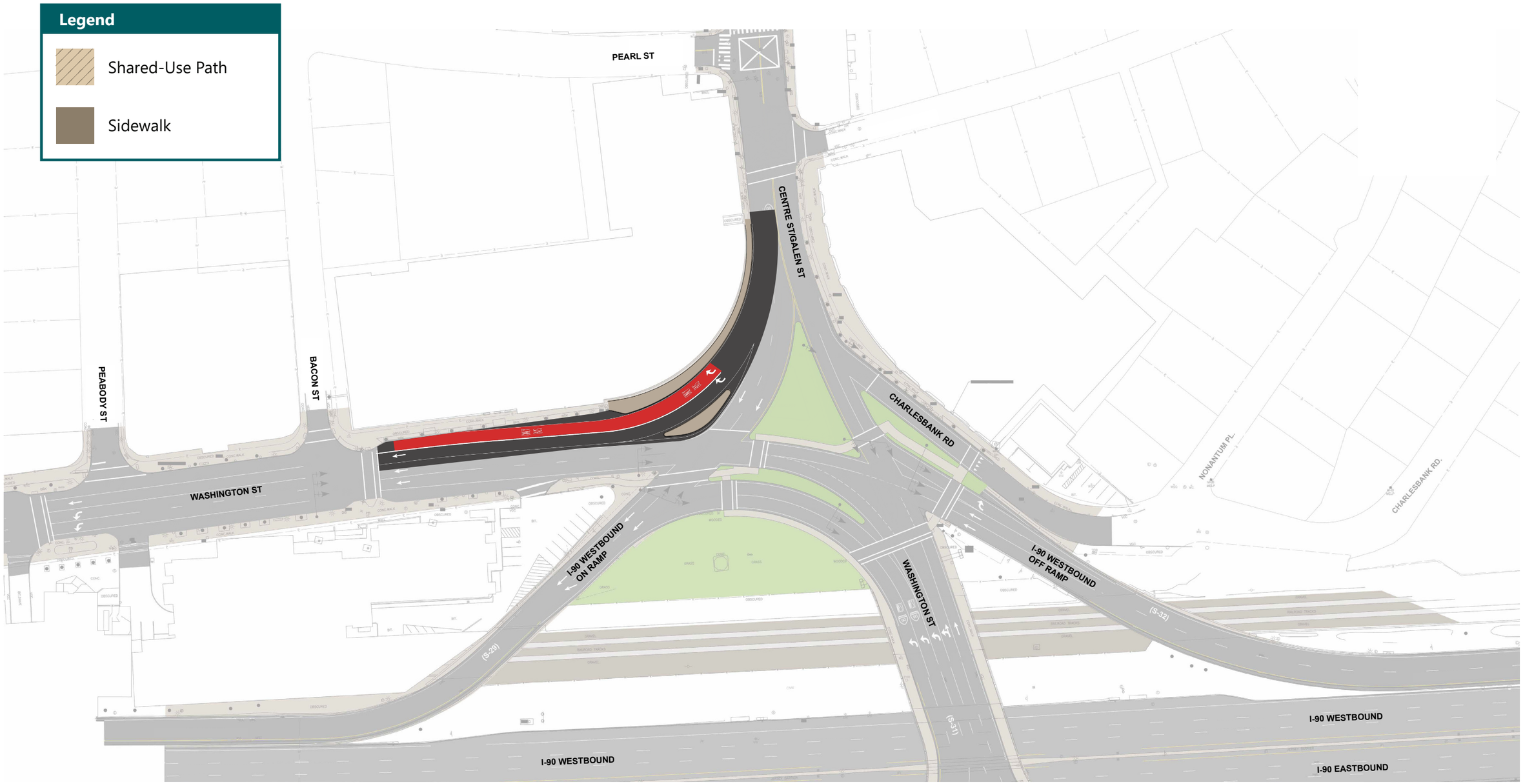
Bicycle and Pedestrian Accommodations

- The same bicycle and pedestrian accommodations are proposed in Concept B as presented under Concept A.

A graphic of Concept B is provided in Figure 5-3.

Figure 5-3: Northeast Quadrant - Concept B

Traffic Signal and Safety Improvements at Interchange 127 | Newton, MA



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Concept C: Intersection Improvements with Washington Street Bus Lane & SB Right-Turn Crosswalk

Concept C includes the following elements:

Signal Improvements

- Like Concept A and Concept B, the existing signals will be updated and modernized.

Geometry Modifications

- The same geometry modifications are proposed in Concept C as presented under Concept A, except for:
  - The roadway width will be expanded to widen the splitter island and to provide a crosswalk across the southbound right-turn lane and a right-turn bus only lane starting after the crosswalk that extends into the bus stop on Washington Street westbound, east of Bacon Street.
  - The sidewalk will be narrowed to fit the bus lane and wider splitter island, eliminating most of the existing planting strip.

Bicycle and Pedestrian Accommodations

- The same bicycle and pedestrian accommodations are proposed in Concept C as presented under Concept A, except for:
  - Crosswalks will be installed across the Centre Street southbound through lanes and the southbound right-turn slip lane. The existing splitter island separating the right-turn slip lane will be expanded to provide a pedestrian refuge area as this will be a two-stage crossing.
  - The crosswalk across the southbound through lanes will be signalized while the crosswalk across the southbound right-turn slip-lane will be unsignalized with the right-turn movement under yield control, likely with an RRFB for the pedestrian crossing.

A graphic of Concept C is provided in Figure 5-4.

Figure 5-4: Northeast Quadrant - Concept C

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Northeast Quadrant Alternatives Evaluation

Table 5-2 presents the potential benefits and limitations of the three Northeast Quadrant alternatives.

Table 5-2 Potential Benefits and Limitations: Northeast Quadrant Alternatives

Potential Benefits	Potential Limitations
Concept A: Intersection Improvements	
› Expanded pedestrian connectivity by providing new pedestrian connections to the east and south › Improved pedestrian accommodations with a larger splitter island between the I-90 westbound off-ramp and Charlesbank Road on the east side of the quadrant, and a new raised crossing across Charlesbank Road › Improved vehicular capacity and throughput through the intersection on Centre Street southbound by formalizing the two through lanes onto the I-90 Westbound On-Ramp	› No pedestrian connection to the northwest corner of the quadrant › No dedicated improvements to transit
Concept B: Intersection Improvements with Southbound Right-Turn Bus Lane	
› Similar to Concept A, but with enhancement of transit accommodations with the installation of a short bus only lane that will allow transit vehicles to bypass the queue of right-turning vehicles to access the existing bus stop	› A slightly narrowed sidewalk on the northwest corner of the quadrant that would eliminate most of the existing planting strip › No pedestrian connection to the northwest corner of the quadrant
Concept C: Intersection Improvements with Washington St Bus Lane & SB Right-Turn Crosswalk	
› Similar to Concept A, but with expanded pedestrian connectivity by providing a new pedestrian crossing across the Centre Street southbound approach connecting to the northwest corner of the quadrant. › Enhancement of transit accommodations with the installation of a short bus only lane that will allow transit vehicles to bypass the queue on Washington Street to access the existing bus stop	› A slightly narrowed sidewalk on the northwest corner of the quadrant that would eliminate most of the existing planting strip › Bus lane is slightly shorter than the one provided in Concept B to accommodate a new crosswalk across the southbound right-turn lane

Table 5-3 presents the scoring matrix for the three Northeast Quadrant concepts as they relate to the six study goals. A summary of the infrastructure changes associated with each goal is included in Appendix D.

Table 5-3 Northeast Quadrant Alternatives Evaluation

Goal	Concept A Intersection Improvements	Concept B Intersection Improvements + SB Right-Turn Bus Lane	Concept C Intersection Improvements + Washington Bus Lane & SB Right-Turn Crosswalk
Enhance Safety	☑	☑	☑
Improve Traffic Operations and Reduce Congestion	☑	☑	☑
Expand Multimodal Infrastructure	☑	☑	☑ ☑
Improve Transit	○	☑	☑
Land Use / Placemaking	○	○	○
Property Access and Parking Issues	○	○	○

Legend: ☑ Positive Impact; ○ Neutral / No Impact; ☒ Negative Impact

Note: Two checkmarks presented as a tiebreaker when one concept is expected to have a greater magnitude of positive impacts

As shown in Table 5-3, all three concepts are expected to have positive impacts when it comes to enhancing safety, improving traffic operations, and expanding multimodal infrastructure. Concept B is also expected to improve transit with a dedicated bus lane provided for the southbound right-turn movement. Concept C is expected to generate more significant benefits for expanding multimodal infrastructure as it includes an additional crosswalk across the southbound right-turn lane providing a new pedestrian connection to the northwest corner of the quadrant. None of the concepts are expected to have a measurable impact on land use/placemaking or property and parking access.

Northeast Quadrant Preferred Alternative

Based on the results of the scoring matrix, **Concept C: Intersection Improvements with Washington Street Bus Lane and Southbound Right-Turn Crosswalk** is the preferred concept for this quadrant and has been advanced to the overall preferred alternative presented in Chapter 6, *Preferred Alternative*.

Northeast Quadrant Public Input

The three concepts for the Northeast Quadrant and the scoring matrix were presented to the public. Table 5-4 summarizes which concept the public thought best meets the goals of the project.

Table 5-4 Northeast Quadrant Public Input

Which Concept in the Northeast Quadrant Best Meets the Goals of the Project?

	In-Meeting Responses		Online Responses		Total Responses	
	Total	Percent	Total	Percent	Total	Percent
Concept A	18	30%	15	21%	33	25%
Concept B	14	23%	15	21%	29	22%
Concept C	24	40%	33	45%	57	43%
Neither [1]	4	7%	10	14%	14	11%
Total	60	100%	73	100%	133	100%

Source: Based on live feedback collected at Public Meeting #3 on October 24, 2023, and in an online poll available on the project website between November 6, 2023, and November 19, 2023.

1 Participants that did not respond in the in-meeting poll or selected "None of the Above" in the online poll.

As shown in Table 5-4, Concept C received the most support from members of the public.

Northwest Quadrant

Two alternatives were advanced to the analysis stage in the Northwest Quadrant, referred to as Concept A and Concept B.

Concept A: Signal Control with One-Lane Eastbound

Concept A includes the following elements:

Signal Improvements

- New traffic signals at the intersection of Washington Street eastbound/ westbound at the Washington Street eastbound bridge, and at the intersection of Washington Street westbound at Thornton Street.

Geometry Changes

- Existing lane geometries will be modified so that the westbound approach to the signal at the eastbound bridge will consist of two lanes and the eastbound approach to the signal will consist of a single lane. The two lanes on Washington Street eastbound will merge into a single lane east of Hovey Street.
- The lanes on the Washington Street eastbound bridge will be formalized with striping and pavement markings as three lanes, with two through lanes for Centre Avenue and one turn lane for Centre Street southbound.
- The weaving conflict on the bridge between vehicles entering from the east and the west will be eliminated, as the Washington Street eastbound and westbound approaches to the bridge will be under traffic signal control, where one approach will have a green light allowing vehicles to proceed when vehicles on the opposite approach are stopped at a red light.
- Washington Street westbound east of Thornton Street will be formalized as two left-turn lanes (onto the eastbound bridge) and one through lane.

Bicycle and Pedestrian Accommodations

- A shared use path will be added on the west side of the bridge, on the south side of Washington Street west of the bridge, and through the island south of Thornton Street.
- New shared use path crosswalks will be installed across the eastbound and westbound approaches, meeting in the existing traffic island area.
- A third crosswalk will be installed across the Washington Street westbound approach at Thornton Street.
- All three crosswalks will be under signal control.

A graphic of Concept A is provided in Figure 5-5.

Figure 5-5: Northwest Quadrant - Concept A

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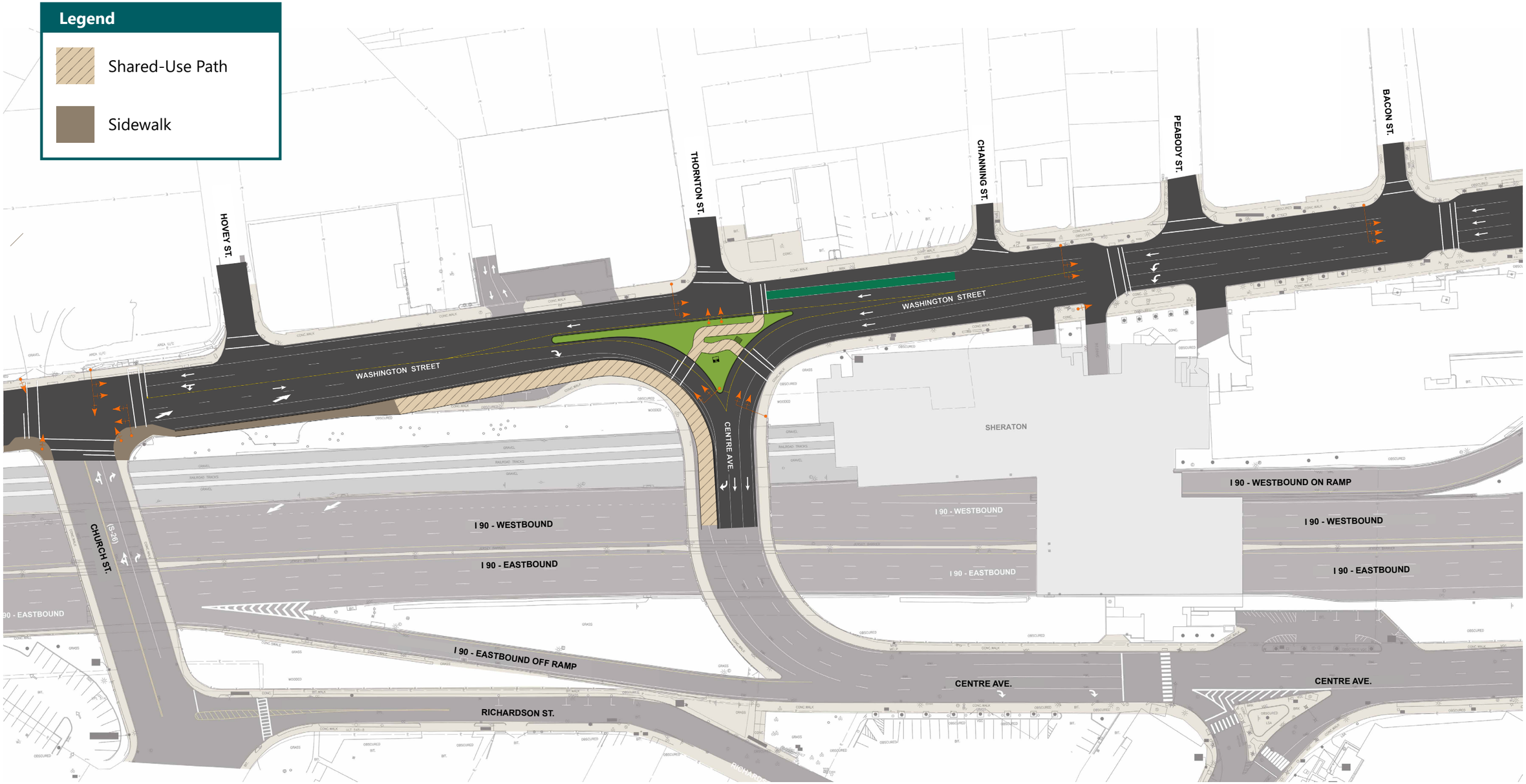

Concept B: Signal Control with Two-Lanes Eastbound

Concept B includes the following elements:

Signal Improvements

- The same signal improvements are proposed in Concept B as presented under Concept A.

Geometry Changes

- The geometry changes for Concept B are similar to Concept A, except that two eastbound lanes will be provided at the proposed signalized intersection of Washington Street eastbound/westbound at the Washington Street eastbound bridge.
- Therefore, westbound drivers will not need to merge into a single lane upstream of the intersection.
- Like Concept A, weaving conflicts on the bridge between vehicles entering from the east and the west will be eliminated, as the Washington Street eastbound and westbound approaches to the bridge will be under traffic signal control, where one approach will have a green light allowing vehicles to proceed when vehicles on the opposite approach are stopped at a red light.

Bicycle and Pedestrian Accommodations

- The same bicycle and pedestrian accommodations are proposed in Concept B as presented under Concept A.
- The shared use path on the south side of Washington Street would be narrower by approximately five feet over Concept A, potentially increasing the BLTS for this segment.

A graphic of Concept B is provided in Figure 5-6.

Figure 5-6: Northwest Quadrant - Concept B

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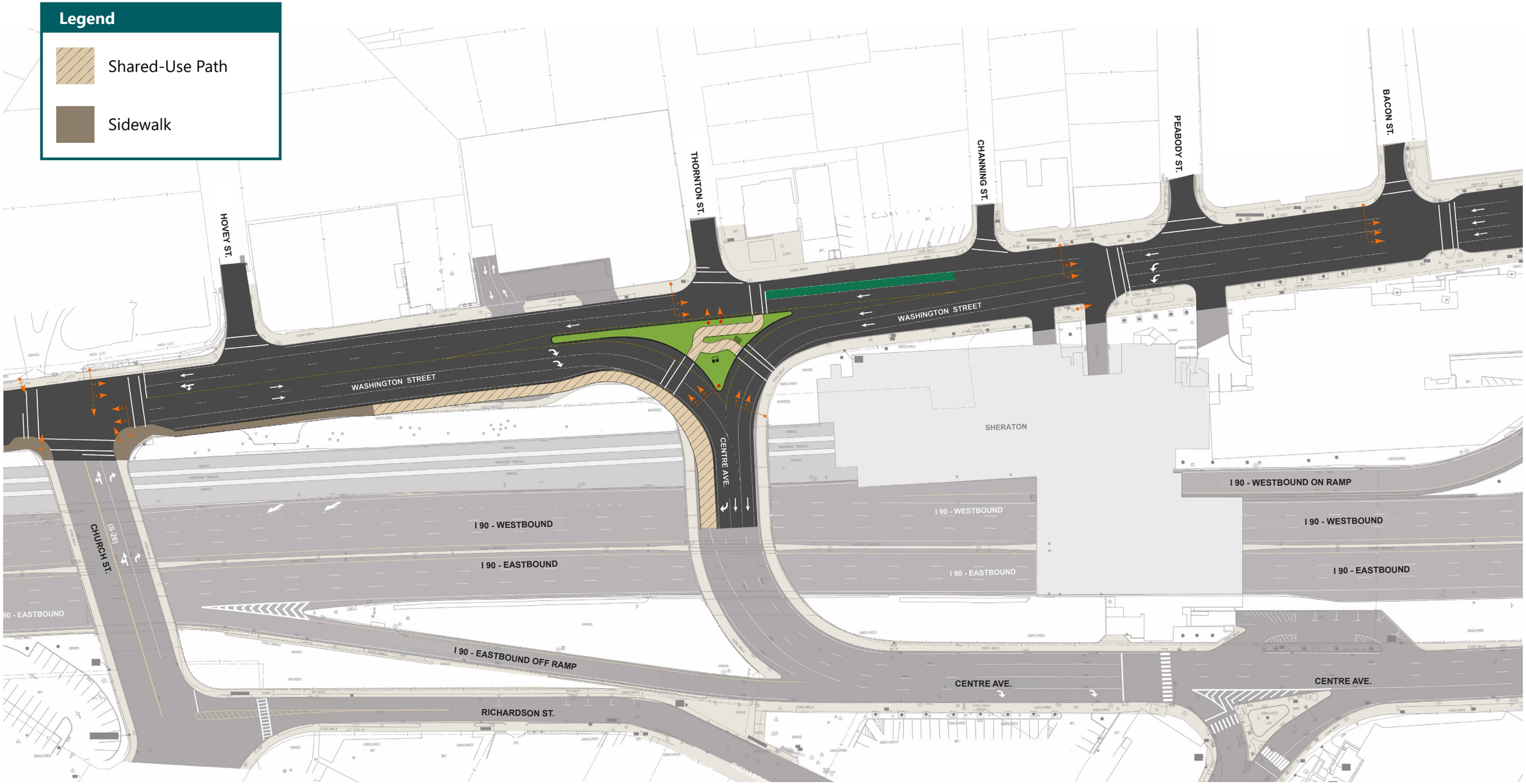

Northwest Quadrant Alternatives Evaluation

Table 5-5 presents the potential benefits and limitations of the two Northwest Quadrant alternatives.

Table 5-5 Potential Benefits and Limitations: Northwest Quadrant Alternatives

Potential Benefits	Potential Limitations
Concept A: Signal Control with One-Lane Eastbound	
› Weaving between eastbound and westbound traffic will be eliminated as all movements entering the eastbound bridge will be placed under signal control	› Potential for increase conflict on Washington Street eastbound, upstream of the new signalized intersection, as traffic now needs to merge from two lanes to a single lane
› Enhanced pedestrian and bicycle accommodations with new signalized crossings connecting the north and south sides of Washington Street	› Conflict likely to increase on Washington Street eastbound between Church Street and the Washington Street eastbound bridge as vehicles get into position
› The roadway can accommodate a 15-foot-wide shared use path on the south side of Washington Street by narrowing the Washington Street eastbound approach to a single lane	› Potential additional conflict with vehicles entering and exiting the on-street parking spaces on Washington Street eastbound while vehicles are merging from two lanes to one
Concept B: Signal Control with Two-Lanes Eastbound	
› Similar to Concept A, but with more storage space provided for the eastbound approach to the new signal and more vehicle throughput provided with two eastbound lanes.	› The shared use path on the south side of Washington Street would be narrower by approximately five feet to provide room for the second travel lane, potentially increasing the BLTS for this segment

Table 5-6 presents the scoring matrix for the two Northwest Quadrant concepts as they relate to the six study goals. A summary of the infrastructure changes associated with each goal is included in Appendix D.

Table 5-6 Northwest Quadrant Alternatives Evaluation

Goal	Concept A Signal Control with One-Lane Eastbound	Concept B Signal Control with Two-Lanes Eastbound
Enhance Safety	☑	☑
Improve Traffic Operations and Reduce Congestion	☑	☑ ☑
Expand Multimodal Infrastructure	☑ ☑	☑
Improve Transit	○	○
Land Use / Placemaking	○	○
Property Access and Parking Issues	☒	○

Legend: ☑ Positive Impact; ○ Neutral / No Impact; ☒ Negative Impact

Note: Two checkmarks presented as a tiebreaker when one concept is expected to have a greater magnitude of positive impacts

As shown in Table 5-6, both concepts are expected to have positive impacts when it comes to enhancing safety, improving traffic operations, and expanding multimodal infrastructure. Concept A is expected to have greater benefits related to multimodal infrastructure by creating a wider shared use path along the south side of Washington Street eastbound. Alternatively, Concept B will improve traffic operations and reduce congestion more significantly by providing two shared-use eastbound lanes instead of one lane to process eastbound traffic demands. Concept A is expected to have a slightly negative impact on parking access as drivers will be entering and exiting on-street parking spaces on the south side of Washington Street eastbound as vehicles are merging into a single lane. Neither concept is expected to have a measurable impact on transit improvements or land use/ placemaking.

Northwest Quadrant Preferred Alternative

Based on the results of the scoring matrix, **Concept B: Signal Control with Two-Lanes Eastbound** is the preferred concept for this quadrant and has been advanced to the overall preferred alternative presented in Chapter 6, *Preferred Alternative*.

Northwest Quadrant Public Input

Both concepts for the Northwest Quadrant and the scoring matrix were presented to the public. Table 5-7 summarizes which concept the public thought best meets the goals of the project.

Table 5-7 Northwest Quadrant Public Input

Which Concept in the Northwest Quadrant Best Meets the Goals of the Project?

	In-Meeting Responses		Online Responses		Total Responses	
	Total	Percent	Total	Percent	Total	Percent
Concept A	21	35%	31	42%	52	39%
Concept B	35	58%	30	41%	65	49%
Neither [1]	4	7%	12	16%	16	12%
Total	60	100%	73	100%	133	100%

Source: Based on live feedback collected at Public Meeting #3 on October 24, 2023, and in an online poll available on the project website between November 6, 2023, and November 19, 2023.

1 Participants that did not respond in the in-meeting poll or selected "None of the Above" in the online poll.

As shown in Table 5-7, a majority of members of the public that responded live in the meeting generally thought that Concept B best meets the goals of the project while those that answered online were almost evenly split between which concept they thought best meets the goals of the project.

Southwest Quadrant

Two alternatives were advanced to the analysis stage in the Southwest Quadrant, referred to as Concept A and Concept B.

Concept A: Off-Ramp Divided to Signal at Centre Street

Concept A includes the following elements, and a graphic of Concept A is provided in Figure 5-7:

Signal Improvements

- The existing signal at the intersection of Centre Avenue at Centre Street will be modified to accommodate three approach movements with the following phasing:
  - Phase 1: Centre Avenue eastbound through, I-90 Eastbound Off-Ramp through, and crosswalk across Centre Street northbound and southbound
  - Phase 2: Centre Avenue eastbound through, I-90 Eastbound Off-Ramp through, and I-90 Eastbound Off-Ramp right-turns
  - Phase 3: Centre Avenue eastbound right-turns, Centre Street northbound right-turns, and crosswalk across Centre Avenue

Geometry Modifications

- The I-90 Eastbound Off-Ramp will be extended to the signalized intersection of Centre Avenue at Centre Street, with the existing Centre Avenue four-lane cross-section converted to two-lanes for the Centre Avenue approach and two-lanes for the I-90 Eastbound Off-Ramp approach with a median dividing the two approaches.
- The distance between the stop bar and the gore point on the I-90 Eastbound Off-Ramp will be extended from approximately 600 feet to 900 feet due to shifting the end point of the ramp east to the signalized intersection at Centre Street.
- The second lane on the I-90 Eastbound Off-Ramp will extend for approximately 250 feet within the right-of-way of the current Centre Avenue and the existing off-ramp will not be widened.
- Both the Centre Avenue eastbound approach and the I-90 Eastbound Off-Ramp approach to the signalized intersection will consist of one through lane and one right-turn lane.
- The Centre Street northbound approach will be fully included in the traffic signal, eliminating the weave between the Centre Street and Centre Avenue traffic east of the intersection. A short second lane will be provided for the Centre Street northbound approach to provide additional queue storage space.

Bicycle and Pedestrian Accommodations

- The crosswalk across Centre Avenue at Centre Street will be shifted east to land in the existing traffic island between the Centre Street northbound and southbound directions.
- A shared use path is proposed on the west side of the Washington Street eastbound bridge (tying into Concept B in the Northwest Quadrant) and a crosswalk will be installed across the I-90 Eastbound Off-Ramp, connecting to a new shared use path that extends to Richardson Street.

Figure 5-7: Southwest Quadrant - Concept A

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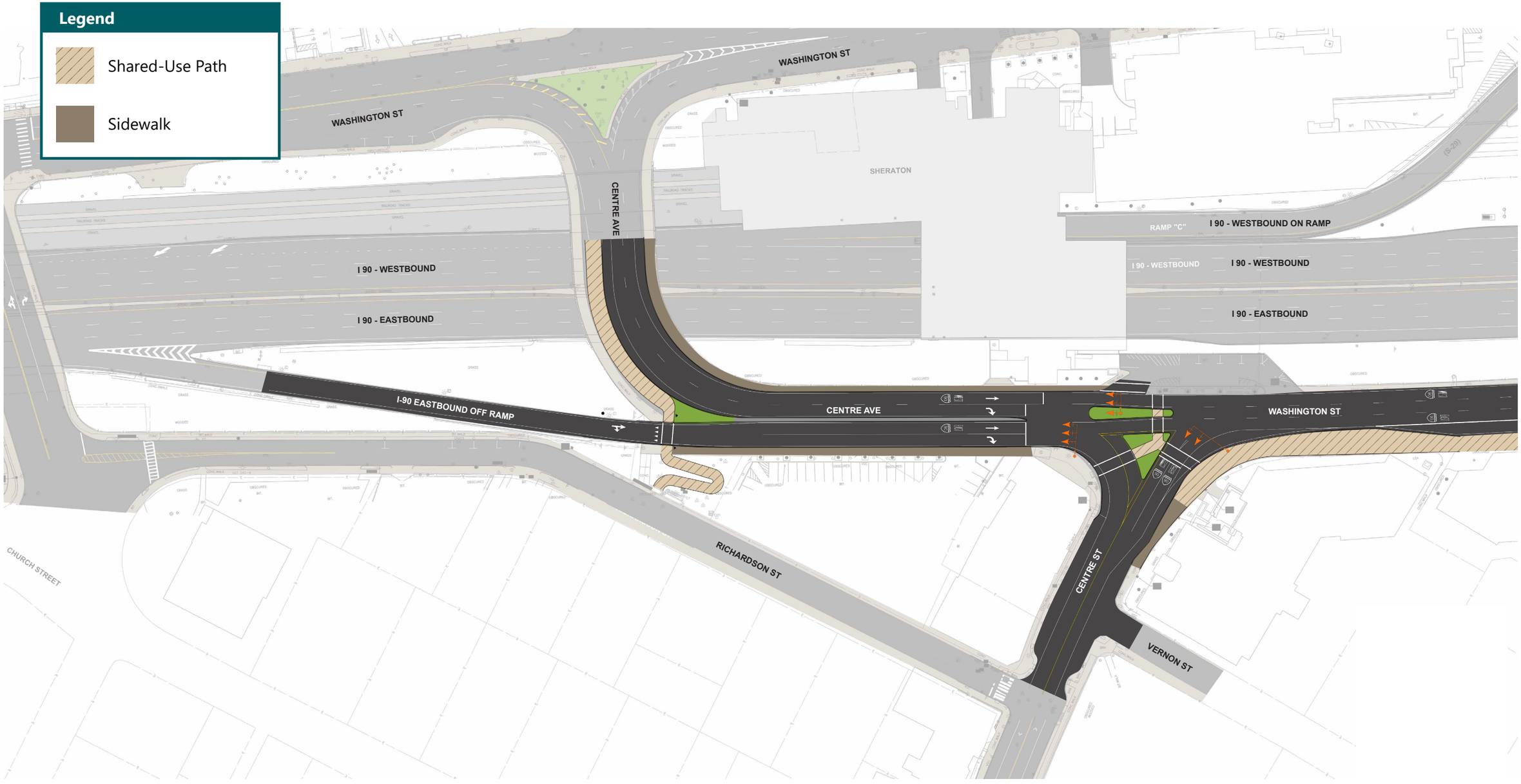

Concept B: Two-Lane Off-Ramp with Signal Control

Concept B includes the following elements, and a graphic of Concept B is provided in Figure 5-8:

Signal Improvements

- A new traffic signal will be installed at the intersection of Centre Avenue at the existing end of the I-90 Eastbound Off-Ramp.
- The I-90 Eastbound Off-Ramp will be widened to provide two approach lanes to the new signalized intersection and the Centre Avenue eastbound approach to the new intersection will have three lanes coming off the Washington Street eastbound bridge with the rightmost lane marked for Centre Street southbound.
- The new signalized intersection would have two phases, one for all traffic on the I-90 Eastbound Off-Ramp and one for all traffic on the Centre Avenue eastbound approach.
- The cross-section on Centre Avenue between the I-90 Eastbound Off-Ramp and Centre Street will include three lanes. The northern two will be designated for through traffic on Centre Avenue and the southern lane will be designated for right-turning traffic onto Centre Street.
- The traffic signalization for the Centre Street northbound approach will operate similar to existing conditions with the Centre Street northbound lane is stopped only when the pedestrian crosswalk is activated. Otherwise, the movement operates under yield control.

Geometry Modifications

- A designated third lane will start on Centre Avenue east of Centre Street for traffic turning right from Centre Street under yield-control. The traffic on Centre Avenue would be separated with the traffic turning from Centre Street with pavement markings.
- The I-90 Eastbound Off-Ramp will be widened with retaining walls installed on the north side of the ramp to provide two lanes of travel for approximately 250 feet approaching the traffic signal.

Bicycle and Pedestrian Accommodations

- Crosswalks will be installed across each approach at the reconfigured intersection of I-90 Eastbound Off-Ramp and Centre Avenue. Crosswalks would have walk phases concurrent with the parallel vehicular movements.
- A shared use path is proposed on the west side of the Washington Street eastbound bridge (tying into Concept B in the Northwest Quadrant) and a new shared use path will extend to Richardson Street. The path will cross the I-90 eastbound Off-Ramp at the signalized crosswalks. A shared use path is also proposed on the south side of Centre Avenue, both east and west of the Centre Avenue at Centre Street intersection.
- At the existing signalized intersection of Centre Avenue at Centre Street, the crosswalk across Centre Avenue will be shifted east to only cross two lanes of traffic and to land in the traffic island between Centre Street northbound and southbound.
- A new two-way separated bicycle lane will be installed on the east side of Centre Street northbound, approaching Centre Avenue. The bicycle lane would turn onto Centre Avenue, eventually moving onto the shared use path along the south side of Centre Avenue. A portion of the bicycle facility would be vertically separated from vehicular traffic.

Figure 5-8: Southwest Quadrant - Concept B

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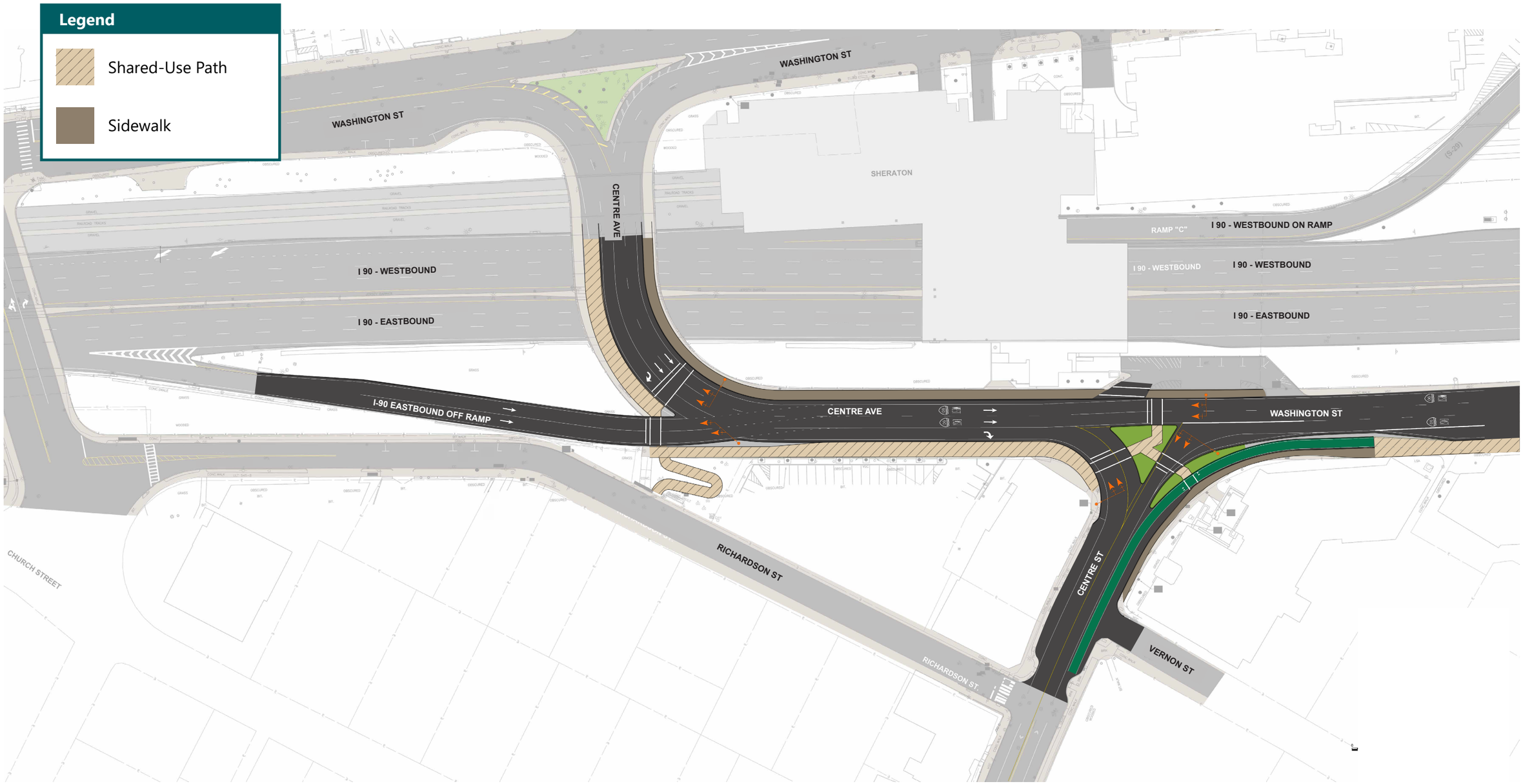

Southwest Quadrant Alternatives Evaluation

Table 5-8 presents the potential benefits and limitations of the two Southwest Quadrant alternatives.

Table 5-8 Potential Benefits and Limitations: Southwest Quadrant Alternatives

Potential Benefits	Potential Limitations
Concept A: Off-Ramp Divided to Signal at Centre Street	
› Additional queue storage space on the I-90 Eastbound Off-Ramp by extending the off-ramp and incorporating the off-ramp into the existing traffic signal at Centre Street › A preliminary review of traffic operations indicates that the queue on the off-ramp would likely be maintained within the length of the off-ramp and would not likely extend back onto I-90 › Weaving movements will be eliminated between vehicles going straight on Centre Avenue from the off-ramp and vehicles turning right onto Centre Street from Centre Avenue by separating the off-ramp and Centre Avenue with a median and placing all movements under signal control › Enhanced pedestrian and bicycle accommodations with a shared use path on the bridge connected to Richardson Street, providing an alternative route for bicyclists	› The new shared use path crosswalk across the off-ramp would be mid-block and would not be under signal control › There is not sufficient right of way to provide a shared use path along the south side of Centre Avenue while providing four vehicular lanes west of Centre Street without impacting property and/or buildings › Eastbound through traffic on Centre Avenue and the I-90 eastbound off-ramp would have a concurrent green light and while this provides more capacity, this results in a weaving movement west of the signalized intersection as drivers get into position heading into the Southeast Quadrant area
Concept B: Two-Lane Off-Ramp with Signal Control	
› Improving queueing and operations on the I-90 Eastbound Off-Ramp by placing it under signal control and expanding the off-ramp to two approach lanes › A preliminary review of traffic operations indicates that the queue on the off-ramp would likely be maintained within the length of the off-ramp and would not likely extend back onto the I-90 mainline › Weaving movements will be eliminated between vehicles going straight on Centre Avenue from the off-ramp and vehicles turning right onto Centre Street from Centre Avenue by adding signal control › Enhanced pedestrian and bicycle accommodations with a shared use path along the Washington Street eastbound bridge and along the south side of Centre Avenue, providing a continuous bicycle route around the western and southern boundaries of the Newton Corner area › New crosswalks at the signalized intersection of Centre Avenue at the I-90 Eastbound Off-Ramp, providing new protected crossings of these roadways	› Centre Street northbound would remain under yield control (except when the signal is activated for a pedestrian crossing), maintaining the existing weave condition on Centre Avenue east of Centre Street › Preliminary traffic analyses indicate that queues on the Centre Avenue eastbound approach would likely extend into the Northwest Quadrant

Table 5-9 presents the scoring matrix for the two Southwest Quadrant concepts as they relate to the six study goals. A summary of the infrastructure changes associated with each goal is included in Appendix D.

Table 5-9 Southwest Quadrant Alternatives Evaluation

Goal	Concept A Off-Ramp Divided to Signal at Centre Street	Concept B Two-Lane Off-Ramp with Signal Control
Enhance Safety	☑	☑
Improve Traffic Operations and Reduce Congestion	☑	☑ ☑
Expand Multimodal Infrastructure	☑	☑ ☑
Improve Transit	○	○
Land Use / Placemaking	○	○
Property Access and Parking Issues	○	○

Legend: ☑ Positive Impact; ○ Neutral / No Impact; ☒ Negative Impact

Note: Two checkmarks presented as a tiebreaker when one concept is expected to have a greater magnitude of positive impacts

As shown in Table 5-9, both concepts are expected to have positive impacts when it comes to enhancing safety, improving traffic operations, and expanding multimodal infrastructure. Concept B is expected to generate greater benefits for improving traffic operations and reducing congestion, as having two separate signalized intersections is anticipated to process the vehicle demands more successfully through the quadrant. Concept B is also expected to generate more significant multimodal infrastructure benefits as a three-lane cross-section on Centre Avenue between the off-ramp and Centre Street provides space for a shared use path on the south side of the roadway. Neither concept is expected to have a measurable impact on transit improvements, land use/placemaking, and property and parking access.

Southwest Quadrant Preferred Alternative

Based on the results of the scoring matrix, **Concept B: Two Lane Off-Ramp with Signal Control** is the preferred concept for this quadrant and has been advanced to the overall preferred alternative presented in Chapter 6, *Preferred Alternative*.

Southwest Quadrant Public Input

Both concepts for the Southwest Quadrant and the scoring matrix were presented to the public. Table 5-10 summarizes which concept the public thought best meets the goals of the project.

Table 5-10 Southwest Quadrant Public Input

Which Concept in the Southwest Quadrant Best Meets the Goals of the Project?

	In-Meeting Responses		Online Responses		Total Responses	
	Total	Percent	Total	Percent	Total	Percent
Concept A	17	28%	18	25%	35	26%
Concept B	38	63%	44	60%	82	62%
Neither [1]	5	8%	11	15%	16	12%
Total	60	100%	73	100%	133	100%

Source: Based on live feedback collected at Public Meeting #3 on October 24, 2023, and in an online poll available on the project website between November 6, 2023, and November 19, 2023.

1 Participants that did not respond in the in-meeting poll or selected "None of the Above" in the online poll.

As shown in Table 5-10, a majority of the members of the public generally thought that Concept B best meets the goals of the project.

Southeast Quadrant

Four alternatives were advanced to the analysis stage in the Southeast Quadrant. Two alternatives involve adding signal control and two involve geometry modifications to install roundabouts.

The two signalized concepts are referred to as Concepts A1 and A2. The following sections detail on each concept and include a scoring matrix comparing the two.

Concept A1: Signal Control with Divided Eastbound Left-Turns

Concept A1 includes the following elements.

Signal Improvements

- Washington Street eastbound, west of the Washington Street westbound bridge, will be reconfigured as two left-turn only lanes and two through lanes. The outside left-turn lane will be for traffic destined for Washington Street westbound and Centre Street northbound and be under signal control.

Geometry Modifications

- Washington Street eastbound, west of the Washington Street westbound bridge, will be reconfigured as two left-turn only lanes and two through lanes.
  - The right turn lane onto Park Street will open closer to Park Street.
  - The two left-turn lanes will be divided from Washington Street eastbound onto the Washington Street westbound bridge with a new median.
  - The inside left-turn lane will be for traffic destined for the I-90 Westbound On-Ramp and be free flow unless the pedestrian signal is called.

Geometry and operations at the intersections of Washington Street eastbound at Park Street and Washington Street / St. James Street eastbound at Washington Street northbound are expected to be similar to current conditions with minimal changes.

Bicycle and Pedestrian Accommodations

- The crosswalk across Washington Street, west of the Washington Street westbound bridge, would be shifted slightly to the east, through the new median, with all four lanes (including both left-turn lanes) included in the pedestrian-activated traffic signal.
- A shared use path will be installed on the south side of Washington Street eastbound by shifting the roadway slightly to the north, into the existing medians between Washington Street eastbound and Relocated Washington Street westbound.

A graphic of Concept A1 is provided in Figure 5-9.

Figure 5-9: Southeast Quadrant - Concept A1

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Concept A2: Signal Control with Combined Eastbound Left-Turns

Alternative A2 consists of the following elements:

Signal Improvements

- The westbound left-turn movement onto the Washington Street westbound bridge will consist of two lanes under signal control.
- A three-phase traffic signal will be constructed at the intersection of Washington Street eastbound / Relocated Washington Street westbound at the Washington Street westbound bridge that will provide a green phase for traffic turning left from Washington Street eastbound, a green phase for traffic from Park Street northbound, and a separate green phase for traffic from Relocated Washington Street westbound.
- Crosswalks will be installed to the northeast and northwest and will have pedestrian walk phases concurrent with parallel traffic movements.

Geometry Modifications

- The Washington Street eastbound approach to Park Street will be modified to include two through lanes and a right-turn slip lane and the crosswalk across Washington Street eastbound will be shifted from the median island east of Park Street to the median island west of Park Street.
- The Park Street northbound approach will be modified to eliminate the traffic island between the through and right-turn lanes, and the Washington Street eastbound to Park Street southbound right turn movement is pulled further southwest, allowing for a wider traffic island between Park Street's northbound and southbound approaches.
- The Washington Street northbound approach will remain as is in the existing conditions with one through lane onto relocated Washington Street westbound and one shared through/right-turn lane.

Bicycle and Pedestrian Accommodations

- The existing traffic island south of the Washington Street westbound bridge will be expanded and will serve as a pedestrian refuge with crosswalks connected to the northeast, northwest, southeast, and southwest.
- The signalized crossing on Washington Street eastbound, west of Park Street, will be maintained across the two through lanes, and will connect to the new pedestrian refuge island.
- A shared use path will be installed on the south side of Washington Street eastbound by shifting the roadway slightly to the north into the exiting medians between Washington Street eastbound and Relocated Washington Street westbound.

A graphic of Concept A2 is provided in Figure 5-10.

Figure 5-10: Southeast Quadrant - Concept A2

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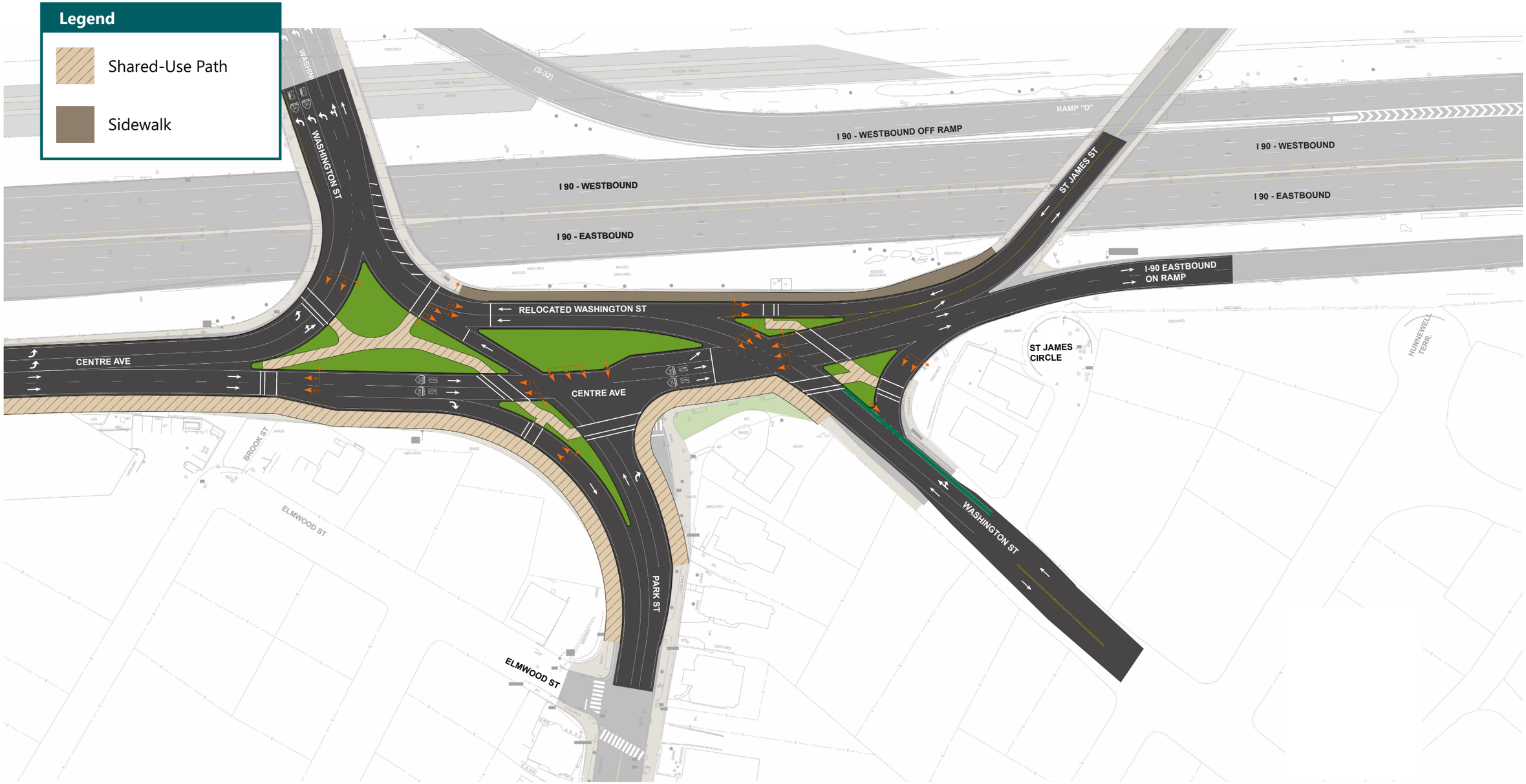

Southeast Quadrant Signalized Concepts Alternatives Evaluation

Table 5-11 presents the potential benefits and limitations of the two Southeast Quadrant signalized alternatives.

Table 5-11 Potential Benefits and Limitations: Southeast Quadrant Signalized Alternatives

Potential Benefits	Potential Limitations
Concept A1: Signal Control with Divided Eastbound Left-Turns	
› Reduced the weaving condition on the Washington Street westbound bridge by placing the outside eastbound left-turn lane under signal control	› Possible driver confusion by vertically separating the two eastbound left-turn lanes,
› The inside left-turn lane destined for the I-90 Westbound On-Ramp will remain under free flow conditions entering the bridge, but there should be minimal weaving between this lane and the adjacent lane, as both lanes lead to the I-90 Westbound On-Ramp	› Possible compliance issues as drivers could use the inside free flow left turn lane instead of the outside signalized left turn lane to bypass the signal and weave into lanes on the bridge destined for Washington westbound or Centre Street northbound
› Enhanced pedestrian and bicycle accommodations with a new shared-use path along the south side of Washington Street	
Concept A2: Signal Control with Combined Eastbound Left-Turns	
› Improved safety and reduced driver confusion by fully eliminating all weaving conditions on the Washington Street westbound bridge by signalizing all roadways that lead into the bridge	› Potential increase in delays and queues for vehicle movements leading into the Washington Street westbound bridge due to the installation of a three-phase traffic signal
› Enhanced pedestrian and bicycle accommodations with the new shared use path and strategically located crosswalks that more closely align with pedestrian desire lines.	

Table 5-12 presents the scoring matrix for the two Southeast Quadrant signalized concepts as they relate to the six study goals. A summary of the infrastructure changes associated with each goal is included in Appendix D.

Table 5-12 Southeast Quadrant Signalized Concepts Alternatives Evaluation

Goal	Concept A1 Signal Control with Divided EB Left-Turns	Concept A2 Signal Control with Combined EB Left-Turns
Enhance Safety	☑	☑ ☑
Improve Traffic Operations and Reduce Congestion	☑	☑
Expand Multimodal Infrastructure	☑	☑
Improve Transit	○	○
Land Use / Placemaking	○	☑
Property Access and Parking Issues	○	○

Legend: ☑ Positive Impact; ○ Neutral / No Impact; ☒ Negative Impact

Note: Two checkmarks presented as a tiebreaker when one concept is expected to have a greater magnitude of positive impacts

As shown in Table 5-12, both concepts are expected to have positive impacts when it comes to enhancing safety, improving traffic operations, and expanding multimodal infrastructure. Concept A2 is expected to produce more safety benefits by eliminating all weaving between traffic entering the bridge from the east and west through implementation of signal control for all eastbound left-turning traffic. Concept A2 is also expected to have a positive impact on land use/placemaking, as the larger median island and pedestrian refuge at the foot of the Washington Street westbound bridge will provide opportunity for increased green space and placemaking opportunities, including wayfinding signage and street furniture. Neither concept is expected to have a measurable impact on transit improvements or property and parking access.

The two roundabout concepts are referred to as Concepts B1 and B2. Details on the concepts and a scoring matrix comparing the two roundabout concepts are described in the following sections.

Concept B1: Roundabouts with Two Lanes Westbound

Alternative B1 has the following elements.

Signal Improvements

- A two-phase traffic signal will be installed at the foot of the Washington Street westbound bridge with two lanes for the left-turn movement from Washington Street eastbound and two lanes for the movements coming from the roundabouts to the east.

Geometry Modifications

- Two new partial roundabouts are proposed, one at the intersection of Washington Street at Park Street and one at the intersection of Washington Street at St James Street.
- Each roundabout will include two through lanes for the eastbound and westbound directions.
- Both the Park Street northbound and Washington Street northbound approaches will consist of two approach lanes with both lanes traveling into the westbound direction towards the Washington Street westbound bridge.
- The roundabout at the intersection of Washington Street at Park Street will provide full circulation, allowing for a new connection between traffic coming from St James Street westbound to Park Street southbound and towards the I-90 Eastbound On-Ramp. The full roundabout also allows for Washington Street northbound to U-turn onto Park Street southbound.
- The Washington Street eastbound right-turn slip lane onto Park Street southbound will be eliminated, to provide full circulation within full roundabout.

Bicycle and Pedestrian Accommodations

- The existing signalized crosswalk across Washington Street eastbound west of the Washington Street westbound bridge will be maintained.
- A shared use path will be installed on the north and south sides of Washington Street, and signalized crosswalks will be installed in between the two roundabouts, providing a protected crossing from the south side to the north side of the quadrant.
- Crosswalks will be provided across each approach at the Washington Street westbound bridge that have pedestrian walk phases parallel with concurrent traffic movements.

A graphic of Concept B1 is provided in Figure 5-11.

Figure 5-11: Southeast Quadrant - Concept B1

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Concept B2: Roundabouts with One Lane Westbound

Concept B2 includes the following elements:

Signal Improvements

- The same signal improvements are proposed in Concept B2 as presented under Concept B1, including installing a new two-phase traffic signal at the foot of the Washington Street westbound bridge to eliminate the weaving condition

Geometry Changes

- The geometry changes for Concept B2 are similar to Concept B1, except that the westbound direction approaching the Park Street roundabout will be one single lane instead of two lanes.
- To support a single westbound lane, the Washington Street northbound approach will only have one lane traveling into the westbound direction with a second dedicated right-turn lane.
- This reduces the possible right-of-way impact for the property in between the two partial roundabouts on the south side. However, a small sliver of right-of-way impact is still likely with the smaller roundabout footprint.

Bicycle and Pedestrian Accommodations

- The same bicycle and pedestrian accommodations are proposed in Concept B2 as presented under Concept B1, including installing a shared use path on the south side of Washington Street eastbound with signalized crossings in between the two roundabouts.

A graphic of Concept B2 is provided in Figure 5-12.

Figure 5-12: Southeast Quadrant - Concept B2

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Southeast Quadrant Roundabout Concepts Alternatives Evaluation

Table 5-13 presents the potential benefits and limitations of the two Southeast Quadrant roundabout alternatives.

Table 5-13 Potential Benefits and Limitations: Southeast Quadrant Roundabout Alternatives

Potential Benefits	Potential Limitations
Concept B1: Roundabouts with Two Lanes Westbound	
› Reduces the number of conflict points and will likely reduce vehicle speeds within the quadrant as compared to a signalized concept › A new traffic signal at the foot of the Washington Street Westbound bridge will eliminate all weaving movements. › The two new roundabouts will provide a new connection for drivers from St. James Street westbound to reverse direction or access Park Street southbound and the I-90 Eastbound On-Ramp. Providing this left-turn/U-turn movement could reduce the amount traffic travelling through the other quadrants at Newton Corner, as those vehicles would now have a more direct connection. › Enhanced pedestrian and bicycle accommodations with a new shared-use path along the south side of Washington Street and a signalized crossing between the two roundabouts	› Possible right-of-way impacts at the property located between the two partial roundabouts on the south side due to the cross-sectional width required to provide two through lanes in both the eastbound and westbound directions. › A preliminary review of traffic operations indicates that queues and delays on the Park Street northbound and Washington Street northbound approaches may be longer than under the signalized options
Concept B2: Roundabouts with One Lane Westbound	
› Similar to Concept B1, but with a reduced right-of-way impact for the property in between the two partial roundabouts on the south side since the footprint of the roadway is reduced with one lane westbound	› By reducing the westbound direction from two lanes to one lane circulating through the roundabouts, this reduces the throughput capacity of the westbound direction, increasing queues and delays on the St. James Street westbound and Washington Street northbound approaches. › There is still likely to be a small right-of-way impact at the property located between the two partial roundabouts on the south side

Table 5-14 presents the scoring matrix for the two Southeast Quadrant roundabout concepts as they relate to the six study goals. A summary of the infrastructure changes associated with each goal is included in Appendix D.

Table 5-14 Southeast Quadrant Roundabout Concepts Alternatives Evaluation

	Goal	Concept B1 Roundabouts with Two Lanes Westbound	Concept B2 Roundabouts with One Lane Westbound
	Enhance Safety	☑	☑
	Improve Traffic Operations and Reduce Congestion	☑	○
	Expand Multimodal Infrastructure	☑	☑
	Improve Transit	○	○
	Land Use / Placemaking	☑	☑
	Property Access and Parking Issues	☒	○

Legend: ☑ Positive Impact; ○ Neutral / No Impact; ☒ Negative Impact

Note: Two checkmarks presented as a tiebreaker when one concept is expected to have a greater magnitude of positive impacts

As shown in Table 5-14, both concepts are expected to have positive impacts when it comes to enhancing safety, expanding multimodal infrastructure, and land use/placemaking. Concept B1 is expected to improve traffic operations and reduce congestion by providing two lanes westbound, which will allow for additional vehicular throughput approaching from the east and south. However, the accommodation of the two lanes in the westbound direction presented in Concept B1 is expected to have a negative impact on property access with a possible partial right-of-way taking likely required from the property in between the two partial roundabouts on the south side. Neither concept is expected to have a measurable impact on transit improvements.

Southeast Quadrant Preferred Alternative

Based on the results of the scoring matrix, two concepts were initially chosen to advance, one signalized option and one roundabout option. **Concept A2: Signal Control with Combined EB Left-Turns** was the preferred signalized concept and **Concept B1: Roundabouts with Two Lanes WB** was the preferred roundabout concept as these concepts best met the goals of the project.

To determine which concept, signalized or roundabout, should advance as the preferred alternative, additional elements were considered:

- **Traffic Operations**: Synchro and Vissim analyses were conducted for both concepts in the Southeast Quadrant to understand expected traffic operations. The Vissim analyses indicated that the roundabout concept generally did a better job processing vehicles through the Newton Corner area, although the queues and operations on the Park Street and Washington Street northbound approaches were more favorable with the signalized concept. Details of the Vissim analyses for both concepts are included in Appendix D.
- **Property Access:** The roundabout concept has possible right-of-way impacts due to the cross-sectional width required to provide two through lanes in both the eastbound and westbound directions, while the signalized concept is not anticipated to have permanent right-of-way impacts.
- **Stakeholder Coordination:** The project team met with the City of Newton to collect their input. Both the signalized and roundabout concept generally achieve the goals of the study, with the roundabout concept expected to more efficiently process vehicles at the trade-off of potential property impacts and increased queues and delays to the Park Street and Washington Street northbound approaches. To avoid impacting any property while still achieving most of the project goals, the City of Newton preferred the signalized option.

As the signalized option was identified by the City of Newton as their preferred option and since it is not anticipated to have significant permanent right-of-way impacts, Concept A2: Signal Control with Combined EB Left-Turns is the preferred concept for this quadrant and has been advanced to the overall preferred alternative presented in Chapter 6, *Preferred Alternative*.

Southeast Quadrant Public Input

The two signalized and two roundabout concepts for the Southeast Quadrant and the scoring matrices were presented to the public. The public was asked three questions:

1. Which signalized option best meets the goals of the project?
2. Which roundabout option best meets the goals of the project?
3. Does a general signalized or roundabout option better meet the goals of the project?

Table 5-15 summarizes the public input for the Southeast Quadrant.

Table 5-15 Southeast Quadrant Public Input

	In-Meeting Responses		Online Responses		Total Responses	
	Total	Percent	Total	Percent	Total	Percent
Which Signalized Concept in the Southeast Quadrant Best Meets the Goals of the Project?						
Concept A1	19	32%	23	32%	42	32%
Concept A2	35	58%	35	48%	70	53%
Neither [1]	6	10%	15	21%	21	16%
Total	60	100%	73	100%	133	100%
Which Roundabout Concept in the Southeast Quadrant Best Meets the Goals of the Project?						
Concept B1	31	52%	24	33%	55	41%
Concept B2	13	22%	29	40%	42	32%
Neither [1]	16	27%	20	27%	36	27%
Total	60	100%	73	100%	133	100%
Which General Concept, a Traffic Signal or a Roundabout, Best Meets the Goals of the Project?						
Signal	35	58%	34	47%	69	52%
Roundabout	21	35%	36	49%	57	43%
Neither [1]	4	7%	3	4%	7	5%
Total	60	100%	73	100%	133	100%

Source: Based on live feedback collected at Public Meeting #3 on October 24, 2023, and in an online poll available on the project website between November 6, 2023, and November 19, 2023.

1 Participants that did not respond in the in-meeting poll or selected "None of the Above" in the online poll.

As shown in Table 5-15, when considering a general signalized and a general roundabout option, a majority of members of the public that responded live in the meeting generally thought that a signalized concept better meets the goals of the project while those that answered online were almost evenly split between which general concept they thought better meets the goals of the project.

6

Preferred Alternative

Chapter 4, *Alternatives Development*, and Chapter 5, *Alternatives Analysis*, developed, screened, and analyzed potential transportation improvements for the Newton Corner area. This chapter presents the details of the preferred alternative that has been identified through the Study planning process.

Study Area Preferred Alternative

The Study Area-wide preferred alternative was developed based on the results of Chapter 5, *Alternatives Analysis*. The preferred alternative for the overall Study Area was developed by combining the preferred alternatives identified in each individual quadrant:

- Northeast Quadrant – Concept C: Intersection Improvements with Washington Street Bus Lane Southbound Right-Turn Crosswalk
- Northwest Quadrant – Concept B: Signal Control with Two-Lanes Eastbound
- Southwest Quadrant – Concept B: Two Lane Off-Ramp with Signal Control
- Southeast Quadrant – Concept A2: Signal Control with Combined EB Left-Turns

A graphic illustrating the preferred alternative concept for the Study Area is presented in Figure 6-1.

Figure 6-1: Preferred Alternative Concept

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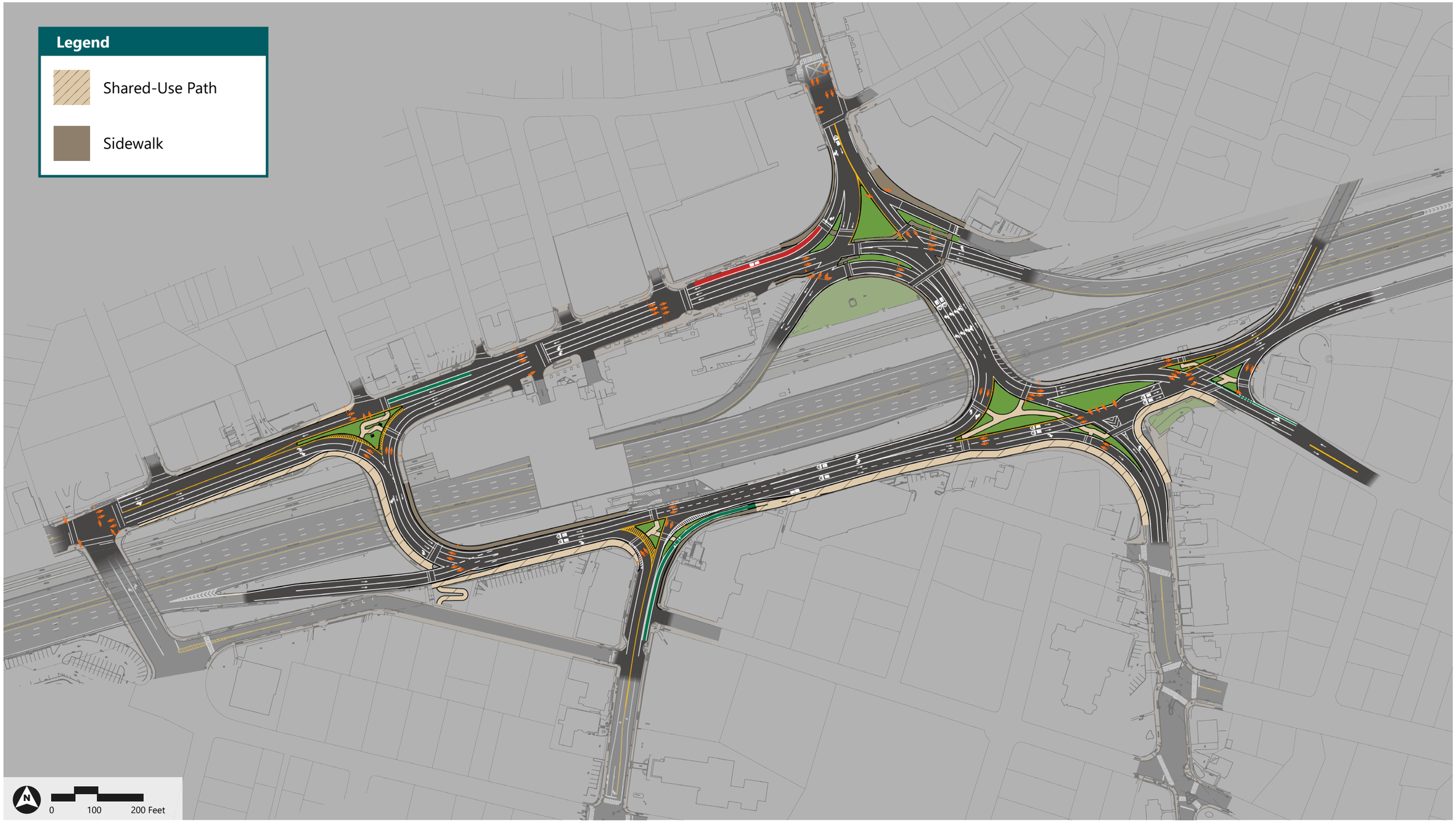

Preferred Alternative Elements

The following sections summarize different elements of the preferred alternative with respect to the six project goals.

Enhanced Safety

One of the main purposes of the project is to improve safety throughout Newton Corner. As noted previously, the existing roadway design can be confusing for drivers and results in significant weaving of vehicles as drivers maneuver into different lanes throughout all quadrants of the Study Area. In addition, the queue on the I-90 Eastbound Off-Ramp frequently backs up onto the I-90 mainline, creating a potential safety hazard with stopped vehicles on the interstate. There are also several potential safety issues for pedestrians and bicyclists, as multimodal connections throughout the Study Area are generally incomplete.

The recommended alternative addresses several safety issues. Consideration was taken to eliminate several weaving conditions within Newton Corner, especially with the signalization of the Washington Street eastbound and westbound approaches to the Washington Street eastbound and westbound bridges in the Northwest and Southeast Quadrants, respectively, and the signalization of the I-90 Eastbound Off-Ramp in the Southwest Quadrant. By adding new traffic signals within the Study Area, additional traffic control will be created, limiting conflicts between vehicles. In addition, the signalization and widening of the I-90 Eastbound Off-Ramp is expected to reduce the queue on the off-ramp, reducing the frequency of queue backups and stopped vehicles on the I-90 eastbound mainline, and improving safety for I-90 travelers.

Pedestrian and bicycle safety will also be enhanced with the preferred alternative, as a new shared use path will be constructed around the west and south sides of Newton Corner. This shared use path will be vertically separated from vehicular traffic and will provide a new facility for bicyclists that does not currently exist. The introduction of new traffic signals at several locations will also include new signalized pedestrian crossings.

Improved Traffic Operations and Reduced Congestion

While it is important to note that improved traffic operations are just one of the project objectives, the preferred solution aims to improve safety, expand multimodal infrastructure, improve transit, consider land use / placemaking and minimize property impacts, while not severely impacting traffic operations.

The preferred concepts were analyzed in Synchro during the alternatives analysis stage to help evaluate the feasibility of each alternative and to help determine which alternative best met the project goals. Once recommended alternatives were identified in each quadrant, a Vissim analysis was conducted to support the Synchro and to understand how traffic would interact throughout the entire study area.

Based on the Synchro and Vissim analyses, the preferred concepts are expected to improve queues and delays at key movements throughout the study, including the I-90 eastbound off-ramp, movements onto the I-90 WB on-ramp, and the northbound bridge on the east side of the interchange. The most notable of these improvements is a reduction in queues at the I-90 eastbound off-ramp, as shown in Table 6-1.

Table 6-1 I-90 EB Off-Ramp at Centre Avenue EB Queues

Condition	Future No-Build	Future with Preferred Concept	Change
Weekday Morning			
Average Queue (ft)	2,992	1,780	-1,212
95th Queue (ft)	3,049	2,765	-284
Weekday Evening			
Average Queue (ft)	2,994	2,389	-605
95th Queue (ft)	3,043	3,030	-13

Source: Based on the Vissim analysis.

Along with the queue improvements, travel times through the study area can be expected to generally remain the same or improved as no-build conditions for most routes through the interchange. A summary of these travel times can be seen in Appendix D.

It's important to note that advancements to signal systems and technology are always improving and there is potential for further improvements to operations throughout the interchanges through the use of adaptive signal systems. Future signal timing and coordination plans will be further refined as part of the design process.

Expanded Multimodal Infrastructure

New Pedestrian Connections

The preferred alternative will improve the pedestrian experience through Newton Corner by providing the following new connections:

- In the Northwest Quadrant, new crosswalks will be constructed at the new signalized intersection across the Washington Street eastbound and westbound approaches to the Washington Street eastbound bridge and across Washington Street westbound to Thornton Street.
- In the Southwest Quadrant, new crosswalks will be constructed across both approaches at the new signalized intersection of Centre Avenue eastbound at the I-90 Eastbound Off-Ramp. Currently the sidewalk on the west side of the Washington Street eastbound bridge ends without a crosswalk, so this will allow pedestrians to safely connect to the existing sidewalk network on the south side of I-90.
- In the Southeast Quadrant, new crosswalks will be constructed at the new signalized intersection across the Washington Street eastbound and westbound approaches to the Washington Street westbound bridge.
- In the Northeast Quadrant, several new crosswalks will be provided, including new crosswalks across the Centre Street southbound approach connecting the northwest corner of the quadrant with points east and south.

A graphic of the existing and new pedestrian connections is provided in Figure 6-2.

New Bicycle Connections

A key benefit of the project is expanding the bicycle infrastructure through Newton Corner, as there are minimal dedicated bicycle accommodations under existing conditions. With the preferred alternative, a continuous shared use path will be constructed along the west and south sides of the Study Area, providing a new bicycle connection across Newton Corner. The shared use path will start on the south side of Washington Street, west of the Washington Street eastbound bridge, with signalized crossings for pedestrians and bicyclists provided to the north side of Washington Street. The shared use path will continue on the west side of the Washington Street eastbound bridge and then run along the south side of Centre Avenue / Washington Street eastbound from the I-90 Eastbound Off-Ramp to St. James Street. Signalized crossings for pedestrians and bicyclists will be provided across the I-90 Eastbound Off-Ramp and across Centre Street and Park Street.

Building off of the proposed shared use path, potential additional bicycle accommodations could be provided on several additional roadways connecting to the new facilities, including on Washington Street westbound between Centre Street and Channing Street, Washington Street in both directions west of Church Street, as well as on Church Street, Richardson Street, and Park Street. These additional accommodations may require the elimination of on-street parking and therefore final determination of these potential connections will be decided by the City of Newton during the design process.

A graphic of the existing and new proposed and potential bicycle connections created as part of this project is provided in Figure 6-3.

Figure 6-2: Existing and Proposed Pedestrian Connections

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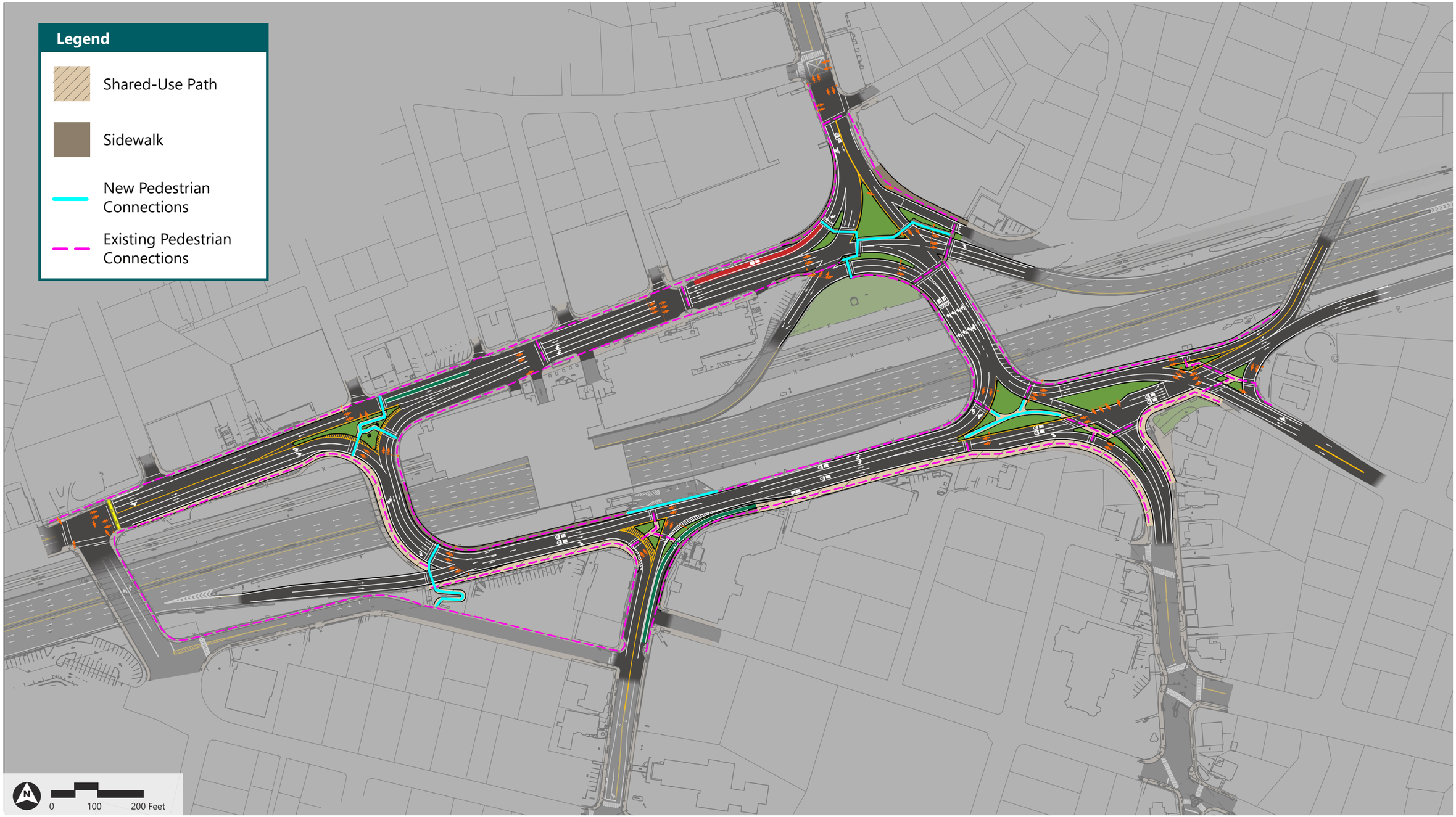
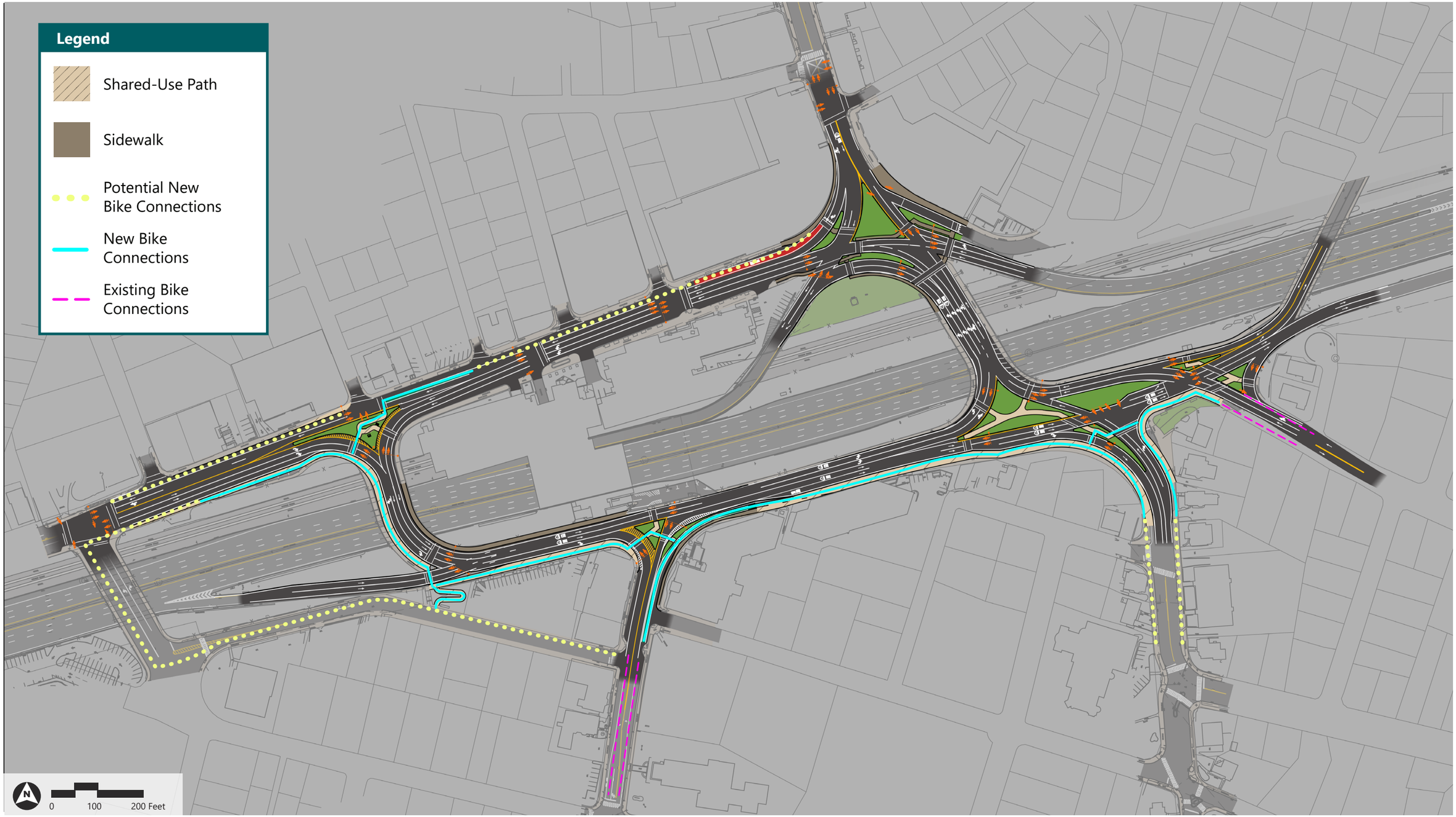


Figure 6-3: Existing and Proposed Bicycle Connections

Traffic Signal and Safety Improvements at Interchange 127 | Newton, MA



Improved Transit

The preferred alternative includes a short bus-only lane on the north side of Washington Street westbound between Centre Street and Bacon Street in the Northeast Quadrant. This bus-only lane will run for approximately 300 feet and will allow buses to bypass vehicular traffic in the Washington Street westbound general-purpose lanes to access the bus stop east of Bacon Street, potentially providing a small savings in travel times for bus riders. In the future conditions with Bus Network Redesign in place, this facility will be used by MBTA Bus Routes 52, 56, 58, 504, T57.

While no other dedicated bus-only lanes are proposed in the preferred alternative, bus riders boarding and alighting in the Study Area will benefit from enhanced pedestrian connections as they walk to and from the bus stops. As the preferred alternative concept progresses into the design phase, enhanced bus stop amenities, such as shelters and benches at all stops, should be considered to further improve the transit experience in the Study Area.

Land Use / Placemaking

With the enhanced streetscape proposed as part of the project, there will be opportunities to improve the placemaking of Newton Corner and support existing land uses. Crosswalks in the Northeast Quadrant will provide a new north-south connection to the Newton Corner Bell Tower Park, providing an opportunity to improve access to the bell tower if desired by the City of Newton. In addition, existing traffic islands in the Northwest, Southeast, and Northeast Quadrants will be enhanced with new crosswalk connections creating pedestrian refuge islands and providing an opportunity for new placemaking such as possible art installations or detailed landscaping.

Property Access and Parking

The preferred alternative generally maintains existing property access and parking opportunities within the Study Area. The specific number of on-street parking spaces provided in the future will be determined during the design phase, but an initial review suggest that of the 118 existing on-street parking spaces within the study area, between two and 22 of the parking spaces may be eliminated. Future design considerations will evaluate the best balance of roadway users, including on-street parking demands and potential bicycle accommodations. The proposed improvements are within the existing right-of-way.

Considerations

The preferred alternative presented in this planning study is only a concept and there are several potential considerations to be made before the final design is determined.

Right-of-Way Impact

During the development of alternatives, one parameter of the project was to limit impacts to the right-of-way beyond the existing roadway cross-section. While the preferred alternative is expected to have no permanent right-of-way takings, temporary right-of-way access may be required during construction. As the project advances to design, any temporary or permanent right-of-way impacts will be identified and coordinated with the property owner.

Vissim Simulation Analysis

The Vissim model developed as part of this study was utilized to test the preferred alternatives within each study area quadrants together. The objective of this modeling effort was to understand how the individual preferred alternatives work together, identify additional details to be revised during the design process.

The results of this modeling effort are provided in Appendix D, and revealed the following:

- Within the study area, congestion is still expected to occur in the future even with the Preferred Concept, as the Preferred Concept prioritizes improving safety by adding traffic signals to control traffic flow. While this will remove weaving conditions within Newton Corner, it will also increase delays by having vehicles stop at red lights where today there is no stopping.
- As the Preferred Concept moves into the design phase, design details will be determined, including detailed coordinated signal timing patterns for all intersections within the study area. This could allow intersections to operate more efficiently and process additional vehicular demand
- Adaptive signal infrastructure should be considered during design phase.
- The geometry and lane designation along Centre Avenue eastbound should be further designed to minimize weaving conflicts while accommodating all movements.

Design Details

While this study identifies a concept-level preferred alternative, additional design efforts will be necessary to finalize project specifications, complete permitting, and begin construction. During the design process, the final details of the project will be determined based on coordination with MassDOT and the City of Newton. The design will need to meet all local and state design guidelines, and some elements of the concept could be slightly refined to ensure that all standards are met. Final details that will be determined in the design stage include signal timing and phasing at all locations, specific crosswalk locations, and lane widths, among other elements.

7

Recommendations & Next Steps

The previous chapters developed, screened, and analyzed 11 mid-term transportation improvements for Newton Corner before presenting the preferred alternative. This chapter summarizes how the preferred alternative can be implemented, provides recommendations on how to advance the project to design and construction, identifies cost and funding considerations, and outlines next steps.

Recommendations & Next Steps Key Takeaways

- The project team recommends advancing the preferred alternative into the design stage through the MassDOT project development process.
- Final design details will be worked out in the design stage to ensure that the project improves safety and mobility for all users while also meeting local and state design guidelines.
- The City of Newton will serve as the Project Champion moving forward and will be responsible for initiating the design phase by submitting a Project Initiation Form with MassDOT to formally initiate the project.
- There are several potential funding sources that could be used for the project, including the State Transportation Improvement Plan (TIP).

Project Champion and Key Stakeholders

The City of Newton will serve as the project champion, tasked with advancing the preferred alternative through the MassDOT project development process (PDP) (described later in this chapter) to construction. To begin this process, the City of Newton will need to initiate the project in MassDOT's PDP. While the City of Newton will guide the project forward, they will do so in tandem with several key stakeholders, including MassDOT and FHWA. It is also crucial for members of the public, including residents and local business owners, to be involved in the project moving forward.

Costs and Funding

The following sections present conceptual cost estimates for the preferred alternative and potential funding sources that could be used to fund the design and construction phases of the project.

The preferred alternative presented in this Study represents a significant financial commitment and will likely require funding from both State and Federal sources to be completed. Project advancement will require prioritization and coordination among the City of Newton, state departments, and other stakeholders. Finally, funding sources and availability may be impacted by other priorities within the transportation network across the Commonwealth, affecting the City's ability to leverage some funds.

Conceptual Cost Estimates

A conceptual cost estimate was developed for the recommended alternative, broken down by quadrant. The cost estimate was developed in March of 2024, using MassDOT methodology[9], in 2024 dollars without an inflation rate. Table 7-1 below summarizes the cost estimate by quadrant, and the full cost breakdowns are provided in Appendix D.

Table 7-1 Conceptual Construction Cost Estimate

Quadrant	Estimated Cost (2024 Dollars)
Northwest Quadrant	$3,250,000
Southwest Quadrant	$3,750,000
Southeast Quadrant	$5,050,000
Northeast Quadrant	$4,100,000
Total	$16,150,000

The preferred alternative is expected to cost **$16,150,000** to construct, in 2024 dollars. This estimate may change in the future, when the project is bid, based on current labor and material cost.

[9] The cost estimate was developed using the Massachusetts Department of Transportation's (MassDOT) average big prices within the last twelve months of March of 2024 (not specific to district), and the MassDOT Highway Division's "A Guide to Estimating Highway Projects", dated January 2023.

Potential Funding Sources

State Transportation Improvement Plan

The most likely funding source for this project is the State Transportation Improvement Plan (TIP). Each Metropolitan Planning Organization (MPO) within the state has a rolling, five-year capital funding program. Eligible transportation projects can receive federal and state roadway funding if the project is selected by the MPO. Selection is based on an evaluation and prioritization of all eligible projects and includes municipal and public feedback. The Boston Region Metropolitan Planning Organization has identified the following six investment programs that focus on specific types of projects that help the MPO achieve its goals and objectives for the transportation system:

- **Complete Streets:** Projects that modernize roadways to improve safety and mobility for all users.
- **Intersection Improvements:** Projects to modernize intersection geometry and signalization to improve safety and mobility.
- **Bicycle Network and Pedestrian Connections:** Projects to expand bicycle and pedestrian networks to improve safe access to transit, schools, employment, and shopping destinations.
- **Major Infrastructure:** Projects that enhance major arterials for all users and modernize or expand transit systems to increase capacity. Projects in this program cost more than $50 million; are on major roadways; or add new connections to or extend the rail or fixed guideway transit network or the bus rapid transit network.
- **Community Connections:** Includes a variety of project types, including first- and last-mile solutions and other small, nontraditional transportation projects to enhance mobility and improve air quality.
- **Transit Modernization:** Projects that modernize transit infrastructure and promote the enhanced ridership, accessibility, or resiliency of transit services.

Additional information on this funding source can be found at https://www.ctps.org/tip.

Other Potential Funding Sources

While the State TIP is a likely funding source, it is not the only possible funding option. Other possible funding sources include:

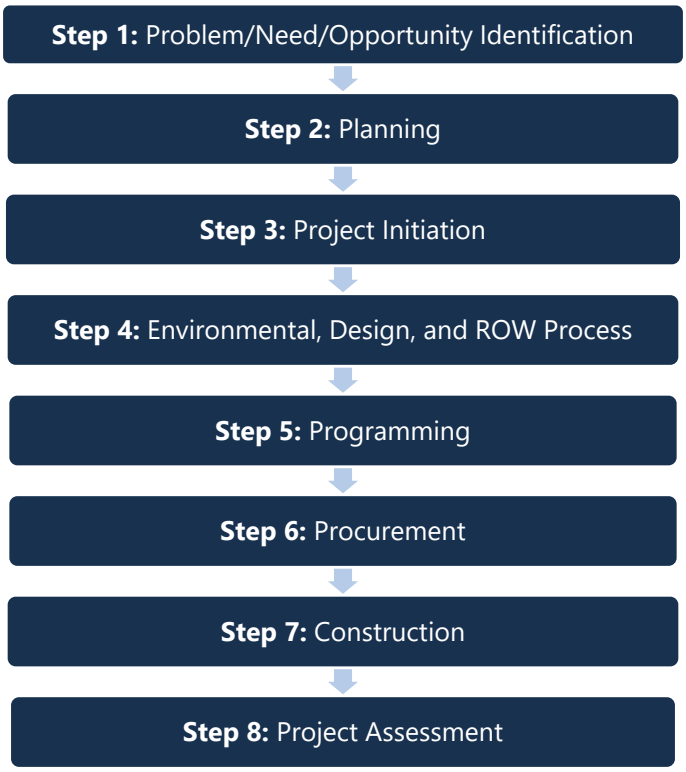
- **MassDOT Complete Streets Funding:** The state currently offers dedicated construction funding to eligible communities to implement Complete Streets infrastructure elements. A 'Complete Street' is one that provides safe and accessible options for all travel modes (walking, biking, transit, and vehicles) for people of all ages and abilities. To be eligible for funding, a municipality must have a MassDOT approved Complete Streets policy and prioritization plan. Additional information on this funding source can be found at https://www.mass.gov/complete-streets-funding-program. The City of Newton approved a Complete Streets Policy in 2016.
- **MassDOT Highway Safety Improvement Program:** MassDOT provides funding for projects that aim to reduce traffic fatalities and serious injuries on public roadways. Eligible programs include any strategy, activity, or project that corrects or improves a hazardous road location or features or addresses a highway safety problem. Additional information on this funding source can be found at: https://www.mass.gov/service-details/highway-safety-improvement-program.

- **Federal Grants:** There are several grants and programs administered at the federal level that may also be applicable to provide support for some of the recommendations. Application for federal grant programs occurs through a coordinated process within MassDOT. In particular, the U.S. DOT and the Federal Highway Administration offer several Bipartisan Infrastructure Law grants programs to support local and state land use and transportation projects, including:
  - Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Discretionary Grants
  - Multimodal Project Discretionary Grant (MPDG) Opportunity:
    - Nationally Significant Multimodal Freight and Highway Projects (INFRA)
    - National Infrastructure Project Assistance Grants Program (MEGA)

Next Steps

Project Development Process

If the recommended improvements are to be funded through the State Transportation Improvement Plan (TIP), the preferred alternative will need to go through the MassDOT project development process. The project development process is an eight-step process used to move a project from problem identification to completion, as presented in the MassDOT Project Development and Design Guide (PDDG)[10]. The eight-step process is shown below.



[10] MassDOT Project Development and Design Guide; Chapter 2 – Project Development; 2006.

The following includes descriptions of each step as provided in the MassDOT PDDG:

- **Step 1 – Problem/Need/Opportunity Identification:** Projects begin with the identification of a problem, need, or opportunity.
- **Step 2 – Planning:** In this phase, the proponent identifies issues, impacts, and potential approvals required. The required level of planning will vary based on the complexity of the project and may benefit from a concurrent public outreach process. **This study generally completes the planning step.**
- **Step 3 – Project Initiation:** In this phase, the process formally begins the review and evaluation of the project by the project review committee and the MPO. This step generally includes the submittal of a Project Initiation Form by the City of Newton and the identification of appropriate funding.
- **Step 4 – Environmental, Design, and ROW Process:** This step begins the process of environmental review, project design, and right-of-way acquisition (if necessary) so that the project can be constructed. This step generally includes the submittals of plans, specifications, and estimates (PS&E), environmental studies, right-of-way plans, and permits.
- **Step 5 – Programming:** In this phase, the project will be scheduled in the State Transportation Improvement Plan (TIP). Once on the TIP, funding for the project can be allocated and the project is ready to move forward. This phase can occur any time during the process from planning to design.
- **Step 6 – Procurement**: Once a design is complete, the project is organized within a construction contract and an open invitation to bidders is published.
- **Step 7 – Construction:** The project is constructed during this phase. The construction process includes public notification and continues until the project is complete.
- **Step 8 – Project Assessment:** In this final stage, construction is complete and project elements and processes are evaluated on a voluntary basis.

Recommended Next Step

This study generally completes the planning stage of the project development process. The City of Newton should consider submitting a Project Initiation Form with MassDOT to formally initiate the project in the PDP. After this step is completed, the City of Newton will be positioned to advance the preferred alternative to design.

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Appendices

Appendix A – Mid-Term Alternative Cut-Sheets

Appendix B – Public Involvement: Additional Information

Appendix C – Existing and Future Conditions: Additional Information

Appendix D – Alternatives Development and Analysis: Additional Information

Appendix E – Report Data and Calculations

Appendix A - Mid-Term Alternative Cut-Sheets

Provided upon Request

Appendix B – Public Involvement: Additional Information

Provided upon Request

- Public Informational Meeting Presentations
- Meeting Notes

Appendix C - Existing and Future Conditions: Additional Information

Provided upon Request

- Vehicular Crash Summary Tables
- Roadway and Intersection Descriptions
- Intersection Capacity Analysis Methodology
- Existing and Future Conditions Level of Service Tables
- Supplemental Bicycle and Pedestrian Level of Traffic Stress Analyses
- Background Development Projects
- Environmental Assessment
- Collision Diagrams (2017-2019 and 2020)

Appendix D - Alternatives Development and Analysis: Additional Information

Provided upon Request

- Short-Term Alternative Concept Drawings
- Short-Term Traffic Operations Memorandum
- Mid-Term Alternative Concept Drawings
- Mid-Term Alternatives Infrastructure Improvements
- Mid-Term Alternatives Level of Service Tables
- Preferred Alternative Cost Estimates

Appendix E – Report Data and Calculations

Provided upon Request

- Vehicular Crash Data
- Traffic Count Data
- Background Development Project-Generated Volumes
- Intersection Capacity Analysis Worksheets
- Vissim Calibration Data
- Signal Warrant Analysis Worksheets

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