Ruthanne Fuller
Mayor

City of Newton, Massachusetts
Department of Planning and Development
1000 Commonwealth Avenue Newton, Massachusetts 02459

Telephone
(617) 796-1120
Telefax
(617) 796-1142
TDD/TTY
(617) 796-1089
www.newtonma.gov

Barney Heath
Director

PUBLIC HEARING/WORKING SESSION III MEMORANDUM

DATE: January 11, 2019

MEETING DATE: January 15, 2019

TO: Land Use Committee of the City Council

FROM: Barney Heath, Director of Planning and Development
Jennifer Caira, Chief Planner for Current Planning
Michael Gleba, Senior Planner

CC: Petitioner

In response to questions raised at the City Council public hearing, the Planning Department is providing the following information for the upcoming public hearing/working session. This information is supplemental to staff analysis previously provided at the Land Use Committee public hearing.

PETITIONS #425-18 & #426-18 156 Oak St., 275-281 Needham St. &., 55 Tower Rd.

Petition #425-18- for a change of zone to BUSINESS USE 4 for land located at 156 Oak Street (Section 51 Block 28 Lot 5A), 275-281 Needham Street (Section 51, Block 28, Lot 6) and 55 Tower Road (Section 51 Block 28 Lot 5), currently zoned MU1.

Petition #426-18- for SPECIAL PERMIT/SITE PLAN APPROVAL to allow a mixed-use development greater than 20,000 sq. ft. with building heights of up to 96' consisting of 822 residential units, with ground floor residential units, with restaurants with more than 50 seats, for-profit schools and educational uses, stand-alone ATMs drive-in businesses, open air businesses, hotels, accessory multi-level parking facilities, non-accessory single-level parking facilities, non-accessory multi-level parking facilities, places of amusement, radio or TV broadcasting studios, and lab and research facilities, to allow a waiver of 1,600 parking stalls, to allow a reduction in the overall parking requirement to not less than 1900 stalls, to waive dimensional requirements for parking stalls, to waive end stall maneuvering requirements, to allow driveway entrances and exits in excess of 25', to waive perimeter landscaping requirements, to waive interior landscaping requirements, to waive lighting requirements for parking lots, to waive general lighting, surfacing and maintenance requirements, to waive off-street loading facilities requirements, to waive sign requirements relative to number, size, location or design, to waive the number of signs allowed.

The Land Use Committee (the "Committee") held a public hearing on September 25, 2018 and working sessions on November 13, 2018 and December 11, 2018 on these petitions. This memo reflects additional information addressed to the Planning Department as of January 10, 2019.

As indicated by the tentative schedule for Land Use Committee public hearings (**Attachment A)** pursuant to the above-referenced petitions, this memorandum is focused on transportation aspects of the so-called "Northland Newton Development" proposed for the subject parcels.

Background

As proposed, and subject to the requested zoning change of the three subject parcels from Mixed Use 1 (MU1) to Business 4 (BU4) and the granting of requested special permit, the project involves the construction of a 1,924,273 gross square foot, 13 building mixed-use development on 22.6 acres of land. The proposal includes 822 residential units comprising 1,089,080 square feet of residential space, (including apartments and several townhouse type units), 193,200 square feet of office space, 237,097 square feet of retail space and 4,000 square feet of community space. The project would have 1,408 on-site parking stalls within garages and surface parking as well as accommodations for 1,106 bicycles.

The project is designed as an urban center with active streetscapes, street level retail, public spaces and "on-street" parking, all arranged within a modified gridded street system. The project's 13 structures range from two to eight stories in height, with the tallest measuring 95.6 feet high. The site would be accessed by four driveways: one located off Tower Road, two off Needham Street (one to the proposed "Main Street", the other to the proposed westerly extension of Charlemont Street), and one on Oak Street serving the proposed "Pettee Lane." All internal roadways, including the proposed "Main Street", Charlemont Street extension and Pettee Lane referenced above are considered internal driveways (i.e., not as accepted public or private ways).

Analysis and Peer Review

As requested by the Land Use Committee and the Planning Department, the BETA Group, Inc. (BETA), in collaboration with Alta Planning+Design, Inc., submitted an initial peer review (**Attachment B**) of the transportation planning materials and documents of the project, including the Northland Newton Traffic Impact and Access Study (dated October 2018) and the Northland Newton Transportation Implementation Plan (dated October 16, 2018) submitted by the petitioner, (a full list of the material reviewed by BETA is provided in its peer review). Please note that the petitioner responded to a draft of BETA's review in letter dated January 4, 2019, attached hereto as **Attachment C**.

The context for any analysis of the traffic and transportation impacts of the proposed project, as the petitioner has stated, is that at present the Needham street corridor "is saturated at certain hours." Further, while public transportation service is relatively limited in the immediate area of the project site, it nevertheless includes two MBTA bus routes (#s 52 and 59), light rail (Green Line) to the north, and commuter rail service on the Needham line to the south.

The analysis and review conducted by BETA addressed many transportation issues related to the proposal. The Planning Department notes that the executive summary of the review highlights several of its most pressing aspects (in addition to these issues, the BETA review also addresses other aspects

of the project, including its Internal Circulation, Loading and Curbside Activity, Transportation Demand Management (TDM) Plan, and consistency with the Newton Street Design Guide and the Needham Street Vision Plan).

The Planning Department offers the following synopsis and comments on the following topics:

Newton Street Design Guide

The Newton Street Design Guide is a living document developed with Toole Design Group and an interdepartmental team and envisions a "safe, smart, accessible, livable, and sustainable multimodal transportation system with the goal of eliminating all transportation-related fatalities and injuries". While the internal street network of the proposed project will be open to the public, the roads will technically be considered internal, private driveways and not public streets. Nonetheless, Planning staff recommends that the petitioner use the principles found in the design guide when designing the internal network. BETA Group provided an analysis of how the project meets the goals of the design guide in their Transportation Engineering Peer Review (**Attachment B, page 65**). The proposed project has been designed to encourage alternative forms of transportation and to slow vehicle travel speeds within the site. The project is consistent with many of the principles found within the design guide, including raised intersections, providing shared use paths, designing streets for low-speed, shared operations, and providing amenity zones for trees, lights and street furniture. Additional opportunities for consistency with the plan include reducing the width of the Village Green loop and providing back-in angled parking where possible. Additionally, as the design progresses, the petitioner should provide evidence as to how the streets meet the dimensional recommendations in the design guide.

Needham Street Area Vision Plan

In August 2018 the City Council voted to adopt the Needham Street Area Vision Plan. The adopted vision for the Needham Street area strives to produce a prosperous mixed-use district designed for all ages. It includes goals such as continuing to reflect the industrial history of the area and the current commercial strength while adding diverse residential options and modern innovation industries and incorporating cultural and recreational opportunities as well as environmentally sustainable technologies and design. The plan includes tailored visions for Environmental Health, Transportation, Land Use, Design and Implementation. The proposed project will be analyzed as each meeting topic relates to the vision document.

In their Transportation Engineering Peer Review, the BETA Group analyzed how the project is consistent with the relevant action items in the vision plan (**Attachment B, page 68**). The transportation proposals included in the project meet many of the goals of the vision plan, including reducing single-occupant vehicle trips, implementing shuttle routes, providing a transit hub, providing a comprehensive transportation demand management program, providing a mix of uses, and creating new connections off of Needham Street.

In addition to the transportation elements proposed, there are additional opportunities to incorporate action items from the Needham Street Vision Plan as provided below and discussed in BETA's peer review:

- Explore additional opportunities for trees adjacent to Needham Street to improve the pedestrian experience;
- Ensure safety and accessibility are priorities in the design of streets, curb ramps, parking, and

shuttle operations;

- Explore traffic calming measures in adjacent neighborhoods;
- Review shuttle routes to determine possibilities for additional stops along Needham Street;
- Contribute towards instituting transit signal priority along Needham Street in order to improve travel time for shuttle buses, MBTA buses and others;
- Provide additional information on proposed care share program;
- Explore additional opportunities for creating connections off of Needham Street – in addition to providing Oak Street access, investigate connection across the greenway at Mechanic Street for vehicles, pedestrians, bicyclists and emergency vehicles;
- Provide additional information on the feasibility of extending the Greenway to the north and extending the bicycle path across the bridge at Christina Street that crosses the Charles River.

Newton Leads 2040: A Transportation Strategy for Newton

The 2017 Transportation Strategy is intended to be a comprehensive guide toward a more equitable, economically and environmentally sustainable multimodal transportation system. The Transportation Strategy contains goals such as: making the transportation network safe for all uses by reducing crashes, improving intersection safety and re-envisioning major traffic corridors; planning for a variety of shared transportation options by working with the public and private sectors to create new community transit options, working with the MBTA, and enhancing options for getting to transit; encouraging walking and bicycling to support wider economic development, sustainability, and public health goals by embracing alternatives to driving, making short trips active and attractive, adding new routes and protection for bicyclists, and promoting walk- and bike-friendly design; actively manage parking to support business vitality and balance the need for driving access with traffic congestion reductions by making finding parking clear and easy and planning for future shifts in behavior and technology; and reducing congestion by utilizing smart transportation, planning and land use decisions to enable better travel decisions.

Several goals of the Transportation Strategy are already being implemented through the planned MassDOT improvements to Needham Street, such as re-envisioning a major corridor, improving intersection safety, and incorporating bike lanes. Additionally, the proposed project meets many of the goals by proposing a new shuttle system that will be open to the public and will provide access to the Green Line, commuter rail, Boston and Cambridge, proposing a robust transportation demand management plan with incentives for alternative modes of transportation and disincentives for driving and parking on site, providing internal shared use and bicycle paths, proposing future bicycle and pedestrian connections across Needham Street and crossing the bridge at Christina Street, incorporating bicycle parking and space for shared vehicles on site, and by providing pedestrian-oriented building and street designs.

Traffic

As detailed in the petitioner's traffic studies and BETA's peer review, the proposed development would impact movements to varying degrees at a number of intersections along the Needham Street corridor and other areas in the vicinity during the Weekday AM peak hours, the Weekday PM peak hours and/or the Saturday Midday peak hour; project-generated traffic will also impact intersections during the

Weekday Midday peak hour. In some cases, the Level of Service (LOS) at given intersections will degrade (e.g., from LOS C to LOD D or LOS E to LOS F); in other cases, intersections that already function at LOS F will degrade further, with delays increasing anywhere from 10 to 126 seconds. Additional detail is provided in the peer review and a summary can be found in the Executive Summary.

The petitioner proposes a number of transportation demand management (TDM) strategies, the most significant of which is the proposal to operate a shuttle system centered on the development's Mobility Hub that would be open to public use at stops along its routes. As proposed, the system would be comprised of the following four routes:

- the "Newton Circulator," which would provide connections to MBTA's Green Line at Newton Highlands and Newton Center and the Worcester-Framingham commuter rail line at the Newtonville Station every 30-45 minutes, depending on the day and time of day
- the "Needham Commuter," which would shuttle between the project site and the Needham Heights Station the of the MBTA's Needham commuter rail line every 30-45 minutes during the AM and PM commuting peaks; it would not operate middays
- the "Cambridge Express," which would travel to and from Kendall Square and Central Square in Cambridge every 60 minutes.
- the "Boston Express," which would provide service daily to the South Boston Seaport District and South Station every 60 minutes.

As indicated in the BETA review, in some instances the successful implementation of the proposed shuttle system could be expected to ameliorate some of the projected negative traffic impacts by lessening the degradation of conditions at certain intersections. However, the BETA review raises concerns shared by the Planning Department regarding this ambitious system and more information is needed at this time to better assess the viability of the proposed system.

First, the petitioner has indicated that the system was designed based upon responses to an online survey of 1,320 participants from the 128 Business Council's current rider base, the Chamber of Commerce, and other various local community groups, employers, developers, and officials. It is unclear whether this sample is adequately representative of potential residents and employees at the project.

Second, the petitioner estimates that this ambitious shuttle system (characterized as "robust" by the petitioner and labeled as such in BETA's review) would result in 30% of the residential and office trips generated by the project to be made via transit. This percentage would be more than double what would be expected under the existing mode share (i.e., without the shuttle). Relatedly, the petitioner forecasts that residential trips by private vehicles would be reduced from 82% to 60% and the private vehicle office trips would be reduced even more significantly, from 88% to 60%. While, as noted by BETA, strong use of a "robust" bus shuttle system can contribute to an increase in transit mode share, "an increase of this magnitude (to 30%) is unlikely" and that additional information from the petitioner as to how such a shift can be achieved is needed

Third, any assessment of the shuttle system's possible efficacy in shifting mode splits will require additional information on the fare structure. It should be noted that the online survey used by the petitioner to shape the proposed system did not include questions or variables related to the system's fare structure and potential riders' willingness/ability to pay specific fares. Cost to the rider (in both

money and time) is a key factor in determining the shuttle system's appeal. Indeed, as noted by BETA, the "absence of any information on fares makes it impossible to assess the long-term effectiveness of the four routes and their ability to attract and sustain ridership."

Fourth, given the substantial capital and operating costs the petitioner projects for the system, the lack of such information also makes it difficult to assess the proposed system's very viability. As indicated by the petitioner and explored in the BETA review, the total estimated cost for the initial seven-vehicle fleet is $1.75 million (whether this sized fleet provides adequate redundancy to ensure uninterrupted service on all four proposed lines should be further examined, as well as the expected vehicle replacement schedule). Initial operating costs are estimated at approximately $3.5 million annually, an amount that can be reasonably be expected to increase over time, reflective of increased labor, fuel and maintenance costs. As such, the petitioner should provide additional information as to its long-term commitment to support the capital and operating costs of the shuttle service.

Also related to the long-term viability of the shuttle system, the Planning Department agrees with BETA's comments that the petitioner should provide information about the impact so-called transportation network companies (TNCs, e.g., Uber, Lyft, etc.) could have on the system's bus ridership and the overall effectiveness. While TNCs are an important factor in reducing the need for on-site parking, they may have a negative impact on the number of peak hour trips generated if they are seen as a more attractive alternative to the shuttle system.

Given the innovative nature of the proposed shuttle system, the petitioner should provide examples and case studies of similar services where the costs are borne by individual mixed-use developments. Such information should include the transit mode share at such developments, their operational and financing structures, and the mechanisms put in place to ensure their long-term operation.

Also relevant to the viability of the proposed system is any needed licensing and oversight/regulation by local and state governmental entities. As such, additional information regarding its proposed organizational structure and its dependency on approvals from regulatory bodies would be helpful.

A further area of concern is what would be the implications in the event the shuttle bus system fails to achieve ridership projections, and/or the project fails to reach the petitioner's forecast 30% transit mode split with the area roadways absorbing higher than expected volumes. Planning staff recommends that if the project is approved, a performance standard be set, and flexibility be provided in how the petitioner meets this standard. One option would be to require compliance with a certain mode split or a maximum number of peak hour trips generated by the project and to allow the petitioner to utilize various transportation demand management strategies to meet that standard and to adjust as necessary as the project evolves, with regular monitoring and reporting. In order to understand the true impacts of the project and to set a realistic standard however, the petitioner must first provide additional information as requested in BETA's peer review. Planning staff also recommends that the petitioner and their consultants work collaboratively with City staff and BETA to further optimize the shuttle routes and operations to best serve residents and workers.

Parking

As designed, the project requires 3,409 parking spaces per the Newton Zoning Ordinance (NZO). The petitioner is seeking parking waivers to reduce the number of spaces to a total of 1,953 (1,793 in various garages and 160 surface spaces). The proposed number of spaces would provide a ratio of 1.0 parking spaces per residential unit, which is consistent with transit-oriented development (TOD) guidelines

provided by the MBTA and MassDOT (0.75-1.0 spaces per unit), with the balance for the other uses on the site.

Using the Urban Land Institute's (ULI) Shared Parking guidelines which are based on existing mixed-use projects, BETA projects that the peak-hour demand for parking for the project's land uses will be 2,149 spaces on a weekday and 2,283 spaces on a weekend. BETA also reviewed the applicable parking regulations in the surrounding communities of Boston, Brookline, Cambridge, Somerville, Quincy, Waltham and Watertown. Excluding Waltham, which had the highest parking ratios, the average required number of parking stalls for the proposed project across the other six communities would be 2,077 spaces. The proposed parking of 1,953 is in the range of what is recommended by the ULI and what would be required in nearby communities. BETA has requested that the petitioner provide additional information supporting the adequacy of the proposed parking facilities as well as further details about the shared parking operations and proposed system for paid parking and employer parking.

Pedestrian and Bicycle Paths

The Planning Department concurs with BETA's request that the petitioner evaluate the potential for extending the Greenway to Winchester Street via Curtis Street and provide information on the ownership and condition of the former rail bridge near 55 Christina Street (now used by pedestrians) over the Charles River to the existing path in Needham, as well as its ability and intent to make any needed improvements to create the multi-use path between Charlemont Street and Christina Street shown in the petitioner's Traffic Impact and Access Study.

Mitigation

BETA has identified an initial list, detailed in its review, of possible mitigation measures to reduce the impact of the project and improve traffic operations along the Needham Street and Winchester Street corridors. These include but are not limited to:

- A computerized traffic signal management system that allows remote monitoring and control of signalized intersections in the Needham and Winchester Street corridors by the Newton Public Works Department;
- Traffic signal improvements at various intersections in the vicinity of the project, including new traffic signals at the Chestnut Street intersections with Route 9 Westbound Service Road and with Route 9 Eastbound Service Road;
- Conduct a Road Safety Audit at high crash intersections and implement improvements based on outcome;
- Study speeds in nearby neighborhoods and implement traffic calming measures as necessary;
- Various traffic studies of several locations, facilities and proposals.

This list of possible measures, the details of which should be further examined (including their costs and potential benefits to enable some quantification of their efficacy in mitigation the project's traffic impact), should be seen as a starting point for mitigation efforts. It can be expected that additional measures should be devised and reviewed in the coming weeks.

In addition to the comments and requests for more information raised by BETA, Planning Staff has also received comments from the City's ADA Coordinator requesting more information regarding the

wheelchair accessibility of proposed connections to the Greenway and future connections to the Christina Street bridge over the Charles River, the wheelchair accessibility of proposed shuttles, how parking disincentives might impact mobility impaired tenants who must drive, and if there is the potential to increase frequency of shuttles or provide on demand service so as to minimize the time spent waiting outdoors. In addition, the ADA Coordinator recommends that potential mitigations include accessible pedestrian signals wherever new traffic signals are recommended and that an assessment of operations at the Newton Highlands Green Line station also ensure shuttle pick up/drop off be at a wheelchair accessible entrance/egress. Planning staff recommends the petitioner respond to these questions and work closely with the ADA Coordinator as the designs are further developed.

Lastly, the Planning Department notes that BETA raises questions and asks for additional information throughout its peer review report. The petitioner should respond to all comments and requests in writing to assist the Department, its consultants, and the Land Use Committee in the review of the proposal.

As identified in the updated schedule for the Land Use Committee's review of the rezoning and special permit petitions, attached, the next public hearing session is currently scheduled for January 29, 2019, however this date is being reserved for a continued discussion of transportation topics if necessary and may be canceled. Please check newtonma.gov/northland for up to date information.

ATTACHMENTS

Attachment A	Tentative schedule for Land Use Committee public hearings
Attachment B	BETA Group, Inc. Transportation Engineering Peer Review, dated January 2019
Attachment C	Petitioner's response to draft BETA Group, Inc. Transportation Engineering Peer Review, dated January 4, 2019

ATTACHMENT A

TENTATIVE LAND USE COMMITTEE SCHEDULE
Updated January 11, 2019

NORTHLAND NEEDHAM STREET/OAK STREET

Special Permit # 426-18 and Request to Rezone #425-18

Land Use Committee Date	Topic	Description
9/25/2018	Project Overview	Applicant to introduce project and committee to discuss schedule.
11/13/2018	Site Design and Open Space	Review of site plan, including placement of buildings, roads and open space as well as sight lines and shadows.
12/11/2018	Housing and Economic Impacts	Review of proposed residential and commercial program, including: analysis of the number of housing units, including affordability levels; the commercial mix; and the overall fiscal and economic impacts of the proposed project.
1/15/2019	Transportation	Review of the proposed internal street network and circulation including bicycle and pedestrian facilities, and analysis of the traffic impacts, shared parking proposal, and transportation demand management strategy.
1/29/2019	HOLD	Hold for continuation of transportation discussion if necessary.
2/12/2019	Sustainability and Stormwater	Review of the sustainability report and efforts to reduce impacts to natural resources as well as sustainability and conservation proposals.
TBD	Project Revisions	Review of revisions made to the project and updated analyses.
TBD	Architecture and Design Guidelines	Review of design guidelines that will regulate future detailed architectural design of the proposed buildings.
TBD	Mitigations Measures	Discussion of necessary mitigation measures and proposed conditions.

ATTACHMENT B

Newton, Massachusetts

The Northland Newton Development

Transportation Engineering Peer Review

January 2019

TRANSPORTATION ENGINEERING PEER REVIEW

BETA
315 Norwood Park South
2nd Floor
Norwood, Massachusetts 02062
781.255.1982
www.BETA-Inc.com

alta
PLANNING + DESIGN

The Northland Newton Development

Newton, Massachusetts

Transportation Engineering Peer Review

TRANSPORTATION ENGINEERING PEER REVIEW

Prepared by: BETA GROUP, INC. and Alta Planning + Design, Inc.
Prepared for: City of Newton

January 2019

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EXECUTIVE SUMMARY

INTRODUCTION

The Northland Newton Development is proposing a mixed-use development to be located along Needham Street and Oak Street in Newton, Massachusetts. The 22.6-acre site is located along the west side of Needham Street and is bordered by Oak Street to the south, the Upper Falls Greenway to the west, and commercial uses and Tower Road to the north. BETA Group, Inc. (BETA) and sub-consultant Alta Planning + Design, Inc. (Alta) have conducted a peer review of the engineering documents submitted to the City of Newton for the proposed development.

The site is located within the Mixed Use 1 Zoning District and currently contains 180,000 square feet of office space (southeast corner), 62,600 square feet of retail space (northeast corner), and 257,000 square feet of vacant manufacturing space (western portion). As proposed, the Applicant is requesting to change the zoning of the property to the Business 4 District and construct 1.9 million square feet of mixed-use development consisting of 400,000 square feet of parking structures (1,953 parking spaces), 180,000 square feet of office space (Saco Petee mill building), 237,000 square feet of restaurant and retail space, and 822 residential units.

The basis of the peer review focused on the following documents submitted by the Applicant:

- Traffic Impact and Access Study: The Northland Newton Development, Newton, Massachusetts, dated October 2018, prepared by VHB, Inc.
- Site Plans, The Northland Newton Development, VHB, Stantec, CUBE 3 Studio, SGA, Selbert Perkins Design, August 6, 2018.
- The Northland Newton Development Transportation Implementation Plan 128, Final report, 128 Business Council for Northland Investment Corporation, October 16, 2018 (update)
- Northland Newton Development – BETA Group Draft Peer Review, Response to Comments, dated January 4, 2018, prepared by Schlesinger and Buchbinder, LLP.

The following elements were reviewed:

- Traffic
- Public Transportation
- Pedestrians and Bicycles
- Internal Circulation and Parking
- Loading and Curbside Activity
- Transportation Demand Management Strategies (including shuttle bus system)
- Consistency with Newton Street Design Guide
- Consistency with Needham Street Vision Plan

- Other Issues

Overall, the Traffic Impact and Access Study, Transportation Implementation Plan, and Project Plans have been developed according to state and industry national practice and standards. The project Applicant has developed a comprehensive transportation demand management (TDM) program to help reduce the impacts of single-occupant automobiles on the surrounding roadways and intersections as well as to improve transit, walking, and bicycling. This program includes a proposed shuttle bus system that is discussed in more detail below.

The project Applicant has identified transportation mitigation measures to help improve operations and safety at study intersections. These improvements include:

- Signal Timing Adjustments
  - Chestnut Street/Elliot Street
  - Chestnut Street/Walnut Street
- Pedestrian Improvements
  - Upgrade pedestrian curb ramps and crosswalks at:
    - Chestnut Street/Route 9 Westbound Service Road
    - Chestnut Street/Route 9 Eastbound Service Road
    - Chestnut Street/Elliot Street
  - Create a multi-use path between Charlemont Street and Christina Street, providing access to the bridge over the Charles River
  - Provide connections from the project to the Upper Falls Greenway
- Transportation Demand Management
  - Mobility Hub on-site
  - Shuttle Bus System providing four routes (2 local, 1 Boston, and 1 Cambridge)
  - Transportation Coordinator to promote transit, pedestrian, and bicycle use
  - TDM Program (not all shown below)
    - Join 128 Business Council Transportation Management Association (TMA)
    - Shared parking
    - Bicycle storage and fix-it stations
    - Ride matching
    - Sponsored vanpools
    - Promote telecommute and flex-work options
    - Car-share and bike-share on-site
    - Electric charging stations

- Parking disincentives to promote alternate travel modes
- Monitoring TDM program and reporting

The summary below focuses on over-arching transportation issues that would have potential impacts to off-site roadways, intersections, transit stations, trails, and pathways. Additional mitigation measures are identified as well as areas where additional information is required. A more detailed discussion of these issues, as well as site design and operations are provided in the body of this peer review report.

TRAFFIC

Several study intersections will be impacted by traffic generated by the proposed Northland Newton Development, resulting in a deterioration of Level of Service (LOS) or resulting in more than 10 seconds of delay per vehicle during the Weekday AM and PM peak hours and Saturday Midday peak hour. Traffic impacts have been identified at study intersections for two conditions: vehicle trip generation assuming a shuttle bus mode share of 13% (existing conditions) and trip generation assuming a projected shuttle bus mode share of 30% (robust shuttle service).

As presented in the traffic study, the proposed project is expected to generate the following vehicle trips during the weekday and Saturday peak hours for Existing (13%) and Robust (30%) shuttle bus mode shares:

Vehicle Trip-Generation Summary

Build Condition	Weekday AM Peak Hour	Weekday PM Peak Hour	Saturday Midday Peak Hour
Existing Bus Mode Share	545	815	950
Robust Bus Mode Share	438	733	890

The Northland Newton Development will significantly impact movements at the following 20 study intersections during either the Weekday AM and/or PM peak hours or the Saturday Midday peak hour under the year 2025 Build conditions (with the MassDOT improvements in place). The delay increase represents the average delay per vehicle due to the project. Where delay increases are minimal, only the degradation in Level of Service is shown (LOS).

- Chestnut Street/Route 9 Westbound Service Road: Weekday PM Peak Hour LOS F Southbound, Existing and Robust Mode Share, **Delay Increase = 23-24 seconds**
- Chestnut Street/Route 9 Eastbound Service Road: Weekday AM Peak Hour LOS E Northbound, Existing Mode Share, **LOS Degrades from LOS D to LOS E and from LOS C to LOS D**
- Chestnut Street/Elliot Street: Weekday PM Peak Hour LOS F Eastbound and Overall, Existing and Robust Mode Share, **Delay Increase = 10-48 seconds**
- Needham Street/Oak Street/Christina Street: Weekday AM/Weekday PM/Saturday Midday Peak Hours LOS F for several movements, Existing and Robust Mode Share, **Delay Increase = 16-42 seconds**

- Needham Street/South Site Driveway: Saturday Midday Peak Hour LOS F Eastbound, Existing and Robust Mode Share, **Delay Increase = 23-24 seconds**
- Needham Street/Tower Road/Industrial Place: Weekday AM/Weekday PM/Saturday Midday Peak Hours LOS F Eastbound, Existing and Robust Mode Share, **Delay Increase = 82-126 seconds**
- Needham Street/Jaconnet Street: Weekday PM/Saturday Midday Peak Hours LOS F Westbound, Existing and Robust Mode Share, **Delay Increase = 66-104 seconds**
- Needham Street/Rockland Street: Weekday AM/Weekday PM/Saturday Peak Hours LOS E & F Westbound, Existing and Robust Mode Share, **Delay Increase = 32-25 seconds**
- Winchester Street/Needham Street/Dedham Street: Weekday PM/Saturday Midday Peak Hours LOS E & F Westbound & Southbound, Existing and Robust Mode Share, **Delay Increase = 11-19 seconds**
- Winchester Street/Route 9 Eastbound Service Road: Weekday AM/Weekday PM/Saturday Midday Peak Hours LOS E & F Northbound & Overall, Existing and Robust Mode Share, **Delay Increase = 13-30 seconds**
- Winchester Street/Route 9 Westbound Service Road: Weekday AM/Weekday PM Peak Hours Southbound LOS F, Westbound & Overall , Existing and Robust Mode Share, **Delay Increase = 10-48 seconds**
- Centre Street/Walnut Street: Weekday AM/Weekday PM Peak Hours LOS E, Northbound & Southbound, Existing and Robust Mode Share, **Delay Increase = 12-19 seconds**
- Nahanton Street/Wells Avenue/JCC Driveway: Weekday PM Peak Hour LOS E, Eastbound, Existing and Robust Mode Share, **LOS Degrades from LOS D to E**
- Highland Avenue/Riverside Street: Weekday AM/Weekday PM/Saturday Midday Peak Hours LOS E & F, Northbound, Existing and Robust Mode Share, **Delay Increase = 11-35 seconds**
- Highland Avenue/Highland Terrace/Highland Circle: Weekday PM/Saturday Peak Hours LOS E & F, Eastbound &Westbound, Existing and Robust Mode Share, **Delay Increase = 10-14 seconds**
- Highland Avenue/2nd Avenue/Staples Driveway: Weekday AM/Weekday PM Peak Hours LOS E, Westbound, Existing and Robust Mode Share, Delay Increase, **Delay Increase = 11-26 seconds**
- Highland Avenue/Charles Street: Weekday PM/Saturday Midday Peak Hours LOS F, Existing and Robust Mode Share, **Delay Increase = 17-34 seconds**
- Highland Avenue/Wexford Street: Weekday AM/Weekday PM/Saturday Midday Peak Hours LOS F, Existing and Robust Mode Share, **Delay Increase = 17-104 seconds**
- Highland Avenue/I-95 Northbound Ramps: Weekday AM Peak Hour LOS F, Existing Mode Share, **Delay Increase = >183 seconds**
- Highland Avenue/I-95 Southbound Ramps: Weekday AM/Weekday PM Peak Hours LOS F, Existing and Robust Mode Share, Delay for both No—Build and Build Conditions >300 seconds, and the delay and delay increase cannot be calculated because volume exceeds capacity.

It is noted that project-generated traffic will also impact study intersections along the Needham Street corridor during the Weekday Midday peak hour.

The proposed project will have significant impacts on study intersection operations as identified above with degradations in LOS and increases in delay, even after the completion of the planned MassDOT improvements along the Needham Street and Winchester Street corridors. **It is important to note that the LOS and delay analysis results do not accurately represent the actual traffic delays and lack of vehicular progression through the Needham Street corridor**. This difference is because the Traffic Impact and Access Study evaluated the study intersections individually, rather than using a corridor-wide traffic simulation analysis. A corridor traffic simulation would more realistically represent traffic delays and long vehicle queues between intersections along the Needham Street corridor that results in congested conditions and slower travel speeds. In VHB's January 4, 2019 letter to Ms. Jennifer Caira, Newton Chief Planner, the Applicant provides "There is no dispute that the corridor is saturated at certain hours, so differing opinions on how much are not useful;" Since VHB has agreed that the Needham Street corridor is congested, using a different computer model to analyze intersection operations would only further demonstrate the saturated conditions. Therefore, BETA recommends that additional corridor analyses not be provided at this time, but has identified additional mitigation measures shown below to reduce the impact of the project and improve traffic operations along the Needham Street and Winchester Street corridors and at other study intersections.

The following traffic mitigation measures are recommended:

- Provide a cloud-based computer system and traffic signal management software capable of remote access between the signalized intersections (Needham and Winchester Street corridors) and the Newton Public Works Department. The system shall include video cameras, a desktop workstation, display monitor screen, and have ATSPM (Automated Traffic Signal Performance Measures) capability for traffic monitoring purposes. Allocate mitigation fund for monitoring and managing traffic and maintaining the adaptive signal system along the Needham and Winchester Streets corridors for a period of two years.

- Provide full signal coordination and communication between the Route 9/Winchester Street intersections (planned to be signalized by MassDOT) and the Centre Street/Walnut Street signal.

- Provide full Transit Signal Priority capability to be interfaced with the proposed Adaptive Signal system by MassDOT along the Needham Street and Winchester Street corridors. Modify signal timing and phasing to accommodate the transit signal priority feature. Coordinate with the MBTA as necessary. Provide shuttle buses with transponders/emitters to interface with the adaptive signal system.

- Upgrade traffic and pedestrian signal equipment at the Chestnut Street intersections with Oak Street and with Elliot Street.

- Provide new traffic and pedestrian signals at the Chestnut Street intersections with Route 9 Westbound Service Road and with Route 9 Eastbound Service Road.

- The Applicant has proposed to fund a Road Safety Audit (RSA) for the intersection of Centre Street/Walnut Street. The Applicant should provide safety and operation improvements based on the outcome of the RSA Report.

- An assessment of the traffic operations at the Newton Highlands Massachusetts Bay Transportation Authority (MBTA) Station should be provided that describes the proposed shuttle bus operations and potential conflicts with traffic, pedestrians, and bicyclists.

- Review the extension of the two-lane eastbound approach lanes on Oak Street at Needham Street to accommodate the left-turn vehicle queue.

- Evaluate and provide traffic calming improvements along the Chestnut Street corridor.

- Prohibit eastbound traffic on Main Street within the site to turn left onto Needham Street northbound at the unsignalized intersection.

- Conduct a vehicle speed study on Upper Falls Neighborhood roadways and provide traffic calming devices as needed.

- The Applicant should evaluate the potential to provide emergency vehicle access to the project site via Mechanic Street.

- The Applicant has provided a draft traffic monitoring proposal (January 4, 2019) to conduct a post-occupancy traffic study one year after issuance of final certificate of occupancy. If project-generated traffic volumes exceed the projected vehicle trip estimates by 10%, the Applicant will meet with City of Newton officials to discuss expanding the TDM program to increase use of alternative travel modes as well as implementing physical improvements at specific intersections. **The Applicant should make a commitment to provide measures, including expanding or revising the shuttle bus system and the TDM program to meet the project-generated vehicle thresholds (and/or mode splits) for the Robust Bus Mode Share condition. The traffic monitoring program should be conducted annually with results presented to the City and adjustments made accordingly.**

PUBLIC TRANSPORTATION AND MODE SHARES

The MBTA currently provides transit services in the vicinity of the proposed development, including two bus routes (52 and 59), light rail (Green Line), and commuter rail (Needham and Worcester/Framingham lines.

For current mode share, the Traffic Impact and Access Study uses the following U.S. Census 2010 Journey-to-Work tabulations:

Newton Mode Share (2010)

	Private Vehicle	Transit	Walk/Bike
Residents of Newton	82%	13%	5%
Workers in Newton	88%	7%	5%

More current estimates are available from the U.S. Census 2015 American Community Survey (ACS). The Needham Street Vision Plan uses the 2015 data shown below.

Newton Mode Share (2015)

	Private Vehicle	Transit	Walk/Bike	Worked at Home
Residents of Newton (workers 16+)	72%	12%	7%	9%
Boston region MPO	69%	17%	8%	5%

The Applicant should use the 2015 U.S. Census data for any additional analysis; this would also be consistent with the Needham Street Area Vision Plan

PEDESTRIANS AND BICYCLES

The Upper Falls Greenway is an off-road, multi-use path that accommodates pedestrians and bicyclists. The utility of the Greenway for transportation is limited, however, as the shared-use path only runs from the Charles River to Easy Street, a distance just under one mile. As part of the Needham Street corridor project (MassDOT Project No. 606635), sidewalks are planned to be reconstructed, rectangular rapid flash beacons (RRFBs) are to be installed at midblock crossings, and leading pedestrian signal phases would be incorporated into the traffic signals. MassDOT's project includes a separated bike lane planned along Needham Street, but provides only shared lane markings along much of the project length from the Needham Street/Winchester Street intersection to the Winchester Street/Route 9 intersections. This design creates a gap in bicycle connectivity between the Newton Upper Falls and the Newton Highlands neighborhood.

The City of Newton has requested that MassDOT revisit the design of the planned improvements along Winchester Street to provide bicycle lanes or accommodation along the west side of Winchester Street to provide a connection between the Upper Falls Greenway and the Newton Highland MBTA Station. At this time, there are no plans to modify the design for the Winchester Street improvements. **BETA has requested that the project Applicant evaluate the potential for extending the Greenway to Winchester Street via Curtis Street.**

The Northland Newton Development *Traffic Impact and Access Study* shows a multi-use path between Charlemont Street and Christina Street, which would provide a pedestrian and bicycle connection to the former rail bridge (now used by pedestrians) over the Charles River to the existing path in Needham. It is understood that Northland Newton Development has acquired the Stark Building at 55 Christina Street that will enable this connection on private property. **The Applicant has been asked to provide information on the ownership and condition of the bridge and Northland Newton Development's ability to make improvements if needed.**

PARKING

Based on the City of Newton Zoning Ordinance, 3,409 parking spaces are required to support the proposed development. The project Applicant proposes a total of 1,953 parking spaces with 1,793 garage spaces and 160 surface spaces.

The proposed parking ratio of 1.0 parking spaces per residential unit is consistent with Transit-Oriented Development (TOD) parking ratio guidelines provided by the MBTA and MassDOT (0.75-1.5 spaces per unit). It is understood that while project residents may use transit to commute to and from work during the week, they may own a vehicle on-site that would be used during off-peak periods and weekends. **Additional information has been requested from the Applicant's project team relating to: A) the adequacy of the proposed parking supply based Institute of Transportation Engineer (ITE) and Urban Land Institute (ULI) guidelines; and B) shared parking operations.**

Based on the City of Newton's request, BETA conducted a preliminary review of the applicable Zoning By-Laws/Ordinances/Code for off-street parking requirements of seven communities in the metro Boston area (Boston, Brookline, Cambridge, Quincy, Somerville, Watertown, and Waltham). Using the proposed Northland Newton Development building program, parking spaces were calculated for each of the seven survey communities based on their zoning requirements. The unadjusted required parking spaces for the project program range between 1,320 spaces (for the City of Boston) to 3,649 spaces (for the City of Waltham). Excluding Waltham that has the highest parking ratios, the average required parking supply for the six other surveyed communities is 2,077 spaces.

Additional information regarding details of the proposed paid parking system and employers has been requested from the Applicant.

PROPOSED SHUTTLE BUS SYSTEM

The Applicant proposes a shuttle bus system as part of the traffic mitigation program. The system is to be supplemented by a staffed Mobility Hub with a variety of amenities, as well as TDM strategies, including an Emergency Ride Home program.

SURVEY. As part of the development of the shuttle bus system concept, the128 Business Council conducted an on-line commuter survey; the sample size was 1,320. These respondents were sourced via the 128 Business Council's preexisting rider contact base, the Chamber of Commerce, the N-Squared Innovation Corridor, community groups, local employers, local developers, and elected officials within the City.

It is unlikely that the sample is representative of the residents and employees that are expected to live and work in the proposed development. The survey did not include a stated preference set of questions to assess willingness to pay; this would have helped inform the development of a fare structure.

APPROACH. The128 Business Council developed the system concept using criteria reflecting the factors that a rider will consider as they decide whether to use transit. These include:

- Connections to other modes and activity centers
- Schedule, including hours of service and frequency
- Accessibility
- Reliable and consistent travel time

However, cost to the rider (i.e., fare) is also a key factor but this was not considered in the development of the shuttle program. The absence of a proposed fare structure makes it difficult to assess the likely long-term effectiveness of the shuttle program.

ROUTES AND OPERATION. The four routes comprising the proposed bus shuttle system are summarized below.

Northland Proposed Shuttle Bus Routes

Route	Service	Objective	Notes
Newton Circulator	*Proposed service:* 5:15 AM to 1 AM weekdays; 6:15 AM to 1 AM weekends *Frequency*: 30-45 minutes peak; 45 minutes off-peak and weekends	Provides connections to MBTA service, including the Green Line and Worcester-Framingham commuter rail.	A 45-minute service offers only a moderate level of service. **Other service concepts should be considered, including coordination with the MBTA or micro-transit operations.**
Needham Commuter	*Proposed service*: 5:45 AM to 10:30 AM; 4:30 PM to 8:30 PM *Frequency*: 30-45 minutes variable to accommodate commuter rail schedule	Provides connection to Needham commuter rail line.	**The schedule and frequency should pivot off of the commuter rail schedule; there is a gap in mid-day rail service.**
Cambridge Express	*Proposed service*: 5:45 AM to 12:45 AM, Monday-Sunday *Frequency*: 60 minutes	Daily service to Kendall Square and Central Square.	This is an important employment center for technology and research. As such, this service is likely to be attractive to many residents. **The 60-minute frequency does not offer a competitive service.**
Boston Express	*Proposed service*: 5:45 AM to 12:45 AM, Monday-Sunday *Frequency*: 60 minutes	Daily service to the South Boston Seaport District	This has the potential to be a heavily used route; the rapid increase in jobs and housing in the Seaport district makes this an attractive destination. **The route would also provide connections to the MBTA at South Station, including the Red and Silver Lines.**

FARE STRUCTURE. **The absence of any information on fares makes it impossible to assess the long-term effectiveness of the four routes and their ability to attract and sustain ridership; at a minimum, starting assumptions need to be made regarding the fare and cost**s. These include:

- What is the base fare; will it vary by peak/off-peak; by distance; by week day/weekend; by resident/non-resident?

- Transit services almost always require a subsidy; what is the source of the subsidy and what is the long-term commitment to continuing the subsidy?

CAPITAL AND OPERATING COSTS. The Implementation Plan proposes the Turtle Top "Terra Transit" Ford F550 V10 for the Northland system; the total estimated cost for the seven vehicle fleet is $1.75 million. Weekly operating costs are estimated at approximately $67,000.

- **Capital costs for the fleet will be substantial; what is the long-term commitment to acquiring/leasing the fleet?**
- **The use of alternative fuel vehicles should be considered; options include CNG and hybrid diesel-electric; all-electric vehicles should be used for daily service when they can provide sufficient range and reliability. Vehicles should meet ADA requirements and include bike racks and Wi-Fi service.**

ESTIMATED MODE SHARE. The Traffic Impact and Access Study presents mode share under two Build conditions: 1) Existing Mode Share and 2) "robust" shuttle service. (See Table below)

Project Build Condition: Comparison of Existing Mode Share [a] vs Robust Mode Share[b]

Land Use	Private Vehicle		Transit		Walk/Bike	
	Existing	Robust	Existing	Robust	Existing	Robust
Residential	82%	60%	13%	30%	5%	10%
Office	88%	60%	7%	30%	5 %	10%

Notes: a) Based on 2010 US Census Journey-to-Work; b) based on strong use of the shuttle system

Under the "robust" shuttle build condition, transit mode share is forecast to be more than twice what would be expected under the existing mode share. **While the "robust" shuttle can contribute to an increase in transit mode share, an increase of this magnitude (to 30%) is unlikely. Documentation on how this mode share goal can be achieved is not provided by the applicant.**

A better assessment of possible change in mode share under the "robust" system could be accomplished with:

- More information on the fare structure
- Details on the long-term commitment by Northland to support the capital and operating costs of the shuttle service
- Examples of transit mode share from other similar mixed-use developments with shuttle service.

A new service requires time to mature and demonstrate its effectiveness. The Implementation Plan is correct that the shuttle bus system will need to be adjusted in response to actual ridership and ability to adhere to schedules and headways. Questions include:

- **How will service development be coordinated/phased with development and occupancy of the site?**
- **What are the metrics that Newton will use to monitor the shuttle system and determine whether it is meeting the HOV goals?**

- **What measures will be taken if the shuttle bus system fails to achieve ridership/HOV goals?**
- **What is the consultation process between Northland and Newton to discuss changes to the system and fare structure?**

Finally, but of great importance, the Applicant should prepare a thorough discussion and assessment of Transportation Network Companies (TNC) impact on shuttle bus ridership and the overall effectiveness of the proposed shuttle program. TNCs compete mainly with public transportation, walking, and biking, drawing customers from these non-auto modes based on speed of travel, convenience, cost and comfort.

OTHER ISSUES

On October 6, 2017, The Executive Office of Energy and Environmental Affairs submitted a Certificate of The Secretary of Energy and Environmental Affairs on the Environmental Notification Form for the Needham Street Redevelopment project submitted by Northland Development, LLC (EEA #15757). The Certificate states, "I have reviewed the Environmental Notification Form (ENF) and hereby determine that this project requires the preparation of a Mandatory Environmental Impact Report (EIR). The Proponent should submit a Draft EIR (DEIR)…" **The Applicant should provide information on the status of the required DEIR.**

1.0 INTRODUCTION

The Northland Newton Development is a proposed mixed-use development to be located along Needham Street and Oak Street in Newton, Massachusetts. The 22.6-acre site is located along the west side of Needham Street and is bordered by Oak Street to the south, the Upper Falls Greenway to the west, and commercial uses and Tower Road to the north. BETA Group, Inc. (BETA) and sub consultant Alta Planning

+ Design, Inc. has conducted a peer review of the engineering documents submitted to the City of Newton for the proposed development.

1.1 PROJECT DESCRIPTION

The site is located within the Mixed Use 1 Zoning District and currently contains 180,000 square feet of office space (southeast corner), 62,600 square feet of retail space (northeast corner), and 257,000 square feet of vacant manufacturing space (western portion). As proposed, the Applicant is requesting to change the zoning of the property to the Business 4 District and construct 1.9 million square feet of mixed-use development consisting of 400,000 square feet of parking structures (1,953 parking spaces), 180,000 square feet of office space (Saco Petee mill building), 237,000 square feet of restaurant and retail space, and 822 residential units.

Access is currently provided by way of five full access driveways: one driveway on Oak Street, three driveways along Needham Street, and one driveway on Tower Road (fenced). In addition, a driveway for service vehicles is provided along Oak Street (west of Needham Street) and a service vehicle driveway is provided along Needham Street (north of the northern full access driveway).

1.2 BASIS OF REVIEW

In conducting this peer review, the BETA team reviewed the following items:

- Traffic Impact and Access Study: The Northland Newton Development, Newton, Massachusetts, dated October 2018, prepared by VHB, Inc.
- The Northland Newton Development: Peer Review Response to Comments Memorandum – Weekday Midday Peak Hour Analyses, VHB, December 10, 2018
- The Northland Newton Development Right-Sized Parking Memorandum, from VHB, Inc. to Mr. Barney Heath Director of Planning, October 12, 2018
- Site Plans, The Northland Newton Development, VHB, Stantec, CUBE 3 Studio, SGA, Selbert Perkins Design, August 6, 2018
- The Northland Newton Development Transportation Implementation Plan 128, Final report, 128 Business Council for Northland Investment Corporation, October 16, 2018 (update)
- Needham Street Area Vision Plan 2018, Adopted August 13, 2018
- Newton Street Design Guide, A Living Document, June 2018
- City of Newton Rules and Regulations of the Planning Board Acting as a Board of Survey, 1997
- Newton City Ordinances Volume II – Chapter 30: Zoning Ordinance, December 31, 2017
- Applicable federal, state, and industry guidelines, standards, and regulations

In addition, BETA staff held conference calls with VHB and 128 Business Council to ask questions regarding transportation issues and receive clarification on project issues.

This peer review document outlines BETA's findings, comments, and recommendations on the engineering plans and studies submitted to the City of Newton for The Northland Newton Development. The peer review includes the following transportation related elements:

- Traffic
- Public Transportation
- Pedestrians and Bicycles
- Internal Circulation and Parking
- Loading and Curbside Activity
- Transportation Demand Management Strategies (including shuttle bus system)
- Consistency with Newton Street Design Guide
- Consistency with Needham Street Vision Plan
- Other

2.0 TRAFFIC

BETA has conducted a peer review of the October 2018 *Traffic Impact and Access Study* prepared by VHB, Inc. for The Northland Newton Development. The following provides a summary of this review.

2.1 STUDY AREA

Based on input provided by City of Newton and Massachusetts Department of Transportation (MassDOT) officials, the traffic impacts of the proposed development were evaluated at the following 27 study area intersections.

- Newton:
    1. Chestnut Street/Route 9 westbound service road
    2. Chestnut Street/Route 9 eastbound service road
    3. Chestnut Street/Elliot Street
    4. Chestnut Street/Oak Street
    5. Oak Street/site driveway
    6. Needham Street/Oak Street/Christina Street
    7. Needham Street/south site driveway
    8. Needham Street/middle site driveway/Old TJ Maxx driveway
    9. Needham Street/north site driveway/Charlemont Street
    10. Needham Street/Tower Road/Industrial Place

11. Needham Street/Jaconnet Street
12. Needham Street/Rockland Street
13. Needham Street/Columbia Avenue/Avalon driveway
14. Winchester Street/Needham Street/Dedham Street
15. Winchester Street/Route 9 eastbound service road
16. Winchester Street/Route 9 westbound service road
17. Centre Street/Walnut Street
18. Nahanton Street/Winchester Street
19. Nahanton Street/Wells Avenue/Jewish Community Center (JCC) driveway

- Needham:
  20. Highland Avenue/Riverside Street
  21. Highland Avenue/Highland Terrace/Highland Circle
  22. Highland Avenue/2nd Avenue/Staples driveway
  23. Highland Avenue/Charles Street
  24. Highland Avenue/Wexford Street
  25. Highland Avenue/1st Avenue/Riverside Community Health driveway
  26. Highland Avenue/I-95 northbound ramps
  27. Highland Avenue/I-95 southbound ramps

In lieu of locally preferred thresholds, ITE methodologies[1] and Massachusetts Department of Transportation's (MassDOT's) *Transportation Impact Assessment Guidelines*[2] suggest that an intersection should be evaluated when site-generated trips are projected to experience a noticeable increase in peak-hour traffic volumes (i.e., ≥100 vehicles and/or ≥5%). The rationale is that an increase of 100 vehicles per hour or 5% could impact the vehicular operations on an intersection approach. **Based on the trip-generation and distribution projections (as reflected on Figure 11: Trip Distribution and the site-generated traffic-volume networks provided in the Appendix), BETA finds the study area intersections evaluated to be appropriate to determine the traffic impacts associated with the proposed development.**

Comment 2.1: As currently proposed, a "Mobility Hub" would be constructed on-site (Building 7) that would provide connections to nearby Massachusetts Bay Transportation Authority (MBTA) transit stations by way of a shuttle service program. As envisioned, the shuttle service would serve the Newton Highlands MBTA rapid transit station (and others) on

[1] *Transportation Impact Analyses for Site Development: An ITE Proposed Recommended Practice*. Washington, DC: Institute of Transportation Engineers, 2010.

[2] Massachusetts Department of Transportation. "Transportation Impact Assessment (TIA) Guidelines." *MassDOT Development Review – Planning Process*. Commonwealth of Massachusetts, 13 March 2014.

the Green Line D Branch located at 60 Station Avenue in Newton. **Therefore, a quantitative assessment should be conducted at the Newton Highlands MBTA Station for the shuttle connection that describes the operations of the buses, pedestrians, bicyclists, transit users, shuttle loading and unloading, and shuttle parking. Current observations and details of future transportation conditions and impacts should be described at the Walnut Street intersections with Floral Street, with Lincoln Street, with Station Avenue, and with Lake Avenue.**

2.2 EXISTING CONDITIONS

2.2.1 INTERSECTIONS

The Northland Newton Development *Traffic Impact and Access Study* provided descriptions of the study area intersections that detailed lane configurations, traffic control, and other characteristics. Based on field reconnaissance conducted by BETA in November 2018, we note the following:

Comment 2.2: At the Chestnut Street unsignalized intersection with the Route 9 (Boylston Street) westbound service road, Chestnut Street travels in a north/south alignment, the east leg provides egress from the Route 9 westbound off-ramp, and the west leg provides access to the Route 9 westbound on-ramp. The Chestnut Street northbound approach is under free flow traffic conditions, with the other three approaches under STOP-sign control. The Route 9 westbound service road westbound approach appears to have limited sight lines to the south (looking left) to see approaching Chestnut Street northbound vehicles. Vehicles exiting from the Route 9 westbound service road approach were observed to stop beyond the STOP line (within the intersection) in an effort to have improved sight lines to on-coming vehicles. **Although a crash evaluation was conducted in the traffic study, this safety concern was not identified at this study area intersection.**

Comment 2.3: Upon review of the Intersection Capacity Analyses provided in the Appendix of the traffic study, the Chestnut Street unsignalized intersection with the Route 9 westbound service road was evaluated as an All-Way Stop-Control (AWSC) intersection. Due to the limitations of the software program used as part of the traffic study, a four-way unsignalized intersection with three approaches under STOP-sign control cannot be properly modeled. **Therefore, a different software program should be used to properly model operations at this intersection (e.g., SIDRA).**

Comment 2.4: At the Chestnut Street unsignalized intersection with the Route 9 eastbound service road, Chestnut Street travels in a north/south alignment, the east leg provides access to the Route 9 eastbound on-ramp, and the west leg provides egress from the Route 9 eastbound off-ramp. The Chestnut Street southbound approach is under free flow traffic conditions, with the other three approaches under STOP-sign control. **The description of the traffic control at this intersection mistakenly states that the Chestnut Street northbound approach is under free-flow conditions and the Chestnut Street southbound approach is under STOP-sign control.**

Comment 2.5: The Route 9 eastbound service road eastbound approach appears to have limited sight lines to the north (looking left) to see approaching Chestnut Street southbound

vehicles. In addition, the Route 9 eastbound service road westbound approach appears to have limited sight lines to the north (looking right) to see approaching Chestnut Street southbound vehicles. Vehicles exiting from the Route 9 eastbound service road approaches were observed to stop beyond the STOP line (within the crosswalks and within the intersection) in an effort to have improved sight lines to on-coming vehicles. **Although a crash evaluation was conducted in the traffic study, this safety concern was not identified at this study area intersection.**

Comment 2.6: Upon review of the Intersection Capacity Analyses provided in the Appendix of the traffic study, the Chestnut Street unsignalized intersection with the Route 9 eastbound service road was evaluated as an AWSC intersection. Due to the limitations of the software program used as part of the traffic study, a four-way unsignalized intersection with three approaches under STOP-sign control cannot be properly modeled. **Therefore, a different software program should be used to properly model operations at this intersection (e.g., SIDRA).**

Comment 2.7: Oak Street and Christina Street intersect Needham Street from the west and east, respectively, to form a four-way signalized intersection with the Oak Street and Christina Street legs slightly offset (Oak Street approximately 40 feet south of Christina Street). Based on field observations, the traffic signal operates on a three-phase vehicular system with a Needham Street northbound/southbound permissive phase, an Oak Street eastbound phase, and a Christina Street westbound phase. Upon review of the Intersection Capacity Analyses provided in the Appendix of the traffic study, however, existing traffic-volume conditions were evaluated with a two-phase traffic signal system (i.e., a Needham Street northbound/southbound permissive phase and an Oak Street/Christina Street permissive phase).

While the existing conditions are not reflected accurately in the analyses for this intersection, the project's impacts are measured under future traffic-volume conditions (i.e., 2025 No-Build and 2025 Build) and roadway improvements are planned along the Needham Street corridor that includes this signalized intersection. As part of the planned improvements (MassDOT Project No. 608137), Christina Street would be relocated to the south opposite Oak Street to form a standard four-way intersection and allow the Christina Street and Oak Street approaches to run permissively. N**o response is required.**

Comment 2.8: At the Winchester Street unsignalized intersection with the Route 9 eastbound service road, the Route 9 eastbound service road intersects Winchester Street from the east. The Route 9 eastbound service road westbound approach appears to have limited sight lines to the north (looking right) and to the south (looking left) to see approaching Winchester Street vehicles. Vehicles exiting from the Route 9 eastbound service road approach were observed to stop beyond the STOP line (within the crosswalks and within the intersection) in an effort to have improved sight lines to on-coming vehicles.

Although a crash evaluation was conducted in the traffic study, this safety concern was not identified at this study intersection. Since the Needham Street, Highland Avenue, and Winchester Street corridor project (MassDOT Project No. 606635) would place this

intersection under traffic signal control, however, this safety deficiency is anticipated to be alleviated. **No response is required.**

Comment 2.9: At the Winchester Street unsignalized intersection with the Route 9 westbound service road, the Route 9 westbound service road intersects Winchester Street from the east (off-ramp) and west (on-ramp). The Route 9 westbound service road westbound approach appears to have limited sight lines to the north (looking right) and to the south (looking left) to see approaching Winchester Street vehicles. Vehicles exiting from the Route 9 westbound service road westbound approach were observed to stop beyond the STOP line (within the crosswalks and within the intersection) in an effort to have improved sight lines to on-coming vehicles.

Although a crash evaluation was conducted in the traffic study, this safety concern was not identified at this study area intersection. Since the Needham Street, Highland Avenue, and Winchester Street corridor project (MassDOT Project No. 606635) would place this intersection under traffic signal control, however, this safety deficiency is anticipated to be alleviated. **No response is required.**

2.2.2 Traffic Counts

Traffic counts were obtained from the Functional Design Report for the reconstruction of Highland Avenue and Needham Street (Highland Avenue FDR) prepared by Stantec that were collected in April and May 2017 at some of the study area intersections. Supplemental traffic counts were collected as part of The Northland Newton Development *Traffic Impact and Access Study* prepared by VHB in October 2017 and in January and February 2018. The manual turning movement counts (TMCs) were collected during the Weekday AM peak period (7-9 AM), the Weekday PM peak period (4-6 PM), and the Saturday Midday peak period (11 AM-2 PM). In addition, daily traffic and vehicular speed counts were collected along Highland Avenue, Needham Street, and Winchester Street in April and May 2017 as part of the Needham Street FDR. Supplemental automatic traffic recorder (ATR) counts were collected along Oak Street and Needham Street in October 2017.

Comment 2.10: Upon review of the ATR data provided in the Appendix of The Northland Newton Development *Traffic Impact and Access Study*, Weekday Midday traffic volumes have been found to be higher than the typical Weekday commuting time periods (i.e., 7-9 AM and 4-6 PM). Table 1 below summarizes our review of the traffic counts.

Table 1: Peak-Hour Traffic Volume Summary (Source: BETA Group, Inc.)

Time Period/Day of Week	Oak Street West of Needham Street [a]		Needham Street North of Oak Street [b]		Highland Avenue West of Second Avenue [c]		Winchester Street North of Needham Street [c]	
	Volume	Hour	Volume	Hour	Volume	Hour	Volume	Hour
Weekday AM Peak Hour:								
Wednesday	773	8-9 AM	1,227	8-9 AM	1,850	7-8 AM	**2,059**	**8-9 AM**
Thursday	786	8-9 AM	1,455	8-9 AM	1,847	7-8 AM	**2,032**	**8-9 AM**
Weekday Midday Peak Hour:								
Wednesday	798	3-4 PM	**1,231**	**9-10 AM**	1,996	2:45-3:45 PM	1,771	3-4 PM
Thursday	**801**	**3-4 PM**	**1,699**	**12-1 PM**	**2,121**	**2-3 PM**	1,834	3-4 PM
Weekday Midday:								
Wednesday	684	12-1 PM	1,230	12-1 PM	1,725	12-1 PM	1,500	12-1 PM
Thursday	697	12-1 PM	**1,699**	**12-1 PM**	1,822	12-1 PM	1,699	12-1 PM
Weekday Midday:								
Wednesday	672	1-2 PM	1,209	1-2 PM	1,653	1-2 PM	1,417	1-2 PM
Thursday	679	1-2 PM	1,604	1-2 PM	1,840	1-2 PM	1,543	1-2 PM
Weekday Midday:								
Wednesday	732	2-3 PM	1,148	2-3 PM	1,901	2-3 PM	1,602	2-3 PM
Thursday	701	2-3 PM	1,491	2-3 PM	**2,121**	**2-3 PM**	1,761	2-3 PM
Weekday Midday:								
Wednesday	798	3-4 PM	1,122	3-4 PM	1,931	3-4 PM	1,771	3-4 PM
Thursday	**801**	**3-4 PM**	1,531	3-4 PM	2,073	3-4 PM	1,834	3-4 PM
Weekday PM Peak Hour:								
Wednesday	**808**	4:15-5:15 PM	1,228	5-6 PM	**2,046**	**4-5 PM**	1,965	5-6 PM
Thursday	783	4-5 PM	1,504	5-6 PM	2,080	4-5 PM	1,934	4-5 PM
Saturday Midday Peak Hour:								
Saturday	--	--	1,681	11 AM-12 PM	--	--	--	--

[a] Traffic counts conducted on 10/25/17 (Wednesday) and 10/26/17 (Thursday). Source: BETA Group, Inc.

[b] Traffic counts conducted on 5/3/17 (Wednesday), 4/27/17 (Thursday), and 10/28/17 (Saturday). Source: BETA Group, Inc.

[c] Traffic counts conducted on 4/26/17 (Wednesday) and 4/27/17 (Thursday). Source: BETA Group, Inc.

NOTE: **Bold text** indicates highest volume during each condition.

- On Thursday, October 26, 2017, traffic volumes along Oak Street west of Needham Street (801) are shown to be higher between 3-4 PM than during the Weekday AM peak hour (786 between 8-9 AM) and during the Weekday PM peak hour (783 between 4-5 PM).

- Traffic volumes along Needham Street north of Oak Street are shown to be higher on Thursday, April 27, 2017, between 12-1 PM (1,699) and on Wednesday, May 3, 2017, between 9-10 AM (1,231) than during the Weekday AM peak hour (1,455 and 1,227 between 8-9 AM) and during the Weekday PM peak hour (1,504 and 1,228 between 5-6 PM).

- On Thursday, April 27, 2017, traffic volumes along Highland Avenue west of Second Avenue are shown to be higher between 2-3 PM (2,121) than during the Weekday AM peak hour (1,847 between 7-8 AM) and during the Weekday PM peak hour (2,080 between 4-5 PM).

A reason for the higher traffic volumes outside of the Weekday commuter peak periods could be attributed to an associated demand with the commercial uses in the area (e.g., retail opens after the Weekday AM peak period, lunchtime demand, etc.). The Institute of Transportation Engineers (ITE) is relied upon for standard traffic engineering guidance by transportation officials. Based on ITE's *Transportation Impact Analyses for Site Development*, "The time period(s) that provide the highest cumulative directional traffic demands should be used to assess the impact of site traffic on adjacent street system and define roadway configurations and traffic control measure changes needed in the study area…In general, the critical traffic time period for a given project is directly associated with the peaking characteristics of both the project-related travel and area transportation system."[3] Since some of the existing adjacent street traffic volumes within the study area are shown to be higher outside of the Weekday commuting peak periods, a sensitivity analysis was requested by BETA Group at the following study area signalized intersections for the highest peak hour for each intersection:

- Needham Street/Oak Street/Christina Street
- Needham Street/north site driveway/Charlemont Street
- Needham Street/Columbia Avenue/Avalon driveway
- Winchester Street/Needham Street/Dedham Street
- Highland Avenue/2nd Avenue/Staples driveway

One option in developing Weekday Midday peak-hour traffic volumes is to conduct supplemental TMCs at these intersections. Another option is to utilize the ATR traffic counts previously collected to determine percentage increases at each location that would be applied to the TMCs previously collected.

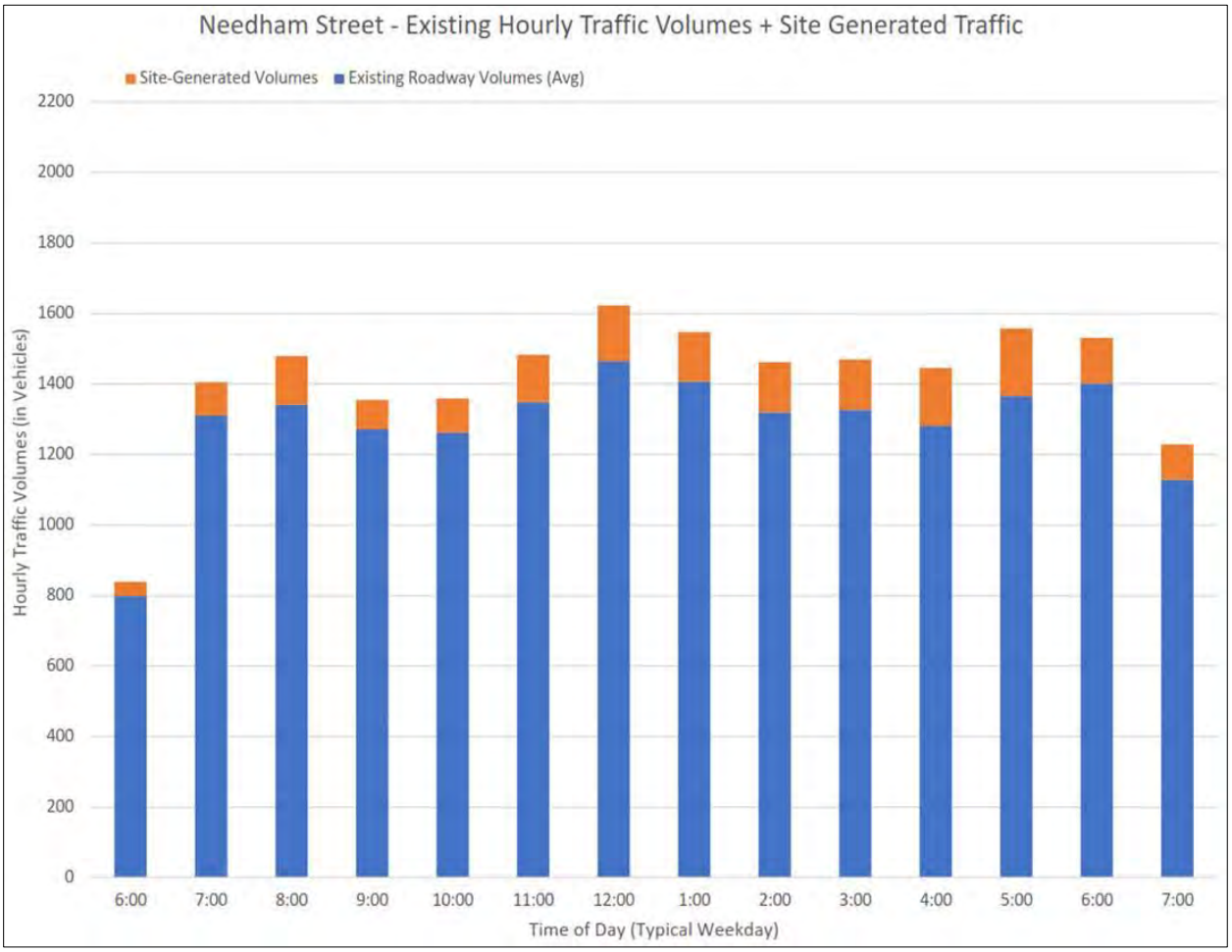
[3] Ibid., 1.

Based on coordination efforts through the City of Newton with the Applicant, VHB submitted a December 10, 2018 memorandum that evaluated these requested study area intersections during the Weekday Midday peak hour. Upon review of the intersection operations during the Weekday Midday peak hour, the proposed development is shown to experience noticeable impacts (see Section 2.5 of this peer review report) at the following intersections under both 2025 Build with Robust Shuttle Service conditions and 2025 Build with Existing Mode Share conditions:

- Needham Street/Oak Street/Christina Street (lane group increases in delays >10 seconds and lane group degradation in service levels)

- Needham Street/North Site Driveway (Charlemont Street Extension)/ Charlemont Street (lane group and overall intersection increases in delay >10 seconds, and lane group and overall intersection degradation in service levels)

In addition, the memorandum provided bar charts to depict the hourly traffic volumes along key roadways in the study area. The traffic volumes included existing traffic volumes and site-generated trips. Based on these bar charts, Needham Street is shown to carry more vehicles during the Weekday Midday peak hour (12-1 PM) than during the Weekday AM peak hour (8-9 AM) and the Weekday PM peak hour (5-6 PM). Since Needham Street is the major roadway that abuts the subject site, this evaluation demonstrates that the Weekday Midday peak hour is the critical time period for the proposed development. Below is a copy of the Needham Street hourly traffic volumes. Comments related to intersection analyses and improvements are identified below in Sections 2.4 and 2.5.



Source: VHB, Inc.

2.2.3 Seasonal Adjustment

Traffic on a given roadway typically fluctuates throughout the year depending on the area and the type of roadway. To determine if the traffic-count data needed to be adjusted to account for this fluctuation, The Northland Newton Development *Traffic Impact and Access Study* evaluated seasonal traffic-volume data from a MassDOT Permanent Count Stations located along Interstate 90 (I-90) and Interstate 95 (I-95) in Newton, Needham, and Wellesley. This information revealed that traffic volumes in January are approximately 6% below annual average-month conditions and traffic volumes in February are approximately 9% below annual average-month conditions. In addition, traffic volumes in April are approximately 2% above average-month conditions, in May are approximately 5% above average-month conditions, and in October are approximately 6% above average-month conditions. Therefore, the traffic counts in January and February were increased accordingly to reflect annual average traffic-volume conditions and the traffic counts in April, May, and October were used as collected to represent above average-month traffic-volume conditions. **BETA finds this methodology appropriate.**

2.2.4 Historical Adjustment

To represent 2018 traffic-volume conditions, The Northland Newton Development *Traffic Impact and Access Study* reviewed historic traffic data and previously submitted traffic studies near the subject site.

The traffic study states that a 0.5% annual growth rate was determined and is consistent with the Needham Street FDR. Therefore, the 2017 seasonally adjusted traffic volumes were increased by a 0.5% annual growth rate to reflect 2018 baseline conditions. While we find this methodology of increasing the traffic counts to represent current traffic-volume conditions to be reasonable, we offer the following comments:

Comment 2.11: MassDOT guidelines state that historical traffic counts should be increased by a seasonal adjustment, a background growth rate, and any new traffic from developments that have been completed subsequent to the time of the original counts.[4] **Therefore, the Applicant should confirm with the Newton Planning Department that no additional developments have been constructed subsequent to the 2017 traffic counts that would increase traffic volumes within the study area. Should developments be identified that have been constructed and occupied within this timeframe, then the existing and future traffic volumes used within The Northland Newton Development *Traffic Impact and Access Study* may need to be revised.**

Comment 2.12: The Northland Newton Development *Traffic Impact and Access Study* stated that research of historic traffic data, the Needham Street FDR, and other developments in proximity to the subject site revealed an annual growth rate of 0.5% for the study area. Although the Needham Street FDR was listed, no other developments were identified and no historic traffic data were provided to support this growth rate. **Therefore, the Applicant should provide this additional data to confirm the growth rate used within the study area.**

Comment 2.13: Traffic counts were collected in 2017 and adjusted to reflect 2018 traffic-volume conditions. As noted in Chapter 2 on pages 17 and 18 of The Northland Newton Development *Traffic Impact and Access Study*, improvements were implemented in 2018 at the Highland Avenue intersections with 1st Avenue and Riverside Community Health driveway, with the I-95 northbound ramps, and with the I-95 southbound ramps. These roadway improvements are not reflected in the 2018 existing traffic volumes, but are accounted for within the 2025 future traffic-volume conditions. While the existing conditions are not reflected accurately, the project's impacts are measured under future traffic-volume conditions (i.e., 2025 No-Build and 2025 Build) that have been evaluated appropriately with planned improvements implemented. N**o response is required.**

2.2.5 Safety Evaluation

Crash data for the study area intersections were obtained from MassDOT between 2011 and 2015. Incident occurrence was also compared to the volume of traffic through each intersection to determine significance and whether potential safety problems exist. Accordingly, crash rates were calculated for each study area intersection and compared with the district-wide (MassDOT District 6) averages. Based on this evaluation, the following 12 study area intersections were noted to have experienced crash rates that exceed the district-wide averages. In addition, these intersections were reviewed to determine

[4] Ibid., 2.

whether they are listed in MassDOT's Highway Safety Improvement Program (HSIP) database such that they are eligible for federal and state funds to alleviate safety deficiencies.

- Chestnut Street and Oak Street:
  - District-wide crash rate for signalized intersections = 0.71 crashes/million entering vehicles (c/mev)
  - Calculated crash rate = 0.86 c/mev
- Needham Street, Oak Street, and Christina Street:
  - District-wide crash rate for signalized intersections = 0.71 c/mev
  - Calculated crash rate = 0.79 c/mev
  - MassDOT HSIP eligible
  - MassDOT Project No. 608137 (begin Spring 2019)= realign Christina Street to be across from Oak Street, retime and re-phase signal parameters, and construct bike lanes.
- Needham Street, Charlemont Street, and North Site Driveway:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 1.15 c/mev
  - MassDOT Project No. 606635 (anticipated completion date of 2022) = realign Charlemont Street to align with site driveway, place under traffic signal control, and provide pedestrian crosswalks across all four approaches.
- Needham Street, Tower Road, and Industrial Place:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 0.70 c/mev
  - MassDOT Project No. 606635 (anticipated completion date of 2022) = reconfigure crosswalks, install rectangular rapid flash beacons at the crosswalk on the Needham Street south leg of the intersection, and construct bicycle lanes along the east and west sides of Needham Street.
- Needham Street and Rockland Street:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 0.65 c/mev
  - MassDOT Project No. 606635 (anticipated completion date of 2022) = restripe intersection and construct bicycle lanes along the east and west sides of Needham Street.
- Needham Street and Columbia Avenue:
  - District-wide crash rate for signalized intersections = 0.71 c/mev
  - Calculated crash rate = 1.18 c/mev

  - MassDOT Project No. 606635 (anticipated completion date of 2022) = provide a crosswalk on the Needham Street south leg of the intersection and construct bicycle lanes along the east and west sides of Needham Street.

- Winchester Street, Dedham Street, and Needham Street:
  - District-wide crash rate for signalized intersections = 0.71 c/mev
  - Calculated crash rate = 0.97 c/mev
  - MassDOT Project No. 606635 (anticipated completion date of 2022) = reconfigure Needham Street eastbound approach to provide a double left-turn lane and a shared through/right-turn lane, construct an exclusive left-turn lane on the Winchester Street northbound approach, and update pedestrian crosswalks.

- Centre Street and Walnut Street:
  - District-wide crash rate for signalized intersections = 0.71 c/mev
  - Calculated crash rate = 1.04 c/mev
  - MassDOT HSIP eligible
  - Proposed development to fund a Road Safety Audit (RSA) to identify current safety deficiencies and potential safety improvements.

- Highland Avenue and Riverside Street:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 0.58 c/mev
  - MassDOT Project No. 606635 (anticipated completion date of 2022) = extend Highland Avenue northbound two travel lanes from Second Avenue to Oak Street/Christina Street stripe.

- Highland Avenue and Wexford Street:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 0.74 c/mev
  - MassDOT HSIP eligible
  - MassDOT Project No. 606635 (anticipated completion date of 2022) = stripe DO NOT BLOCK INTERSECTION pavement markings along Highland Avenue to allow turns to and from Wexford Street.

- Highland Street and 1st Avenue:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 0.64 c/mev
  - MassDOT HSIP eligible

- MassDOT Project No. 607889 (September 2018) = remove Highland Avenue median to allow left turns from 1st Avenue, place under signal control, and construct additional turn lanes.

- Highland Avenue and I-95 Northbound Ramps:
  - District-wide crash rate for unsignalized intersections = 0.52 c/mev
  - Calculated crash rate = 0.53 c/mev
  - MassDOT HSIP eligible
  - MassDOT Project No. 603711 (late 2017) = reconstruct interchange, place under signal control, and provide sidewalks.

Comment 2.14: In accordance with MassDOT *Transportation Impact Assessment Guidelines*, a RSA shall be conducted in the place of a safety review for those locations considered HSIP-eligible. Accordingly, the RSA should be completed during the early project stages to help identify appropriate improvements. **Since the Centre Street and Walnut Street intersection is a high crash location and is MassDOT HSIP eligible, the proposed RSA at this location should be conducted before the mitigation measures can be finalized.**

Comment 2.15: Of these 12 high crash rate locations, no improvements are planned for the Chestnut Street and Oak Street intersection. **The Applicant should coordinate with the Newton City Planner, the Newton City Engineer, and the Newton Police Department in identifying safety improvement measures that should be considered. For example, pedestrian crossing indications and signal equipment should be upgraded in conformance with current standards.**

2.2.6 Vehicle Speeds

In accordance with MassDOT guidelines, a speed study may be required as part of a sight distance evaluation, safety reviews, and determining community impacts. Vehicle speeds are important as motorists relate travel speeds to safety, convenience, time, comfort, and economics. Based on a review of The Northland Newton Development *Traffic Impact and Access Study*, ATR counts were collected along Needham Street and along Oak Street in the vicinity of the proposed site driveways to help with the sight distance evaluations (Stopping Sight Distance and Intersection Sight Distance). The travel speeds were recorded using ATRs over a 24-hour period, thereby also recording data during non-peak hours when vehicle speeds are not affected by platooning. The speeds were determined by dividing the elapsed time by the measured distance between two checkpoints.

Traffic speed data were noted in the text for the 85th percentile speeds. The 85th percentile speed represents the speed at which 85% of vehicles are traveling at or below. Since this speed more accurately represents the overall travel speed on the roadway, 85th percentile speeds are typically used to verify speeding concerns. In addition, the speed observations include the average (medium) speeds and the pace of the vehicles traveling in each of the specific sections within the study area. The pace is the 10 mph range containing the largest number of sample vehicles. Based on a review of the October 2017 vehicle speed data provided in the Appendix, we noted the following:

- Oak Street:
  - Eastbound:
    - Average = 25 mph
    - 85th Percentile = 30 mph
    - Pace = 22-32 mph
  - Westbound:
    - Average = 29 mph
    - 85th Percentile = 34 mph
    - Pace = 24-34 mph
- Needham Street:
  - Northbound:
    - Average = 23 mph
    - 85th Percentile = 30 mph
    - Pace = 18-28 mph
  - Southbound:
    - Average = 20 mph
    - 85th Percentile = 30 mph
    - Pace = 12-22 mph

BETA conducted vehicle travel time runs along the Highland Avenue/Needham Street corridor during the Weekday Midday and Weekday PM peak periods to better understand vehicle speeds within the study area during these time periods. The travel times are summarized in Table 2 below.

Comment 2.16: The average vehicle travel speed through much of the corridor during the Weekday Midday and Weekday PM peak period was found to be approximately 4-5 miles per hour. The travel times confirm that the Needham Street corridor experiences significant congestion during the Weekday Midday peak period. **Due to these oversaturated conditions along the corridor, a software program (e.g., SimTraffic) should be used that evaluates operations along a corridor instead of at individual intersections (Synchro) as was presented in the traffic study (see Comment 2.24).**

Table 2: Travel Time Summary
Needham Street Corridor (Source: BETA Group, Inc.)

Time Period/Direction/Travel Route	Duration	Distance	Speed
Wednesday (11/28/18) 12:30 PM			
Westbound:			
Winchester Street to Columbia Avenue	3:30	0.22 miles	4 mph
Columbia Avenue to Oak Street	3:00	0.52 miles	10 mph
East Street to Columbia Avenue	3:00	0.17 miles	3 mph
Tuesday (12/4/18) 5 PM			
Eastbound:			
1st Avenue to Oak Street	6:00	0.38 miles	4 mph
Oak Street to Winchester Street	3:00	0.74 miles	15 mph
Westbound:			
Winchester Street to Columbia Avenue	3:00	0.22 miles	4 mph
Columbia Avenue to Tower Road	3:00	0.27 miles	5 mph
Tower Road to Oak Street	3:00	0.25 miles	5 mph

2.3 FUTURE CONDITIONS

In accordance with MassDOT *Transportation Impact Assessment Guidelines*, The *Traffic Impact and Access Study* prepared by VHB for The Northland Newton Development evaluated the project's impacts over a seven-year design horizon. Other design horizons may be required depending on such factors as the nature, location, and scheduling of the development as well as the extent of off-site mitigation measures.

Comment 2.17: **While we concur that the seven-year design horizon is considered to be the typical future time period to evaluate traffic conditions in Massachusetts, the Applicant should confirm that the proposed development will not be phased and the full build-out of the project is expected to be completed by 2025. Should The Northland Newton Development be phased and/or not completed by 2025, then the project's impacts will need to be evaluated under other design horizons.**

2.3.1 BACKGROUND TRAFFIC GROWTH

The Northland Newton Development *Traffic Impact and Access Study* applied a 0.5% annual growth rate to the 2018 traffic volumes over a seven-year period to reflect 2025 baseline traffic volumes. As previously stated (Comment 2.12), the Applicant should provide the historic traffic data and identify the other traffic studies in the area (other than the Needham Street FDR) that were used in determining this growth rate.

In addition to utilizing a historical growth rate, traffic generated by other planned developments was considered in developing the 2025 No-Build traffic volumes. Based on discussions with City of Newton and Town of Needham officials, the traffic study included the following background developments:

- Newton Nexus (131-181 Needham Street, Newton):
  - Redevelopment of Newton Technology Park to include 55,060 square feet of office space, 66,960 square feet of retail space, and a 20,000 square-foot market.
  - Traffic volumes were obtained from traffic study prepared for that development.
- Day Care Center (49 Winchester Street, Newton):
  - Occupying vacant space with a 90-student day care center.
  - Traffic volumes were developed based on ITE trip-generation data.
- Wells Office Park (Newton):
  - 180 Wells Avenue:
    - Renovate and expand an office building from 55,775 square feet to 116,340 square feet.
    - Traffic volumes were obtained from traffic study prepared for that development.
  - 2 Wells Avenue:
    - Renovate and expand an office building from 68,740 square feet to 135,598 square feet.
    - Traffic volumes were obtained from traffic study prepared for that development.
- The Kendrick (275 2nd Avenue, Needham):
  - 390 residential units on a former parking lot.
  - Traffic volumes were developed based on ITE trip-generation data.
- Needham Crossing Business Park (156 B Street, Needham):
  - Replace a vacant office building with a 128-room hotel.
  - Traffic volumes were developed based on ITE trip-generation data.
- NBC Universal Regional Headquarters (189 B Street, Needham):
  - Redevelopment of 171,000 square feet of vacant office space.
  - Traffic volumes were developed based on ITE trip-generation data.
- Re-occupancy of Light Industrial Space (160 Charlemont Street, Newton):
  - Re-occupancy of 91,000 square feet of light industrial space.
  - Traffic volumes were developed based on ITE trip-generation data.
- Former TJ Maxx (260 Needham Street, Newton):
  - Re-occupancy of 35,100 square-foot retail building.
  - No additional traffic added since the existing traffic counts were conducted prior to the relocation of the TJ Maxx to the Newton Nexus site.

- Re-occupancy of Existing Site:
  - Re-occupancy of existing site with by-right uses (180,000 square feet of office space in the former mill building, 62,600 square feet of retail space, and 257,100 square feet of manufacturing space).
  - No credit was taken for the manufacturing space, as it was unlikely that this use would be tenanted in the future.
  - Traffic volumes were developed based on ITE trip-generation data.

Comment 2.18: As previously stated (Comment 2.11), any developments constructed and occupied subsequent to the 2017 traffic counts (and not listed above) that would generate traffic within the study area should be included. In addition and in accordance with MassDOT guidelines, developments that generated traffic within the past 2 years but are currently vacant can be accounted for as being re-occupied with by-right uses (either based on the traffic studies prepared for those projects or estimated using ITE methodologies). If the vacant space within the existing site was unoccupied for more than 2 years from the date of the traffic study, however, then a vehicle trip credit cannot be made for re-occupancy of the existing site with by-right uses. **Therefore, the Applicant should confirm how long the existing space on the site has been vacant.**

2.3.2 Roadway Improvements

As previously stated, MassDOT is in the process of implementing measures along the Needham Street, Highland Avenue, and Winchester Street corridor to improve vehicular operations, alleviate safety deficiencies, and provide multi-modal accommodations (MassDOT Project No. 606635). MassDOT will also be reconstructing the Needham Street signalized intersection with Oak Street and Christina Street to realign the side streets (MassDOT Project No. 608137). This project was originally incorporated into the Needham Street, Highland Avenue, and Winchester Street corridor project (MassDOT Project No. 606635), but was separated out into a standalone project through the MassWorks grant. Improvements have been implemented along Highland Avenue at the I-95 interchange (MassDOT Project No. 603711) and at 1st Avenue (MassDOT Project No. 607889) to install traffic signals, reconstruct pedestrian facilities, and geometric modifications. Similar to the Needham Street, Oak Street, and Christina Street intersection project, Highland Avenue and 1st Avenue was originally incorporated into the Needham Street, Highland Avenue, and Winchester Street corridor project (MassDOT Project No. 606635), but was separated out into a standalone project through the MassWorks grant. The City of Newton is reviewing improvements for the Nahanton Street corridor to upgrade traffic signal equipment, improve pedestrian facilities, and modify geometrics. **Since these improvements are planned to be constructed within the design horizon, BETA concurs with the methodology of including these roadway improvement measures in future traffic-volume conditions.**

2.3.3 Trip-Generation Estimates

The site currently consists of 62,600 square feet of retail space, 180,000 square feet of office space, and 257,000 square feet of manufacturing space. As proposed, the mixed-use development would include 822 residential units, 180,000 square feet of office space, and 237,000 square feet of restaurant and retail space, and 4,000 square feet of community center space. Trip-generation estimates were calculated using

ITE trip-generation data. **BETA concurs with the trip-generation methodologies used in determining the unadjusted vehicle trips for the existing and proposed uses.**

2.3.3.1 PERSON TRIPS

The ITE trips were then converted to person trips to be able to estimate the modal split of site trips. Based on data published by the United States Department of Transportation (USDOT) and Federal Highway Administration (FHWA) summarized in Table 16 of the 2009 National Household Travel Survey (to or from work = 1.13, shopping other family/personal errands = 1.78), average vehicle occupancy rates for residential, office, and retail uses were applied to the ITE unadjusted trips in order to determine person trips. **BETA finds this methodology to be reasonable.**

2.3.3.2 INTERNAL CAPTURE TRIPS

The vehicle trips calculated for each of the proposed uses represent single-use trips to the site on the study area system. Based on the ITE *Trip Generation Handbook*, studies have shown that for developments of mixed-use or multi-use sites, it is realistic to assume that there will be some internal trips within the site itself. This concept means that some patrons could visit more than one of the uses on the site. This ITE internal capture rates were then applied to the person trips generated by the proposed development to determine the number of person trips occurring entirely within the site. The resulting trips represent the persons entering and exiting the site from the adjacent roadway system. **BETA finds this methodology to be reasonable.**

2.3.3.3 MODE SHARE SPLITS

The Traffic Impact and Access Study presents mode shares based on 2010 US Census data for the City of Newton as shown below:

Table 3: Newton Mode Share (2010)

	Private Vehicle	Transit	Walk/Bike
Residents of Newton	82%	13%	5%
Workers in Newton	88%	7%	5%

These mode share percentages were then applied to the estimated person trips to be generated by the proposed development to determine how people may visit the site. This scenario was referred to as "Build Condition with Existing Mode Share."

More recent data are available from the U.S. Census 2015 American Community Survey (ACS) and are displayed in Table 4, both for Newton and the region.

Table 4: Newton Mode Shares (2015)

	Private Vehicle	Transit	Walk/Bike	Worked at Home
Residents of Newton (workers 16+)	72%	12%	7%	9%
Boston region MPO	69%	17%	8%	5%

Comment 2.19: There is an issue for the reported *Private Vehicle* estimates for 2010 (82%) compared to 2015 (72%); the Applicant should determine the reason for this discrepancy. Table 4 indicates that *Transit* mode share is slightly less than that reported in the traffic study, while *Walk/Bike* is slightly higher; however, what is most interesting is that the *Worked at Home* category is comparable to both *Transit* and *Walk/Bike* and is about twice that of the region. **The Applicant should use the 2015 U.S. Census data for any additional analysis; this would also be consistent with the Needham Street Area Vision Plan, page 25-25 (see Comment 3.2).**

Comment 2.20: The mode share percentages for the proposed residential trips were based on the data associated with Newton residents. In addition, the mode share percentages for the proposed office trips were based on the data associated with those people working in Newton. While this methodology is in conformance with standard traffic engineering practice, the rationale for the mode share percentages associated with the proposed retail trips was not provided in The Northland Newton Development *Traffic Impact and Access Study* (90% vehicle, 5% transit, and 5% walk/bike). **Therefore, support should be provided for the selected mode share used for the retail portion of the proposed development.**

As proposed, the development would include a robust shuttle bus program with direct connections to nearby transit stations and to Cambridge and Boston. This scenario was referred to as "Build Condition with Robust Shuttle Service" that assumed the following modal splits:

- Residential and Office Trips:
  - 60% by vehicle
  - 30% by transit
  - 10% by walking/bicycling
- Retail Trips (consistent with the "Build Condition with Existing Mode Share" condition):
  - 90% by vehicle
  - 5% by transit
  - 5% by walking/bicycling

Comment 2.21: While an improved or newly implemented transit system can reduce the number of vehicles on the roadway, the methodology for determining these theoretical mode share percentages was not provided in The Northland Newton Development *Traffic Impact and Access Study*. **Therefore, support should be provided for the estimated mode share percentages.**

2.3.3.4 PASS-BY TRIPS

Not all of the vehicle trips expected to be generated by the proposed retail component of the development represents *new* trips on the study area roadway system. A substantial portion of the vehicles visiting commercial/retail developments have been found to already be present in the adjacent passing traffic stream or are diverted from another route to the subject site. Based on data presented in

the ITE *Trip Generation Handbook,* the average *pass-by* trip percentage for Land Use Code 820 (Shopping Center) is 34% during the Weekday PM peak hour and 26 percent during the Saturday Midday peak hour. **BETA concurs with this methodology.**

2.3.3.5 PROJECT-GENERATED TRIPS – BUILD CONDITIONS

The next step in determining the site-generated trip impacts on the adjacent roadway system was to apply the mode share splits to the person trips and then to recalculate these values back to vehicle trips from person trips.

Comment 2.22: Since these calculations were not provided in the Appendix of The Northland Newton Development *Traffic Impact and Access Study*, BETA attempted to confirm the numbers provided in Tables 7 through 10. Based on our estimates, we have found differing values than as presented in the traffic study. **Therefore, the breakdown of the calculations used to generate the values presented in these tables should be provided for review.**

2.3.3.6 TRIP DISTRIBUTION

Trips were assigned to the study area based on existing traffic patterns, population densities, places of employment, and the type and efficiency of the nearby roadway system. Since the different components of the proposed mixed-use development (residential, office, and retail) have varying characteristics, the U.S. Census Data were used to estimate a trip-distribution of the proposed residential and office site trips. For the proposed retail component of the overall development, travel patterns are anticipated to be similar to those within the study area due to the existing commercial nature of nearby land uses. **BETA finds this methodology to be reasonable.**

Comment 2.23: Upon review of the site-generated networks provided in the Appendix of The Northland Newton Development *Traffic Impact and Access Study*, the proposed residential, office, and retail site trips were combined into the same figures. **Due to the different distribution patterns used for the three components of the proposed mixed-use development, the individual site-generated peak-hour traffic volumes should be provided on separate figures for the proposed residential, office, and retail site trips.**

2.4 INTERSECTION ANALYSES

Capacity analyses were performed for the study intersections with the 2018 Existing, 2025 No-Build, and 2025 Build traffic volumes during the weekday AM, weekday PM, and Saturday midday peak hours based on the methodology and procedures set forth in the *Highway Capacity Manual* (HCM). The Northland Newton Development *Traffic Impact and Access Study* presented the intersection analyses using the Trafficware Synchro software program, a MassDOT approved traffic analysis tool.

Table 16 in the traffic study incorrectly labels the Route 9 eastbound access road at Winchester Street as the eastbound approach instead of the westbound approach. This typo does not impact the analysis results as the Synchro worksheets properly identify this approach. **No response is required.**

As defined in the Synchro User Guide, the 50th percentile and 95th percentile maximum queue lengths exceed capacity when the "~" and "#" are shown, respectively, to indicate those conditions when traffic

volumes exceed capacity. These queue lengths could be longer with the blocking and spillover problems. Based on a review of the signalized intersection analyses (Tables 16 and 18 and in the Appendix), the following locations are identified with these footnotes. See Appendix A of this Transportation Engineering Peer Review for the specific lane groups that satisfy these criteria.

- Chestnut Street and Elliot Street
- Chestnut Street and Oak Street
- Needham Street, Oak Street, and Christina Street
- Needham Street, Charlemont Street, and North Site Driveway
- Needham Street, Columbia Avenue, and Avalon Driveway
- Winchester Street, Needham Street, and Dedham Street
- Winchester Street and Route 9 Eastbound Service Road
- Winchester Street and Route 9 Westbound Service Road
- Centre Street and Walnut Street
- Nahanton Street, Wells Avenue, and JCC Driveway
- Highland Avenue, 2nd Avenue, and Staples Driveway

Some reasons for oversaturated conditions could be related to spillback between intersections, spillback beyond turning lanes, forced lane changes, unbalanced lane usage for downstream turning movements, turning vehicles from driveways, and other intricate traffic-flow interactions. The HCM methodology (Synchro program) does not account for delay generated by vehicle queues extending from adjacent signals or spilling over from exclusive turn lane. Therefore, some measures of effectiveness produced from the computer analyses (e.g., delay, LOS, and volume-to-capacity [v/c] ratio) may reflect better operations than those experienced in the field.

Comment 2.24: Due to the limitations of the software program used as part of the traffic study, the queue results are not accurately modeled. A computer program to consider is SimTraffic software, also a MassDOT analytical tool, that accounts for these factors of delay and constrained intersections (i.e., vehicles that may not reach a downstream intersection due to spillback conditions). The SimTraffic software performs micro-simulation and animation of vehicular traffic. With SimTraffic, individual vehicles are modeled and displayed traveling through a roadway network.

In addition, the signalized intersections appear to provide lower lane group delays in The Northland Newton Development *Traffic Impact and Access Study* presented than are experienced in the field. Based on the travel time runs along the Highland Avenue/Needham Street corridor (see Section 2.2.6 – Vehicle Speed Study), the

average vehicle travel speed through much of the corridor during the Weekday Midday and Weekday PM peak period was found to be approximately 4-5 miles per hour.

In VHB's January 4, 2019 letter to Ms. Jennifer Caira, Newton Chief Planner, the Applicant provides "There is no dispute that the corridor is saturated at certain hours, so differing opinions on how much are not useful;" Since VHB has agreed that the Needham Street corridor is congested, using a different computer model to analyze intersection operations would only further demonstrate the saturated conditions. Therefore, BETA recommends that additional corridor analyses not be provided at this time, but has identified additional mitigation measures shown below (Comment 2.27) to reduce the impact of the project and improve traffic operations along the Needham Street and Winchester Street corridors and at other study intersections.

Comment 2.25: As stated in the Synchro User Guide, when the defacto left-turn lane ("dl") indication is listed for a shared left-turn/through lane on a multi-lane approach, that shared lane is experiencing congestion that exceeds the level of the other through lanes. Since the Synchro computer program does not model this situation correctly, the user is required to manually change the shared lane into an exclusive left-turn lane. Based on a review of the signalized intersection analyses, the Highland Avenue westbound approach to the signalized intersection with 2nd Avenue and Staples Driveway includes the "dl" indication under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday AM peak hour (Table 16 and in the Appendix). **Therefore, this intersection should be reanalyzed under existing and future conditions during the Weekday AM peak hour with the Highland Avenue westbound approach modeled as an exclusive left-turn lane and a shared through/right-turn lane.**

Comment 2.26: Based on a review of the capacity analysis worksheets provided in the Appendix, it was noted that the traffic signal splits and phases at the Highland Avenue, 2nd Avenue, and Staples Driveway intersection appear to be incorrect under future traffic-volume conditions. For Phase 2 (Highland Avenue westbound approach) and Phase 6 (Highland Avenue eastbound approach) permissive phase, the green time for Phase 2 should be extended to end at the same time as Phase 6. **Therefore, this intersection should be reanalyzed with this adjustment to the traffic signal parameters.**

2.5 MITIGATION

In accordance with MassDOT guidelines, a development would be considered to have an impact at an intersection if the added site trips result in **a degradation in level of service**. In addition, MassDOT guidelines state that a development may be considered to have a significant impact if post-development trips result in a **delay of 10 seconds or more** even if there is no degradation in level of service. Based on a review of the 2025 No-Build, 2025 Build with **Existing Mode Share**, and 2025 Build with **Robust Shuttle** (shown in Tables 16-18 and in the Appendix), the following off-site study area intersections were noted to satisfy these MassDOT criteria and thus **are required to assess options to mitigate those impacts**. See Appendix B of this Transportation Engineering Peer Review for the specific lane groups or critical movements that satisfy these criteria.

- 2025 Build with Existing Mode Share:

  - Needham Street, Columbia Avenue, and Avalon Driveway

- 2025 Build with Existing Mode Share and 2025 Build with Robust Shuttle Service:
  - Chestnut Street and Route 9 Westbound Service Road
  - Chestnut Street and Route 9 Eastbound Service Road
  - Chestnut Street and Oak Street
  - Needham Street, Oak Street, and Christina Street
  - Needham Street, Tower Road, and Industrial Place
  - Needham Street and Jaconnet Street
  - Needham Street and Rockland Street
  - Winchester Street, Needham Street, and Dedham Street
  - Winchester Street and Route 9 Eastbound Service Road
  - Winchester Street and Route 9 Westbound Service Road
  - Nahanton Street and Winchester Street
  - Nahanton Street, Wells Avenue, and JCC Driveway
  - Highland Avenue and Riverside Street
  - Highland Avenue, Highland Terrace, and Highland Circle
  - Highland Avenue, 2nd Avenue, and Staples Driveway
  - Highland Avenue and Charles Street
  - Highland Avenue and Wexford Street
  - Highland Avenue and I-95 Northbound Ramps
  - Highland Avenue and I-95 Southbound Ramps

- 2025 Build with Existing Mode Share and 2025 Build with Robust Shuttle Service **with proposed mitigation in place**:
  - Chestnut Street and Elliot Street
  - Centre Street and Walnut Street

MassDOT traffic study guidelines state that signalized intersections that operate at LOS F in urban areas should be evaluated for potential improvements. Under these conditions, the applicant is supposed to meet with MassDOT officials regarding the implementation of improvements prior to submitting the traffic study.

Comment 2.27: **Since these intersections satisfy MassDOT's criteria for locations with significant impact as a result of a proposed development, the Applicant should develop improvement measures for these study area intersections (also see Comment 10.2).**

The following traffic mitigation measures are recommended:

- Provide a cloud-based computer system and traffic signal management software capable of remote access between the signalized intersections (Needham and Winchester Street corridors) and the Newton Public Works Department. The system shall include a desktop workstation at the remote site (Newton Public Works Department). The workstation shall provide a flat-panel display monitor screen to be wall mounted in the remote traffic management workstation room to be identified by the City. The size of the flat-panel display monitor shall be capable of displaying live traffic surveillance footage form the workstation for traffic monitoring purposes and used to view multiple intersection locations within one display. The system shall have ATSPM (Automated Traffic Signal Performance Measures) capability for traffic monitoring purposes. The cloud-based system shall be operational at the completion of the project.

- Provide video cameras along the Needham Street and Winchester Street corridors to provide live traffic footage to the remote workstation at the Newton Public Works Department.

- Provide all necessary communication equipment required to operate the cloud-based computer system, traffic management software, workstation, and future selected adaptive traffic control system (as part of the MassDOT project) between the signalized intersections along Needham and Winchester Streets corridors and the remote operational location at the Newton Public Works Department.

- Allocate mitigation fund for monitoring and managing traffic and maintaining the adaptive signal system along the Needham and Winchester Streets corridors for a period of two years.

- Provide full signal coordination and communication between the Route 9/ Winchester Street intersections (planned to be signalized by MassDOT) and the Centre Street/Walnut Street signal.

- Provide full Transit Signal Priority capability to be interfaced with the proposed Adaptive Signal system by MassDOT along the Needham Street and Winchester Street corridors. Modify signal timing and phasing to accommodate the transit signal priority feature. Coordinate with the MBTA as necessary. Provide shuttle buses with transponders/emitters to interface with the adaptive signal system.

- Upgrade traffic and pedestrian signal equipment at the Chestnut Street intersections with Oak Street and with Elliot Street.

- As documented in the June 19, 2018 Traffic Safety Evaluation of Boylston Street at Chestnut Street Memorandum prepared by Environmental Partners Group, Inc. (see Appendix D), the Chestnut Street intersections with the Route 9 eastbound and westbound ramps satisfy the eight-hour (Warrant 1), four-hour (Warrant 2), and peak-hour (Warrant 3) warrants of the Manual on Uniform Traffic Control Devices

(MUTCD) for signalization. Due to the current operations of the intersections, the proximity of the intersections, and the long delays and queueing, signalization of these intersections is recommended. In addition, consideration should be given to placing these intersections under one controller.

- The Applicant has proposed to fund a Road Safety Audit (RSA) for the intersection of Centre Street/Walnut Street. The Applicant should provide safety and operation improvements based on the outcome of the RSA Report.

- An assessment of the traffic operations at the Newton Highlands Massachusetts Bay Transportation Authority (MBTA) Station should be provided that describes the proposed shuttle bus operations and potential conflicts with traffic, pedestrians, and bicyclists.

- Review the extension of the two-lane eastbound approach lanes on Oak Street at Needham Street to accommodate the left-turn vehicle queue.

- Based on a review of the estimated site-generated trips, the proposed development is anticipated to send 61 to 112 additional vehicles per hour along the Chestnut Street corridor between Oak Street and the Route 9 interchange (with City of Newton's existing mode share). During field reconnaissance, Chestnut Street was noted to have a posted speed limit of 25 mph, two-lane cross-section (one travel lane per direction), and sidewalks along both sides of the roadway. In addition, Chestnut Street is primarily residential in nature with the Officer Bobby Braceland (Upper Falls) Playground located along the west side of Chestnut Street south of Pennsylvania Avenue. Due to the roadway characteristics, the residential environment, and the additional vehicles to be added along the Chestnut Corridor, it is recommended that the Applicant provide safety improvement measures to be coordinated with the City.

- Evaluate and provide traffic calming improvements along the Chestnut Street corridor.

- Prohibit eastbound traffic on Main Street within the site to turn left onto Needham Street northbound at the unsignalized intersection.

- Conduct a vehicle speed study on Upper Falls Neighborhood roadways and provide traffic calming devices as needed.

- The Applicant should evaluate the potential to provide emergency vehicle access to the project site via Mechanic Street.

- The Applicant has provided a draft traffic monitoring proposal (January 4, 2019) to conduct a post-occupancy traffic study one year after issuance of final certificate of occupancy. If project-generated traffic volumes exceed the projected vehicle trip estimates by 10%, the Applicant will meet with City of Newton officials to discuss expanding the TDM program to increase use of alternative travel modes as well as

implementing physical improvements at specific intersections. **The Applicant should make a commitment to provide measures, including expanding or revising the shuttle bus system and the TDM program to meet the project-generated vehicle thresholds (and/or mode splits) for the Robust Bus Mode Share condition (see Comment 10.2). The traffic monitoring program should be conducted annually with results presented to the City and adjustments made accordingly.**

Comment 2.28: **With the proposed improvements, Traffic Management Plans should be prepared and submitted to the City of Newton. These plans should include Temporary Traffic Control Plans (TTCPs), typical layouts, detour routes, and pedestrian and bicycle accommodations as necessary.**

3.0 PUBLIC TRANSPORTATION

3.1 EXISTING SERVICES

The MBTA currently provides a variety of services in the development area including:

- Bus – Routes 52 (Watertown and Dedham Mall) and 59 (Watertown and Needham Junction)
- Light Rail – Green Line (Riverside Branch)
- Commuter Rail – Needham Line (Needham Heights) and Worcester/Framingham Line (Newtonville)
- The RIDE – door-to-door paratransit service

The most recent ridership and schedule information is shown below[5]:

- Green Line at Newton Highlands: 1,627 typical daily boardings
- Green Line at Eliot: 814 typical daily boardings
- Route 59: 1,497 daily boardings; ranked 88th in typical daily ridership. Inbound service is provided from 6:20 AM to 8:20 PM; outbound service runs from 6:05 AM to 7:35 PM
- Route 52: 766 daily boardings; ranked 126th in typical daily ridership. Inbound service is from 6:15 AM to 07:20 PM; outbound is from 7:00 AM to 07:57 PM. There is no Saturday or Sunday service.
- Commuter Rail at Needham Heights: 1,104 inbound boardings; ranked 14th in station boardings
- Commuter Rail at Newtonville: 293 inbound boardings; ranked 94th in station boardings

[5] Source: MBTA Ridership and Service Statistics, 2017 (14th Edition); Chapter 2 reports subway ridership, Chapter 3B reports bus ridership, and Chapter 4 reports commuter rail station boardings, all for calendar year 2012.

In addition, the 128 Business Council operates a variety of private shuttles in the area; over 40 companies are members of the Council, including AstraZeneca, Boston Dynamics, Liberty Mutual, and the Town of Lexington. The Council has considerable capability and experience in providing transit services and managing operations.

The Needham Shuttle (operated by the 128 Business Council) serves trips from the Newton Highlands Green Line Station to the Needham Crossing area. This is a free fare ride for employees of companies that are Business Council members; non-members pay a $4 fare per trip.

Newton residents traveling to work sites in Boston have a range of options. However, fewer options are available for circumferential trips (i.e., trips not destined for the Boston CBD).

3.2 TRIP DISTRIBUTION

As shown in the Traffic Impact and Access Study (Table 12 and Figure 11) and the Appendix (Trip Distribution Calculation Worksheets, pages 269-270), almost half (44%) of residential trips are destined for the I-95/Route 128 Corridor. These trips are heading for widely dispersed lower-density employment locations and are difficult to efficiently serve with transit. The Transportation Implementation Plan acknowledges the challenge of serving north-south trips.

While the 128 Business Council operates an extensive array of shuttle services, the proposed shuttle system (discussed later) for the Northland Newton Development will not serve locations along the I-95/ Route 128 corridor. However, the Council anticipates conducting a transportation survey with the City of Waltham and the Town of Lexington and this should yield data that will inform the feasibility of developing circumferential service.

Comment 3.1: U.S. Census Journey to Work tabulations for 2010 was used to support the trip distribution analysis and this is the appropriate database to use. **No response is needed.**

3.2.1 EXISTING MODE SHARE

The Traffic Impact and Access Study presents mode shares based on 2010 US Census data for the City of Newton as shown below:

Table 5: Newton Mode share (2010)

	Private Vehicle	Transit	Walk/Bike
Residents of Newton	82%	13%	5%
Workers in Newton	88%	7%	5%

More recent data are available from the U.S. Census 2015 American Community Survey (ACS) and are displayed in Table 6, both for Newton and the region.

Table 6: Newton Mode shares (2015)

	Private Vehicle	Transit	Walk/Bike	Worked at Home

Residents of Newton (workers 16+)	72%	12%	7%	9%
Boston region MPO	69%	17%	8%	5%

Comment 3.2: There is an issue for the reported *Private Vehicle* estimates for 2010 (82%) compared to 2015 (72%); **the Applicant should determine the reason for the discrepancy**. Table 6 indicates that *Transit* mode share is slightly less than that reported in the impact study, while *Walk/Bike* is slightly higher; however, what is most interesting is that the *Worked at Home* category is comparable to both *Transit* and *Walk/Bike* and is about twice that of the region. **The applicant should use the 2015 U.S. Census data for any additional analysis; this would also be consistent with the Needham Street Area Vision Plan, page 25-25 (see Comment 2.19).**

3.3 COMMUTER SURVEY

The survey instrument collected a broad range of information on commuter behavior and preferences and can be used to build a profile of the attributes that commuters and others value when considering using a particular mode. The survey sample was conducted on-line and had 1,320 respondents. The 1,320 total respondents were sourced via the 128 Business Council's preexisting rider contact base, the Chamber of Commerce, the N-Squared Innovation Corridor, community groups, local employers, local developers, and elected officials within the City. It is unlikely that the sample is representative of the residents and employees that are expected to live and work in the proposed development.

Comment 3.3: This survey was used by the 128 Business Council to develop a map of key trip destinations and the level of demand to and from those destinations. Combined with existing transit service routes, this provided a good starting point for the shuttle service routes and schedules. **For future surveys, it may be useful to include a stated preference set of questions to assess willingness to pay; this would help inform the development of the fare structure.**

4.0 PEDESTRIAN AND BICYCLE ACCOMMODATIONS

Non-motorized transportation amenities are provided within the study area in various levels. Other than along Nahanton Street, sidewalks are provided along the major roadways and crosswalks are provided at signalized intersections and at midblock crossings (Needham Street north of Charlemont Street and south of Industrial Place). Although no dedicated bicycle facilities are provided along the roadways currently, the Upper Falls Greenway is an off-road, multi-use path that accommodates pedestrians and bicyclists. The utility of the greenway for transportation is limited however, as the shared use path only runs from the Charles River to Easy Street, a distance just under one mile. As part of the Needham Street corridor project (MassDOT Project No. 606635), sidewalks are planned to be reconstructed, rectangular rapid flashing beacons (RRFBs) are to be installed at midblock crossings, and leading pedestrian phases would be incorporated into the traffic signals. MassDOT's project includes a separated bike lane planned along Needham Street, but provides only shared lane markings along much of the project length from the Needham/Winchester intersection to the Winchester/Rt. 9 on/off ramp intersection. This creates a gap in bicycle connectivity between the Newton Upper Falls and the Newton Highlands neighborhood.

The proposed Northland Newton Development project includes a number of facilities for pedestrians and bicyclists, and traffic calming interventions to ensure a walkable, bikeable, and highly livable new

neighborhood in Newton. The key interventions that promote active transportation and safety within the study area are 1) raised intersections, 2) sidewalks, 3) a multi-use path intended to link the Upper Falls Greenway to the west with the Charles River path to the south. MassDOT's proposed reconstruction of Needham Street and Winchester Street also have the potential to improve pedestrian and bicycle safety for those who will live in, work at and/or visit the Northland Newton Development.

4.1 RAISED INTERSECTIONS

The intent of the raised intersections is to help reduce vehicle speeds and make motorists aware of pedestrian crossing locations and bicyclists. As shown on the project site plans, internal raised intersections are proposed at the following locations:

- Main Street/Tower Road
- Main Street/Unnamed Street
- Main Street/Pettee Lane
- Tower Road/Pettee Lane

Comment 4.1: **Will the one-way loop around the Village Green also be raised? If so, are there curbs separating the roadway from the adjacent sidewalk and green space?**

Comment 4.2: **What is the design speed of the raised intersections?**

Comment 4.3: **Will there be a posted speed limit on internal project roadways? Based on the pedestrian orientation of the internal streets, a maximum of 20 mph should be considered.**

Comment 4.4: **What is the unit paver material shown at the raised intersections? Will the material be colored and is it porous?**

Comment 4.5: No crosswalks are shown at the two raised intersections on Main Street and the Village Green Loop. **Crosswalks should be included to encourage pedestrian crossing at designated locations.**

4.2 SIDEWALKS AND PARKS

Sidewalks are shown on both sides of internal roadways for most locations and will provide an effective pedestrian circulation system.

Comment 4.6: **Ensure that the design of the sidewalks along Main Street include a furniture zone flexible enough to incorporate plentiful bike racks that provide convenient access to the retail businesses. Additionally, a significant portion of the bike racks designated for the Mobility Hub should be covered so that bus shuttle users can leave their bicycles out of inclement weather for the duration of a workday.**

Comment 4.7: **Will the Village Green, parks, and playground be accessible by the public?**

Comment 4.8: The drawings seem to indicate that the only entry to the retail space in Building 2 is from Main Street**. Enlivening Needham Street with an entry to the east would help to make a more pedestrian friendly environment.**

4.3 MULTI-USE PATH

The site plans show a "shared use bike path" between Needham Street and the Upper Falls Greenway, via the north side of Charlemont Street, the east side of Tower Road, and north of Building 9. The plans show the shared use bike path to be eight feet wide.

Comment 4.9: **The shared use bike path should be a minimum of 11 feet wide (Newton Street Design Guide), preferably 12 feet, to accommodate two-direction travel for pedestrians and bicyclists. To provide the additional width, it may be prudent to shift 2 feet of width from the Charlemont Street south sidewalk to the north sidewalk/bike path. Because this entails moving Charlemont's centerline 2 feet to the south, impact to the Needham Street/ Charlemont Street intersection geometry will need to be considered.**

Comment 4.10: **A more visible and intuitive connection is needed from the shared use bike path to Main Street and the Village Green. The most logical route is Tower Road. While a designated bike lane is unlikely to be necessary—due to low traffic volumes—an enhanced link should be made at the northeast corner of the Charlemont Street/Tower Road intersection. This can be achieved with a wide, bike friendly curb cut, potential pavement markings and/or additional signage at this corner.**

Comment 4.11: **A turning radius is needed at the north end of the share use bike path, just east of where the path turns to cross Tower Road. Though very close to the adjacent sidewalk, a minimum 10-foot inner radius is needed to accommodate bicyclists with trailers or on tandem bicycles. The nearby bikeway crossing should include green pavement marking to distinguish it from the adjacent Tower Road crosswalk (see *Newton Street Design Guide*, 5.1.3 Bicycle Crossing Design, p. 49).**

Comment 4.12: **Due to the two-way bicycle crossing of the bikeway at Needham Street, a bicycle signal with its own distinct phase will need to be part of the Needham Street/Charlemont Street intersection and signal design.**

The Northland Newton Development *Traffic Impact and Access Study* shows a multi-use path between Charlemont Street and Christina Street, which would provide a pedestrian and bicycle connection to the former rail bridge (now used by pedestrians) over the Charles River to the existing path in Needham. It is understood that Northland Newton Development has acquired the Stark Building at 55 Christina Street that will enable this connection on private property.

The proposed multi-use path will provide a beneficial connection for pedestrians and bicycles between the Upper Falls Greenway and the Charles River Bridge into Needham. The proposed facility will be located on a combination of private property and lower-volume public roadways**.**

Comment 4.13: The old rail bridge over the Charles River south of Christina Street is currently gated, but not locked. The bridge deck is in poor condition. **Please provide information on**

the ownership and condition of the bridge and Northland Newton Development's ability to acquire an easement over the bridge and make improvements if needed.

Comment 4.14: **A crosswalk should be provided where the proposed multi-use path would cross Christina Street. It appears there is limited site distance at this location due to a curve in the road. Identify the required stopping sight distance at this location and indicate if enhancements such as an RRFB or other devices would be required to improve motorist awareness of the crossing. Indicate if Northland Newton Development would provide a new crosswalk and safety enhancements as needed.**

Comment 4.15: The area behind the Stark Building at 55 Christina Street includes a paved walkway with wooden guardrail between the Stark parking lot and a rear entrance of the building. **This walkway would need to be modified to 1) provide at least 10 feet of width for bicycle and pedestrian travel and 2) provide a connection to the old rail alignment between the walkway and Christina Street. Please indicate Northland Newton Development's commitment to provide these improvements.**

4.4 Reconstruction Plans for Needham Street/Winchester Street

MassDOT's current design plans for the reconstruction of Needham Street/Winchester Street (Project No. 606635) is a missed opportunity to improve bicycle connectivity from the Northland Newton Development site and Upper Falls Greenway to the Newton Highlands MBTA station.

Comment 4.16: **Suggested changes to MassDOT's plans—from the Needham Street/Easy Street intersection to the Winchester Street/Route 9 Westbound on-ramp—include:**

- Additional signage and Shared Lane Markings (SLMs) on Easy Street between Needham Street and the Greenway in order to further brand the street as part of the Upper Falls Greenway route
- Narrow all 11-foot wide travel and turn lanes along Winchester Street to 10'-6" and widen the west sidewalk an additional 18"-24" in order to designate it as an extension of the Upper Falls Greenway (10-12-foot wide share use path, with discrete 8'-wide segments, as needed)
- Consider shifting 1-2 feet of width from Winchester Street's east sidewalk to the west sidewalk in order to maintain the 10-12 foot wide extension of the Upper Falls Greenway
- Reduce the length of the southbound right turn lane from Winchester Street to Needham Street to minimize the length of the 8-foot wide path/sidewalk pinch point
- Delineate the crossing of Curtis Street with a raised crosswalk
- Narrow the 11-foot wide travel lanes to 10'-6" on Winchester Street between the Rt. 9 on- and off-ramps in order to widen the west sidewalk by 2'-0"

- Extend the west sidewalk along Route 9 westbound on-ramp from Winchester Street to the Floral Street intersection (will likely require a small retaining wall)

- Though beyond the Scope of the MassDOT project, additional improvements are needed to enhance the connection from the Winchester Street/Rt. 9 on-ramp to the Newton Highlands MBTA station including:

  - Northbound contra-flow bike lane along the east curb of Floral Street from the Rt. 9 on-ramp to Walnut Street

  - Striped bike lanes on Walnut Street from Floral Street to Lincoln Street, at minimum (requires either relocation of existing taxi stand on the Walnut Street bridge to accommodate the bike lanes or shared lane markings in the adjacent through lane)

It is recognized that the suggestions above are unlikely to be made by MassDOT as part of their planned improvements along Needham and Winchester Streets (Project No. 606635). **The Applicant should investigate if it is feasible to extend the Upper Falls Greenway along the former rail right of way to the northeast to intersect with Winchester Street via Curtis Street.**

4.5 Miscellaneous Additional Comments

The project proponent is proposing to upgrade all curb ramps, provide detectable warning strips and crosswalk markings to ADA standards at Chestnut Street/Route 9 WB Service Road; Chestnut Street/ Route 9 EB Service Road and Chestnut Street/Elliot Street. **We agree that these proposed measures will help improve pedestrian mobility and safety.** Other miscellaneous comments include:

Comment 4.17: The intersection of Chestnut Street/Elliot Street has old pedestrian and traffic equipment and signal heads. **The Applicant should consider upgrading both the traffic and pedestrian signal equipment including countdown signal heads.**

Comment 4.18: Generally, the two designated bike share drop spots are in the most-logical locations within the proposed development. **The Mobility Hub drop spot would be more easily accessible to/from the shared use bike path if relocated to the opposite side of Unnamed Road however.** Though a few steps further from the shuttle service pick-up/drop-off locations, its proximity to the Charlemont Street crosswalk will provide more seamless access to the path. Avoiding the need for bike share users to cross the Unnamed Road crosswalk will also minimize the conflicts between bike share users and shuttle buses turning right onto Charlemont Street.

Comment 4.19: **Ensure that all shuttle buses have front-mounted racks to carry at least two bicycles. These should be intuitive to use and similar in design to those used on MBTA buses.**

5.0 Internal Circulation and Parking

5.1 Site Access Plan

As proposed, 13 buildings will be provided on the site: the existing mill building and 12 new structures. To provide connectivity and allow motorists to visit more than one use without being required to enter and exit the mainline traffic stream, an internal roadway system is proposed that would provide a connection between Oak Street and Needham Street. The site would be accessed by way of four driveways (a reduction of one full access driveway).

- The existing driveway on Oak Street would be relocated to align with Saco Street approximately 200 feet to the east (away from the Chestnut Street signalized intersection).
- The existing southern driveway on Needham Street would be relocated approximately 100 feet to the north.
- The existing middle driveway on Needham Street would be closed.
- The existing northern driveway on Needham Street would be across from Charlemont Street (with Charlemont Street relocated to the south).
- Access to Tower Road would remain.

Based on the City of Newton Zoning Ordinance (Articles 5.1.8.C.1 and 5.1.8.C.2), the minimum aisle widths for internal roadways providing access to parking stalls should consist of the following:

- One-Way Traffic:
  - With Parallel Parking Stalls = 12 feet
  - With 30-degree parking Stalls = 12 feet
  - With 45-degree Parking Stalls = 14 feet
  - With 60-degree Parking Stalls = 19 feet
  - With 90-degree (parallel) Parking Stalls = 24 feet
- Two-Way Traffic:
  - Minimum = the greater of either 20 feet or the required width for one-way traffic

Upon preliminary review of the site plans, the proposed internal aisle widths conform to the City's requirements. **No response is required.**

Comment 5.1: **The Applicant should indicate if site roadways will be privately owned and maintained.**

Comment 5.2: Based on a review of the site plans (Sheet A-7.01), the Needham Street south site driveway is shown as a shared through/right-turn lane instead of a shared left-

turn/right-turn lane. **Due to the heavy traffic demands along the Needham Street corridor and the long delays for vehicles attempting to exit the site destined for Needham Street to the north, BETA recommends that the south site driveway be modified to restrict left-turns onto Needham Street.** On-site vehicles can use the north site driveway signalized intersection to complete this maneuver.

Comment 5.3: Based on a review of the site plans and the intersection capacity analyses provided in the *Traffic Impact and Access Study*, vehicle queues are projected to extend westerly along the north site driveway (Charlemont Street Extension) from Needham Street and through the first internal intersection (Unnamed Street) during the Weekday PM and Saturday Midday peak hours. **With Building 7 representing the transportation hub and vehicles estimated to turn right onto the north site driveway headed for Needham Street, BETA recommends that DO NOT BLOCK INTERSECTION pavement markings and signs be implemented at this location.**

Comment 5.4: As shown on the site plans (Sheet C-6.1) and as described in the *Traffic Impact and Access Study*, the proposed Oak Street site driveway would be relocated across from Saco Street to form a four-way signalized intersection. The site plan depicts the site driveway as a two-lane approach with an exclusive left-turn lane and an exclusive right-turn lane. Based on the traffic study, however, this site driveway would be a single lane approach. **If the site driveway would be a two-lane approach, then updated intersection analyses should be provided.** In addition, the traffic study analyzed the proposed Oak Street site driveway as a three-way unsignalized intersection. **The updated intersection analyses should also include Saco Street within this location.**

A one-way counter-clockwise roadway is shown around the Village Green.

Comment 5.5: **A Do Not Enter sign should be installed on the Village Green loop exit at Main Street.**

The internal roadways are shown to be 20 or 22 feet wide with on-street parking in some areas. **The proposed roadway widths appear adequate in terms of encouraging slower vehicular speeds. The proposed four raised intersections will further reduce vehicle speeds.**

Comment 5.6: The site plans show that the raised intersections will be constructed with pavers. **Are the pavers permeable? Will the site roadways be constructed with a porous material?**

Comment 5.7: **Will there be a posted speed limit on internal project roadways?**

Comment 5.8: **The Newton Fire Department should review the proposed plan for emergency vehicle access and circulation. The Applicant should evaluate the potential to provide emergency vehicle access to the project site via Mechanic Street. This would allow a faster response time for Fire Station 7 located at 144 Elliot Street. The Applicant should confirm that all internal turn radii are adequate to accommodate emergency vehicle.**

In accordance with the City of Newton's Rules and Regulations of the Planning Board Acting as a Board Survey (Section V.B.4), the grades of roadways and access points shall be between 0.6% and 12% unless

otherwise permitted by the Planning Board. Upon review of the site plans, the internal roadways and driveways appear to meet this criterion.

The site plans show a separated pull-out for loading and shuttle service and drop-off/pick-up on the east side of the Unnamed Road. There is a bump-out shown on the east side that separates the two areas.

Comment 5.9: **The Applicant should consider removing the bump-out to maximize the curb space available for loading, shuttle service, and drop-off/pick-up. Confirm that the proposed pull-out curb space is adequate to accommodate peak loading/shuttle/drop-off and pick-up volumes.**

5.2 PARKING

5.2.1 CITY'S REQUIREMENTS

As proposed, the development will provide 400,000 square feet of parking structures to support 1,953 parking spaces. A new parking garage would be able to accommodate 1,125 of these spaces. Based on the City of Newton Zoning Ordinance, 3,409 parking spaces are required to support the proposed development. In accordance with Section 5.1.4 (Number of Parking Stalls) of Article 5 (Development Standards), The Northland Newton Development requires the following:

- Residential:
  - Multi-Family Dwelling = 2 spaces/unit
  - Proposed = 822 units
  - Required = 1,644 spaces
- Retail:
  - Bank, Retail Store, and Service Establishment = 1 space/300 square feet PLUS 1 space/every 3 employees during largest shift
  - Proposed = 105,200 square feet and 200 employees
  - Required = 417 spaces
- Restaurant:
  - Restaurant (food or beverage establishment) = 1 space/3 patron seats PLUS 1 space/every 3 employees during largest shift (excludes sidewalk café seating)
  - Proposed = 50,000 square feet, 1,595 seats, and 148 employees
  - Required = 581 spaces
- Medical Office:
  - Medical Office (not on or abutting hospital property) = 1 space/200 square feet PLUS 1 space/every 3 employees in any lab or pharmacy in building
  - Proposed = 10,000 square feet, no lab, and no pharmacy

- Required = 50 spaces

- Health Club:
  - Health Club (similar establishment) = 1 space/150 square feet PLUS 1 space/every 3 employees during largest shift
  - Proposed = 20,000 square feet and 24 employees
  - Required = 142 spaces

- Office:
  - Office (professional building) = 1 space/250 square feet up to 20,000 square feet, or 1 space/333 square feet over 20,000 square feet
  - Proposed = 180,000 square feet
  - Required = 560 spaces

- Community:
  - Personal Service and Post Office = 1 space/300 square feet PLUS 1 space/every 3 employees during largest shift
  - Proposed = 4,000 square feet and 3 employees
  - Required = 15 spaces

- **TOTAL 3,409 Spaces**

5.2.2 Shared Parking Spaces

For mixed-use developments, a motorist can park the vehicle once and then may be able to visit more than one of the land uses within that property when two or more land uses are within walking distance. In order to account for this event, ITE guidelines suggest that the internal trip credit be applied to the required parking generation for each of the land uses. In addition and as supported in the ITE Trip Generation Handbook, "The hourly variation in parking demand for the individual land use can result in conditions where the parking demand for one land use is high while the demand for a different land use is low. In this situation, parking demand for both land uses may be able to use the same parking space at different times of the day. The end result can be a reduction in overall peak parking demand. Parking areas with different peak parking demands for land uses within a mixed-use development can reduce the total number of parking spaces required.

The Urban Land Institute (ULI) prepared guidelines to document shared parking analyses based on recent parking needs of mixed-use developments, the types of tenants and visitors that would be attracted, and the available transportation resources in the area. The intent of the ULI's Shared Parking report is to assist engineers, planners, developers, architects, and governmental agencies find the balance between providing adequate parking in support of a development and minimizing the negative impacts of excessive land areas and resources dedicated to parking.

As provided in Appendix B of The Northland Newton Development *Traffic Impact and Access Study* prepared by VHB and as detailed in the Right-Sized Parking calculations submitted by VHB, the ITE and ULI methodologies were used to determine the parking demands for the proposed mixed-use development and compared the calculations with the required parking spaces per the City of Newton Zoning Ordinance (Section 5.1.4). This evaluation was conducted in compliance with MassDOT guidelines. Based on these procedures, a shared parking assessment was conducted using the internal capture rate developed as part of the trip-generation estimates, a split of parking occupancy patterns of customers/visitors and employees/ residents, and time-of-day factors. This assessment revealed that a parking supply of 1,884 spaces would accommodate the vehicles on the proposed site as compared to the 3,409 required parking spaces per zoning. To provide a conservative approach, the development would provide 69 additional spaces for a total of 1,953 parking spaces.

Comment 5.10: Based on a review of the October 12, 2018 Right-Size Parking calculations provided for The Northland Newton Development, discrepancies were found with the base parking ratios that were used versus the ULI recommended ratios. The following differences were found (assuming a residential parking ratio of 1 space/unit):

- Annual Peak Demand:
  - Presented:
    - Weekday = 2,032 spaces
    - Weekend = 2,043 spaces
  - ULI Ratios:
    - Weekday = 2,411 spaces
    - Weekend = 2,464 spaces
- Seasonal Demand:
  - Presented:
    - Weekday = 2,027 spaces
    - Weekend = 2,032 spaces
  - ULI Ratios:
    - Weekday = 2,406 spaces
    - Weekend = 2,459 spaces
- Peak-Hour Demand:
  - Presented:
    - Weekday = 1,869 spaces (2-3 PM)
    - Weekend = 1,790 spaces (6-7 PM)
  - ULI Ratios:
    - Weekday = 2,149 spaces (1-2 PM)

- Weekend = 2,283 spaces (6-7 PM)

The seasonal parking demand adjusts the annual peak parking demand during peak months for each land use. The peak-hour demand is an hourly representation of the seasonal parking demand for each land use distributed over the course of a day. Therefore, the peak-hour parking demand of the proposed development is 2,149 spaces on a weekday and 2,283 spaces on a weekend. This review revealed that the proposed 1,953 parking spaces would not be able to accommodate the peak hour parking demand of 2,283 parked vehicles. **Therefore, the Applicant should indicate if 2,283 parking spaces are required on-site to meet the demand per ITE and ULI methodologies.**

5.2.3 MBTA and MassDOT Transit Oriented Development Policies and Guidelines

The Northland Newton Development project has incorporated a Transit-Oriented Development (TOD) type approach to developing the site. While the site location is not adjacent to an existing transit station, the Applicant has proposed providing a new shuttle bus system that will transport project residents and employees to and from MBTA Green and commuter rail stations, and Boston and Cambridge. The shuttle buses proposed to serve the nearby MBTA Stations (Newton Highlands, Newton Centre, Newtonville, and Needham Heights) will act as last-mile connections. The Northland Newton Development project has included the four principles of a typical TOD development[6]:

- A level of density to take advantage of transit, in this case shuttle buses
- A mix of uses serving not only the development to make it a community, but to serve as an origin and destination for commuters
- A public realm, including street grid, sidewalks, bike routes, wayfinding, mobility hub, and open space that is attractive, safe and interconnected
- A TOD-friendly approach to parking: lower ratios, shared parking, and location of off-street parking facilities in the interior of the project rather than the front.

The Applicant is proposing to "right-size" the overall project supply by utilizing shared parking supply on-site to reduce the number of parking spaces that would be typically be developed for stand-alone uses on-site. In this way, the proposed project generally follows the policies of the MBTA and MassDOT to "right-size" parking supply in TOD settings.[7]

Comment 5.11: The Applicant is proposing one parking space for each of the 822 residential units. It understood that while project residents may use transit to commute to and from work during the week, they may own a vehicle on-site which would be used during off-peak periods and weekends. This ratio meets the TOD parking guideline for residential land

6 Massachusetts Bay Transportation Authority, Massachusetts Department of Transportation, TOD Policies and Guidelines, DRAFT, revised March 31, 2017.

7 Ibid.

use (0.75-1.5 spaces per unit) provided in the MBTA and MassDOT TOD Policies and Guidelines.[8] Parking ratio guidelines for the other relevant land uses include:

- Office: 1.0-2.5 spaces per 1,000 square feet
- Retail 1.5-3.0 per 1,000 square feet

As presented in Table 2 – Peak Parking demand – Shared Parking, Memorandum from VHB, Inc. to Mr. Barney Heath, Director of Planning, October 12, 2018, it appears that the shared parking demand for the retail, office, restaurant, medical office, and health club components may exceed the parking ratios provided in the MBTA and MassDOT TOD guidelines.[9] **Please provide information on the proposed parking supply ratios for each of the project land use components.**

5.2.4 Comparison of Parking requirements for Other communities

Based on the City's request, BETA conducted a preliminary review of the applicable Zoning By-Laws/Ordinances/Code for off-street parking requirements of seven communities in the metro Boston area. The following communities were reviewed:

1. City of Boston (685,000 population)
2. Town of Brookline (population 60,000)
3. City of Cambridge (110,000)
4. City of Quincy (population 93,000)
5. City of Somerville (population 81,000)
6. Town of Watertown (population 35,000)
7. City of Waltham (population 63,000)

Using the proposed Northland Newton Development building program, parking spaces were calculated for each of the seven survey communities based on their zoning requirements. Table 3 summarizes the estimated parking required for each community. The unadjusted required parking spaces for the project program range between 1,320 spaces for the City of Boston to 3,649 spaces for the City of Waltham. Of the surveyed communities, Waltham is the only one with a higher parking requirement than Newton (3,409 spaces). Accounting for shared parking, the required spaces in Waltham is 2,820 spaces.

Taking an average of the required parking supply for all seven survey communities equals 2,301 spaces. Excluding Waltham, the average required parking supply for six survey communities is 2,077 spaces. This

[8] Ibid., 17

[9] Ibid., 17

average parking figure is approximately six percent higher than the proposed 1,953 parking spaces by Northland Newton Development. Parking calculation details are provided in the Appendix C.

Table 7: Summary of Off-Street Parking Requirements for Other Communities

LAND USES	BUILDING PROGRAM	CITY/TOWN							
		Newton	Quincy	Brookline	Boston	Cambridge	Watertown	Waltham	Somerville
		Number of Parking Spaces Required							
Residential	822 units	1,644	1,028	1,656	575	822	1,006	1,644	1,349
Retail (Bank, Retail Store, and Service Establishment)	105,200 square feet 200 employees	417	263	301	210	210	301	631	248
Restaurant	50,000 square feet 1,595 seats 148 employees	581	125	143	100	160	399	550	455
Medical Office	10,000 square feet, no lab, and no pharmacy	50	25	40	20	25	29	67	25
Office	180,000 square feet	560	450	399	258	225	506	600	360
Health Club	20,000 square feet 24 employees	142	142	142	142	142	50	142	40
Community (Personal Service and Post Office)	4,000 square feet 3 employees	15	15	15	15	15	15	15	15
Shared/Mixed Use	*See Note 1.*								
	TOTAL (Unadjusted)	**3,409**	**2,048**	**2,696**	**1,320**	**1,599**	**2,306**	**3,649**	**2,492**
		Shared/Mixed Use Number of Parking Spaces Allowed							
	TOTAL (Adjusted for shared as applicable)	**1,953 (SP*)**	**2,048**	**SP**	**1,320**	**SP**	**SP**	**2,820**	**SP**

Notes:

1 - Per the City of Newton Zoning Ordinance - In the case of a combination, in a single integrated development, of 3 or more uses listed in the table above, the City Council may grant as special permit, to reduce the sum total of stalls required for each of the uses involved, but in no case may such a reduction exceed 1/3 of such total.

SP = Special Permit is required for reduction of parking spaces.

Source: BETA Group, Inc.

5.2.5 Parking Design and Layout

On-street angle parking is show on the south end of the Village Green loop.

Comment 5.12: **The applicant should consider reverse-angle spaces for this area to reduce conflicts with pedestrians when backing out of the spaces.**

Based on the City of Newton Zoning Ordinance (Articles 5.1.8.B.1 and 5.1.8.B.2), parking stalls must be a minimum of 9 feet wide, and 19 feet deep for angle/perpendicular parking or 21 feet deep for parallel parking.

Comment 5.13: The internal on-street parking spaces are shown to be 21 feet long and 8 feet wide. Off-street surface spaces are 19 feet long and 9 feet wide. **Since the internal on-street parking spaces are shown to be only 8 feet wide, the City's minimum requirements are not met (9 feet).**

Comment 5.14: The on-street parking spaces along Main Street between Buildings 3 and 6 are shown to be 16 feet long for the angle/perpendicular parking. **Since these on-street parking spaces are shown to be only 16 feet deep, the City's minimum requirements are not met (19 feet).**

Comment 5.15: **Any other parking stalls not previously identified as part of this peer review that do not meet the City's requirements should be reconfigured accordingly.**

Comment 5.16: **Indicate where visitors for on-site retail will be directed to park**.

Comment 5.17: **Any compact parking stalls should be identified, counted, and supported with industry standards.**

In accordance with the City of Newton Zoning Ordinance (Article 5.1.8.B.3 and Article 5.1.8.B.4), accessory parking facilities should be incorporated within the site plan. Since the proposed development is proposing over 801 parking stalls, 1% of these spaces (but not less than 16 stalls) must be designated for the physically handicapped. These specially designated stalls must be clearly identified and located nearest to the building's entrance. The handicapped parking stalls must be a minimum of 12 feet wide and 19 feet deep for angle/perpendicular parking or 24 feet deep for parallel parking.

Comment 5.18: **The number and dimensions of the proposed handicapped parking stalls should be provided.**

6.0 Loading and Curbside Activity

As proposed, delivery trucks would service the office, retail, and restaurant uses of the overall development. In accordance with the City of Newton Zoning Ordinance (Article 5.1.12):

- Each required loading bay must not be less than 10 feet wide, 35 feet deep, and 12 feet high.

- The necessary maneuvering space needed must be located entirely within the lot with direct ingress to the intended building.

- Driveways providing access to on-site loading facilities must be no larger than 30 feet in width.

Comment 6.1: **To confirm that the City's Ordinances are being met, truck turning plans should be provided for each of the delivery areas and within the site to ensure that all necessary maneuvering space can be accommodated on-site and would not require traveling onto parking spaces or into vertical obstructions.**

Comment 6.2: **To ensure that the City's Ordinances are being met, dimensions of all loading areas should be provided.**

Comment 6.3: As identified in the Northland Newton Development *Traffic Impact and Access Study*, the existing loading dock for Building 1 along Oak Street will be maintained. Based on a review of the site plans (Sheet C-5.1), however, the existing loading dock would be expanded to accommodate two trucks. **This discrepancy should be clarified and the dimensions of the Oak Street curb cut should be provided.**

Comment 6.4: The study states that on-street spaces would be provided along Unnamed Road to load and unload for Building 2. It appears, however, that direct ingress to Building 2 may not be available. **This issue should be clarified and a designated loading space should be identified.**

Comment 6.5: A loading dock would be provided for Building 3 that would be accessed by way of the Village Green Perimeter Road. **With the Village Green Perimeter Road proposed as a one-way counterclockwise roadway, details should be provided as to how a delivery truck would be able to access the loading area (i.e., turn right in or need to reverse in).**

Comment 6.6: As proposed, delivery trucks would access the loading dock for Building 4 from the surface parking lot off Pettee Lane. **A description and details should be provided as to how delivery trucks would access the loading dock (e.g., enter parking lot via Pettee Lane, circulate in a counterclockwise manner, and back into loading area).**

Comment 6.7: For Building 5, delivery trucks would enter the parking garage from either Pettee Lane or Tower Road to access the loading dock. **A description and details should be provided as to how delivery trucks would access the loading dock within the parking garage.**

Comment 6.8: As proposed, trucks would access the loading dock at Building 6 from the North Site Driveway (Charlemont Street Extension). During times when service and loading trucks are not present, parking would be permitted in front of the loading curb cut. **A description and details should be provided as to how delivery trucks would access the loading dock (e.g., back in from Charlemont Street Extension eastbound/ westbound). In addition, it is recommended that the proposed parking spaces in front of the loading area curb cut be removed to ensure no conflicts would occur.**

Comment 6.9: On-street parking spaces along Unnamed Road would be designated as a loading and shuttle service area for Building 7. With Building 7 proposed to be the transportation hub, it is expected that there will be heavy activity and conflicts in this area along Unnamed Road. **It is recommended that these areas be signed to indicate separate areas and that consideration be given to removing the bump-out area between the loading area and the drop off/pick up area to provide more storage.**

Comment 6.10: For Building 8, the driveway on Needham Street would be maintained for access to the existing loading dock (north of Charlemont Street). **A description and details should be provided as to how delivery trucks would access the loading dock (e.g., back in from Needham Street or back out onto Needham Street).**

Comment 6.11: Service and loading activity for Buildings 9 through 13 are proposed to be conducted within the abutting on-street parking spaces along Pettee Lane. **For Building 13, a description and details should be provided as to how delivery trucks would ingress and egress that parking area access (e.g., enter parking area off Pettee Lane, align parallel to Building 13, and then back out onto Pettee Lane).**

7.0 Transportation Demand Management Strategies

The TIAS summarizes the Travel Demand Management (TDM) program proposed as part of the project. It includes the following major elements.

7.1 Mobility Hub (Located on-site in Building 7)

The Mobility Hub is proposed to be located near an existing MBTA bus stop. The facility is expected to support a wide range of features and amenities including:

- Shuttle bus stop
- Bus shelter
- Indoor TransitScreen
- Comfortable benches and seating with charging stations
- Electronic real-time information displays and static signs

Comment 7.1: **Wi-Fi should also be provided, along with security (e.g., CCTV) appropriate for the operation. The Applicant should define the commitment to staff and maintain the Hub.**

7.2 SHUTTLE SYSTEM

The overall approach to developing shuttle concepts is systematic and uses a set of criteria that includes many of the factors that a rider will consider as they decide whether to use transit. These include[10]:

- Connectivity
- Schedule, including hours of service and headways
- Accessibility

Based on these factors and the survey information, the 128 Business Council developed a system of four proposed routes that are intended to serve commuter trips as well as internal trips. Service hours and headways were developed for each route and rider estimates were developed by route. The operating and service planning expertise of the 128 Business Council was applied to the data to develop a system that would meet a variety of trip purposes (commuter, retail, personal services) in a cost-effective manner.

For the most part, the proposed system could provide the residents and employees of the Northland Newton Development with a range of attractive travel alternatives in lieu of using private vehicles. Each proposed route is discussed in later sections.

The scheduled daily start and end times for the shuttles provides service earlier and later in the day than current MBTA bus schedules; this is likely to make the Cambridge and Boston routes reasonable alternatives for commuting, even though headways are to be set at 60 minutes for these two routes.

The Implementation Plan identified the importance of serving local (i.e., internal) trips that have origins and destinations in the immediate area. This is consistent with the Needham Street Area Vision Plan, which used the 2015 American Community Survey to identify top commuting destinations for area residents (pages 24-25). By addressing local trips and providing shared-ride alternatives, the shuttle system can be expected to reduce the impact of the development on the local road network.

However, several questions remain to be addressed:

Comment 7.2: **Fare structure: to assess the long-term feasibility of the service and its ability to attract and sustain ridership, starting assumptions need to be made regarding the fare and costs. These include:**

- **What is the base fare; will it vary by peak/off-peak; by distance; by week day/weekend; by resident/non-resident?**
- **Will there be discounts, monthly passes, etc.**
- **Transit services almost always require a subsidy; what is the source of the subsidy and what is the commitment to continuing the subsidy?**

[10] Cost to the rider (i.e., fare) is also a key factor.

- **Related to the previous item, is there a target fare recovery ratio?**

- **Capital costs for the fleet will be substantial (and discussed in a following section); what is the commitment to acquiring/leasing the fleet?**

Comment 7.3: Service phasing: A new service requires time to mature and demonstrate its effectiveness. The Implementation Plan is correct that the shuttle system will need to be adjusted in response to actual ridership and ability to adhere to schedules and headways. **Questions include:**

- **How will service development be coordinated/phased with development and occupancy of the site?**

- **What are the metrics that Newton will use to monitor the shuttle system and determine whether it is meeting trip reduction goals?**

- **What is the consultation process between Northland Newton Development and the City of Newton to discuss changes to the system and fare structure?**

Comment 7.4: Emergency Ride Home: This is an important feature of the Implementation Plan; it provides shuttle system users with the assurance that in the event of personal illness or family emergency they will have access to transportation. Although the program may not be extensively used, it provides a critical level of confidence to transit and TDM users. **What is the long-term commitment to the program and how will the service be funded?**

Comment 7.5: Connectivity and Schedules: An important feature of the shuttle system is connectivity to MBTA services, particularly commuter rail and the Green Line. The shuttle system will need to be flexible in order to respond to MBTA service delays. The 128 Business Council has an active dispatch capability that can adjust operations in response to MBTA system delays. **Will this system be used for the project shuttles?**

Comment 7.6: **Passenger surveys: To align the schedules and routes with demand, regular passenger surveys should be conducted to refine the service; this may result in revisions to the existing service or identification of new destinations.**

7.2.1 Proposed Shuttle System – Newton Circulator

- Potential rides: 18,410 weekly
- Proposed service: 5:15 AM to 1 AM weekdays; 6:15 AM to 1:00 AM weekends
- Frequency: 30-45 minutes peak; 45 minutes off-peak and weekends
- 2 vehicles in rotation

Locations: Newton Highlands; Newton Centre; and Newtonville

Comment 7.7: This route provides several connections to MBTA service, including the Green Line and Worcester-Framingham commuter rail. Accessibility for those with physical disabilities is a challenge at the Highlands stop and at Newtonville. This route may also serve local personal and shopping trips. **A 45-minute service offers only a moderate level of service. For a route that will serve multiple trip purposes, 30-minute service is recommended.**

7.2.2 Proposed Shuttle System - Needham Commuter

- Potential rides: 3,680 weekly
- Proposed service: 5:45 AM to 10:30 AM; 4:30 PM to 8:30 PM
- Frequency: 30-45 minutes variable to accommodate commuter rail schedule
- 1 vehicle in rotation

Comment 7.8: **The schedule and frequency should pivot off of the commuter rail schedule; although there is a gap in mid-day rail service. The Emergency Ride Home program can serve as an on-demand alternative for those who have a valid need to return from Boston midday.**

7.2.3 Proposed Shuttle System - Cambridge Express

- Potential weekly rides: 8,288 weekly
- Proposed service: 5:45 AM to 12:45 AM, Monday-Sunday
- Frequency: 60 minutes
- 2 vehicles in rotation

Comment 7.9: The Kendall Square area is an important regional employment center for technology and research. As such, this service is likely to be attractive to many residents. One challenge will be maintaining headways, since the shuttles will use a road network that is congested during peak periods. **The 60-minute service is not likely to offer a competitive service. The proposed shuttle would also provide a similar level of service on weekends. One revision to consider would be to curtail weekend service and re-deploy bus hours to weekday service at 30-minute headways. A cover bus should also be available in order to maintain service headways.**

7.2.4 Proposed Shuttle System - Boston Express

- Service details are equivalent to the Cambridge Express

Comment 7.10: This has the potential to be a heavily used route; the rapid increase in jobs and housing in the Seaport district makes this an attractive destination. The route would also provide connections to the MBTA at South Station, including the Red and Silver Lines. **Again, road congestion will be a challenge and it may be necessary to have a cover bus to maintain headways, even at 60 minutes.**

7.2.5 Estimated Ridership

It appears the method used by the 128 Business Council to estimate ridership relied on the capacity of the proposed shuttle system, rather than a building an estimate from survey data and ridership at comparable developments. Limited data (from the survey) were available to support the ridership estimates.

The 128 Business Council Implementation Plan (page 56) presents a summary of peak trip capacity (3,458) and a peak weekday trip ridership goal (2,281).

Comment 7.11: The Traffic Impact and Access Study presents trip generation estimates; Table 7 on page 52 indicates peak trips (weekday morning + weekday evening) of 363 transit trips. **The Applicant's transportation planning team should coordinate their transit trip and shuttle ridership estimates and present a unified estimate of ridership and expected future mode share.**

Comment 7.12: There needs to be a thorough discussion and assessment of TNC impact on shuttle bus ridership. Several studies have recently documented the effect of TNC on transit use.[11] TNCs compete mainly with public transportation, walking, and biking, drawing customers from these non-auto modes based on speed of travel, convenience, and comfort.

7.2.6 Build Condition Mode Share

The Traffic Impact and Access Study presents mode share under two build conditions: i) Existing Mode Share and ii) "robust" shuttle service. (See Table 8 below)

Table 8: Project Build Condition: Comparison of Existing Mode Share [a] vs Robust Mode Share [b]

Land Use	Private Vehicle		Transit		Walk/Bike	
	Existing	***Robust***	Existing	***Robust***	Existing	***Robust***
Residential	82%	***60%***	13%	***30%***	5%	***10%***
Office	88%	***60%***	7%	***30%***	5 %	***10%***

Notes: a) Based on 2010 US Census Journey-to-Work; b) based on strong use of the shuttle system

Under the "robust" shuttle build condition, transit mode share is forecast to be more than twice what would be expected under the existing mode share. **While the "robust" shuttle can contribute to an increase in transit mode share, an increase of this magnitude is unlikely.**

The "robust" mode shares are unlikely to be achieved without a long-term commitment to frequent service and a low-fare. For example, 45-minute and 60-minute headways as proposed on several of the routes are unlikely to provide an attractive level of customer service.

[11] "The New Automobility: Lyft, Uber and the Future of American Cities", Schaller Consulting, July 25, 2018

Comment 7.13: **A better assessment of possible change in mode share under the "robust" system could be accomplished with:**

- **More information on the fare structure**
- **Details on the long-term commitment by Northland Newton Development to support the capital and operating costs of the shuttle service**
- **Examples of transit mode share from other similar mixed-use developments with shuttle service**

7.2.7 Fleet and O & M Cost Estimates

The Implementation Plan presents a variety of vehicle types for the shuttle fleet; the Turtle Top "Terra Transit" Ford F550 V10 is proposed for the Northland Newton Development system. The total cost for the fleet is an estimated $1.75 million. Weekly operating costs are estimated at approximately $67,000. (See Table 9)

Table 9: Fleet and O & M Estimates

Route	# Vehicles in in rotation	Fleet cost [a]	Weekly bus hours (unscaled)	Weekly operating cost [b]
Newton Circulator	2	$500,000	181.25	$16,313
Needham Commuter	1	$250,000	43.75	$3,938
Cambridge Express	2	$500,000	257.25	$23,153
Boston Express	2	$500,000	257.25	$17,640
Totals	**7**	**$1.75 M**	**739.5**	**$66,555**

Notes: a) Assumes a Ford F550 v10 Terra Transit @ $250,000 per bus. b) $90/hour.

Source for fleet and operating costs: 128 Business Council

Comment 7.14: **Alternative fuel vehicles should be considered; options include CNG and hybrid diesel-electric; all electric may become available in the future. Vehicles should meet ADA requirements and include bike racks and Wi-Fi service.**

7.2.8 Shuttle Bus System Conclusion

The Implementation Plan presents a reasonable initial proposal for a comprehensive shuttle bus system. The system would serve key destinations, both local (Newton and Needham) and non-local (employment centers in Boston and Cambridge), and do so with a fleet that would be equipped with important passenger amenities. The plan appropriately acknowledges that the service may be scaled and adjusted as development occurs and ridership evolves.

While MBTA bus routes 52 and 59 have adequate capacity to accommodate additional trips from this development, it is unlikely that the travel times offered would be sufficient to substantially increase the

development's mode share. The shuttle system can serve as an important companion service that complements the MBTA and expands options for residents and employees. As an added benefit, the shuttle service will also be available to the general public.

Nonetheless, as noted in the above sections, the ability to achieve the transit mode share projection of 30% and the commitment to long-term financial support are critical unknowns. Moreover, it was not possible to reconcile the transit/ridership estimates prepared by the applicant's consultants.

The following conditions of approval should be considered:

Comment 7.15: **Ridership, Route Planning and Mode Share:**

- **VHB and the 128 Business Council should prepare an addendum that presents a coordinated and internally consistent estimate of transit trips and ridership.**
- **Consider a route to serve the I-95/Route 128 corridor: develop ridership estimates and service characteristics for this route.**
- **Provide detailed supplemental documentation and calculations on the feasibility of achieving a 30% transit mode share.**
- **Prepare an analysis of the impact of TNCs on the shuttle system and how pick-up/drop-off activity will be managed. The emergence of TNCs as an alternative to transit should not be overlooked; this may have implications for the ultimate mode share that can be attained by this development.**

Comment 7.16: **Financial:**

- **The shuttle bus system represents substantial capital expenditures and continuing operating costs (Table 4); it is important to confirm the commitment (financial and duration) to the service.**
- **Develop an initial fare structure for the city to review.**
- **Develop a 5-year operating plan that estimates service hours and operating costs for the shuttle and capital costs/lease for the fleet; the operating plan should also identify the costs of maintaining and staffing the Hub, including a budget for the TDM coordinator position.**

Comment 7.17: **Monitoring:**

- **Require regular reporting of mode share and system ridership**.

One approach to the mode share issue would be to set a mode share goal tied to a specified level of build-out. For example, at 300 residential units and 100,000 square feet of office, the mode share goal is X%; at 500 residential units and 180,000 square feet of office, the mode share goal is Y%. In addition, at Build-Out the mode share goal is 30%.

Comment 7.18: If the targets are not met, then additional mitigation is implemented**:**

- **Identify mode share goals and other metrics to be used to evaluate the shuttle operation at 6- and 12-month intervals for at least five years. A starting point for metrics would be the projected ridership summarized on page 56 of the Implementation Plan.**
- **Identify potential mitigation if goals are not met.**

7.3 TRANSPORTATION COORDINATOR

- Promote alternative transportation modes to residents and employees
- Liaison with site employers and MassRIDES
- Ride matching and transportation planning
- Disseminate travel information
- Host transportation events
- Monitor effectiveness of TDM measures
- Complete regulatory reports
- Implement a travel-related website
- Provide "Zip Car" car share
- Provide bike share

Maintain a central commuter information center within the project site.

Comment 7.19: **As part of the monitoring and reporting process, a quarterly summary should be provided to the City of Newton that includes daily shuttle bus ridership by route, revenue and cost information, carpool/vanpool ridership, car share and bike share usage.**

Comment 7.20: **The Transportation Coordinator should conduct an annual transportation survey of residents and employees and report results to the City of Newton.**

7.4 BICYCLE AND PEDESTRIAN AMENITIES

- Pedestrian-friendly layout to encourage walking on-site
- Raised on-site intersections to reduce vehicle speeds
- Bicycle facilities on-site and connections to off-site multi-use trails

- Secured, covered bike storage within each building and bike racks
- Bike Fix-it stations
- Bike-sharing service
- Shared-parking uses

7.5 Additional TDM Measures (TIAS provides full list of measures)

- Sponsored vanpools
- Provide telecommuting or compressed work-week schedules for employees
- Electric car charging stations
- Preferential electric vehicle/low emission car parking in parking garages by providing electric vehicle charging stations
- Paid parking charged directly to employers
- Daily parking fees to provide a daily incentive to use alternative modes
- Parking "cash-out" programs (offer cash equivalent for alternative travel modes versus subsidized parking)
- Charge higher parking prices and shorter period to reduce high turnover in congested portions of the site
- Shared parking spaces for all users, encouraging customers to park once and walk between destinations on-site
- Transportation Network Companies (TNC)

The Transportation Implementation Plan acknowledges that managing TNC operations is critical and proposes to identify designated pick-up/drop-off curb locations. TNCs provide a high level of on-demand service, often at competitive prices. While the TNC pricing structure will continue to evolve, especially as the two major companies (Uber and Lyft) head towards an IPO, TNCs offer a competing and often attractive alternative to shuttle buses, especially for local trips. The popularity of TNCs and their rapid adoption for many trip purposes (commuting, shopping, and leisure) has implications for curb design as well as the feasibility of the shuttle service.

Comment 7.21: **The 128 Business Council and VHB should prepare an addendum that provides a more detailed analysis of TNC operations, both in terms of pick-up and drop-off locations, as well as the relative attractiveness of TNCs compared with shuttle operations.** While the site plan may designate specific curb pick-up and drop-off locations for TNCs, these services use apps that have algorithms that would direct the driver to pick-up at the location from where the ride request is originating. Similarly, drop-off would be at

the location that the rider entered into the app when booking the ride. **The applicant should clarify how this activity can be managed effectively.**

Comment 7.22: The Transportation Implementation Plan 128 indicates that the Northland Newton Development will begin with four shared vehicles for a pilot period of six months. **When will the six month pilot occur: at first phases of project or at project completion? Will they be available to the general public? What if there is low demand during the pilot period, will shared vehicles still be provided on-site? Where will the shared vehicles be located?**

Comment 7.23: **Indicate how many carpool and vanpool spaces will be provided on-site and in what locations.**

Comment 7.24: **Indicate how many EV charging stations are proposed and what locations including preferential parking spaces.**

Comment 7.25: **Explain how paid parking charged directly to employers will work.**

Comment 7.26: **Will visitors have to pay for parking on-site in garage and surface spaces?**

8.0 Consistency with Newton Street Design Guides

The Northland Newton Development was reviewed with respect to the Newton Street Design Guide, June 2018. The project site has been designed to encourage walking and biking and to encourage slow vehicle travel speeds on-site. The project site plan includes many elements outlined in the Newton Street Design Guide. Raised intersections (to slow traffic) have been proposed at four locations. The elements focusing on/or relating to transportation are summarized below. Note that comments covering some of the element topics are provided in other sections of this peer review document. The elements and related comments are provided in this section to show how specific Street Design elements have been incorporated into the proposed Northland Newton Development.

8.1 Sidewalks

- For local streets, sidewalks should be a minimum of 5 feet wide. For village centers, sidewalks should be at least 5 feet wide, with 10 feet recommended.
- For local streets, amenity zones (trees, lights, etc.) are recommended to be at least 2 feet wide. For village centers, the recommended amenity zone is at least 6 feet wide.
- The recommended offset for trees to face of curb is 2 feet minimum. The recommended offset from back of bench, lights, and signs to face of curb is 18".
- The recommended offset for bike racks is 4 feet minimum to face of curb.

The Applicant has developed a pedestrian-friendly network of sidewalks, plazas, shared roadways, and amenities.

Comment 8.1: **Confirm that amenity zones are at least 2 feet wide on-site. The amenity zones around the inside of the Village Green appear to be approximately 2 feet wide. Consideration should be given to widening the amenity zone around the Village Green.**

Comment 8.2: **Confirm that all on-site sidewalks are at least 5 feet wide.**

Comment 8.3: **Confirm that all offset dimensions listed above are met.**

8.2 ROADWAYS

- Travel lane and shoulder widths should be minimized to provide the space to accommodate all roadway users, reduce total impervious surface area, and support the city's established safety goals, including the citywide adoption of a 25 mph statutory speed limit, except where a regulatory speed limit has been established.

- Center lines are required on streets with > 6,000 vehicles per day and >20 foot traveled way per the MUTCD.

- Local streets should be designed for low-speed, shared operations.

- Restrict on-street parking at least 20 feet in advance of pedestrian crossings to provide adequate sight distance.

- Where angled parking is considered, back-in parking is preferable to front-in parking to increase motorist visibility when exiting a parking spot.

- For local streets, the parking lane is recommended to be unmarked.

- For local streets, the recommended curb-to-curb width for a two-way yield street with parking on both sides is 26-28 feet. The maximum travel lane width is 10 feet.

Comment 8.4: **Indicate if posted speed limits are proposed for the on-site roadways.**

Comment 8.5: Roadway center lines on-site are shown on the site plans only at the intersections of Charlemont Street/Needham and Pettee Lane/Oak Street. Charlemont Street, Unnamed Road, and Tower Road are shown to have 22 feet for two travel lanes. The 22 feet proposed for travel lanes may be appropriate for Unnamed Road (moderate to heavy traffic volumes due to drop-offs/picks, and shuttle buses) and Charlemont Street (heavy traffic volumes and width needed for loading). **Center lines should be considered for these roadways. The Applicant should consider narrowing the travel lane width on Tower Road from 22 feet to 20 feet.**

Comment 8.6: **Indicate if the recommended 26-28 foot curb-to-curb width for a two-way yield street is not appropriate for on-site roadways given the lack of driveway spacing and on-street parking utilization that is expected to be above 50 percent during most periods.**

Comment 8.7: The one-way loop roadway around the Village Green is shown to be 20 feet wide. This width appears excessive. **Consideration should be given to providing a 16 or 18-foot wide roadway.**

Comment 8.8: **Confirm that there is no on-street parking at least 20 feet in advance of proposed crosswalks on-site.**

Comment 8.9: **The applicant should consider reverse-angle spaces on the Village Green to reduce conflicts with pedestrians when backing out of the spaces.**

8.3 BIKEWAYS

- The recommended width for a shared use path is 11 feet and the minimum is 8 feet.
- The recommended buffer width between a shared use path and a parking lane or travel lane is at least 3 feet with a minimum of 2 feet.

Comment 8.10: The shared use bike path meets the minimum required width of 8 feet. **The Applicant should consider widening the path to at least 11 feet as recommended in the Newton Street Design Guide, June 2018, to better accommodate two-direction travel for pedestrians and bicyclists.**

Comment 8.11: The shared use bike path has a buffer of at least 4-feet wide on the north side of Charlemont Street that exceeds the recommended 3 foot width. **This is acceptable.**

Comment 8.12: **Confirm that a planned shared use path along Charlemont Street east of Needham Street and connecting with Christina Street will meet standards in the Newton Street Design Guide.**

8.4 TRAFFIC CALMING MEASURES

- Vertical deflection is designed to be traversed at operating speeds between 20-25 MPH.
- A full reveal height of typically 6” should be used for vertical deflection.

Comment 8.13: **What is the design speed of the raised intersections? For this type of setting, a design speed of 20 MPH may be appropriate**.

Comment 8.14: **Will the full reveal height of the raised intersections be 6-inches?**

8.5 INTERSECTIONS AND CROSSINGS

- Standard crosswalk design includes 2-foot wide lines, 2-foot spacing between lines, and 9-foot long lines (Figure 5.1 in Newton Street Design Guide).
- Intersection corner radius should allow 10 MPH turning speeds for passenger cars and 5 MPH for design vehicles.

Comment 8.15: The Site Detail Plan (C-10.1) shows a pedestrian crosswalk detail with 1-foot wide lines, 2-foot spacing between lines, and 8-foot long lines. **All on-site crosswalks should be designed to meet the Newton Street Design Guide standards noted above.**

Comment 8.16: **Intersection corner radius should be designed to meet the Newton Street Design Guide standards noted above.**

9.0 Consistency with Needham Street Vision Plan

The TIAS summarizes the project's consistency with the Needham Street Vision Plan (adopted by the City on August 13, 2018). Many elements and actions of the Vision Plan have been incorporated into the Northland Newton Development design. The elements focusing on/or relating to transportation are summarized below. Note that comments covering some of the element topics are provided in other sections of this peer review document. The elements and related comments are provided in this section to show how specific Vison Plan actions have been incorporated into the proposed Northland Newton Development.

9.1 Increase Climate Resiliency

- Encourage alternate forms of transportation to reduce single-occupant vehicle exhaust.

The Applicant has developed a comprehensive Transportation Demand Management program to reduce single-occupant auto travel. This includes a shuttle bus system, car and bicycle sharing, shared parking and pedestrian and bicycle amenities.

9.2 Improve Health of Existing Open Space and Create Diversity in New Open Space

- Coordinate with MassDOT to add street trees along Needham Street where possible. Require trees on private property along Needham Street in any new development.

- Require new development/redevelopment to incorporate new publicly accessible open spaces in the Needham Street area.

Comment 9.1: **Indicate if the open spaces proposed on-site will be accessible to the public.**

Comment 9.2: The Planting Plan does not show any street trees at Building 1 on both Needham Street and Oak Street. **The Applicant should consider providing street trees in this area to enhance the pedestrian walking environment**.

9.3 Provide Ready Access

- Increase access to those with disabilities through addition of ADA-compliant trails and amenities.

- Place bike racks, benches, and informational, educational, and/or play features along trails.

- Construct trail and open space infrastructure that increases access to the Charles River.

The Applicant has proposed new pedestrian and bicycle connections between the project site and the Upper Falls Greenway and a new connection to the bridge over the Charles River on Christina Street.

Comment 9.3: **In addition to providing new connections on the site to the Greenway, the Applicant should consider providing walking/biking amenities as listed above.**

9.4 Improve Safety and Accessibility

- Manage driving speeds in neighborhoods to be at or below posted speeds limit through roadway design and safety education.
- Incorporate principles of accessibility/universal design in street, sidewalk, and parking lot lighting.
- MassDOT's Needham Street/Highland Avenue Reconstruction Project.

The Applicant has developed the site to promote walking and biking and encourage slow vehicle travel speeds.

Comment 9.4: **The Applicant should consider performing a speed study on the Upper Falls Neighborhood roadways to measure average and 85th percentile vehicles speeds, identify measures, and provide traffic calming devices as needed to improve safety for pedestrians and bicyclists. Roadways should include Chestnut Street between Oak and Elliot Streets; Chestnut Street east of Oak Street; and Linden Street, Ossipee Street, and Mechanic Street.**

9.5 Expand and Enhance Transit Connections along Needham Street

- Join the 128 Business Council.
- Coordinate existing and encourage new publicly accessible fixed-route shuttle services along Needham Street to the Green Line.
- Encourage and/or require use of electric or hybrid shuttles.
- Improve bus stops with bus shelters, benches, real-time information, lighting, etc.
- Institute transit signal priority between Newton Highlands Station and the Needham border to improve reliability of buses and shuttles.

The Applicant is a proposing a new bus shuttle system (four routes) between the site and the Green Line, Commuter Rail, Boston and Cambridge. The Applicant has also committed to joining the 128 Business Council to help develop and operate the proposed TDM measures.

Comment 9.5: **Will the proposed shuttle buses have the ability to make additional stops along the Needham Street corridor? (which will help to reduce auto trip making between destinations).**

Comment 9.6: A short-term action in the Vision Plan is to encourage and/or require use of electric or hybrid shuttle buses. **Will the Applicant provide shuttle buses with electric or hybrid propulsion?**

Comment 9.7: A long-term action in the Vision Plan is to institute transit signal priority (TSP) between the Newton Highlands Station and the Needham border to improve reliability of buses and shuttles. **Will the applicant provide or contribute to providing TSP to improve travel time and reliability for project shuttle buses, MBTA buses, and others?**

9.6 Convert Needham Street from an Isolated to a Connected Roadway

- Encourage public connections between parking lots and require wayfinding signage to guide drivers to those routes.

Comment 9.8: **Indicate if the Applicant will provide wayfinding signage to amenities and visitor parking on-site and to the connections to the Greenway?**

9.7 Manage Transportation Demand in New Development

- Design new development to encourage walking, biking, and transit, including supporting a mix of uses.
- Establish standards for transportation demand management in new development (e.g. subsidies for transit, bike storage).
- Track commute flows and develop transportation management strategies for top destinations.
- Consider parking management strategies and explore options for centralized parking facilities.

The Applicant has developed a comprehensive Transportation Demand Management program. Specific comments for Transportation Demand Management are provided in Section 7.0.

9.8 Prepare for Future Tech: Shared, Electric, Autonomous Vehicles

- Coordinate with existing and emerging shared fleet companies (e.g. Uber/Lyft/Zipcar)
- Require new development to assign space for shared vehicles (e.g. Zipcar)

Comment 9.9: The site plans show residence drop-off/pick-up areas on the Unnamed Road. **Provide information on potential levels of demand for transportation network companies (Uber, Lyft) and if this level of demand can be accommodated in the designated areas without impacting shuttle bus, private drop-off/pick operations, and loading. Indicate if the proposed drop-off/pick-up curb areas can be expanded and/or if additional areas can be provided if required.**

Comment 9.10: The Transportation Implementation Plan recommends that the project begin a car share program with four vehicles for a pilot period of six months. **Provide information on any discussions or arrangements made with car share companies (e.g., ZipCar) as**

to the potential demand on-site and within the Needham Street corridor and the ability to expand the program as demand warrants.

9.9 Big Ideas in Transportation

- Shared transportation services (bike share, shared shopping carts, circulator shuttle).

See Comment 9.5 above.

9.10 Support a Mix of Uses

- Attract employers and support employees by encouraging housing and transportation options as well as amenity uses such as restaurants, retail, and entertainment.

9.11 Increase Support for Small Local Businesses within the Retail Spine

- Allow shared parking and reduce parking minimums to support retailers in encouraging customers to shop at multiple locations on Needham Street.

9.12 Create a Range of Community Gathering Spaces

- Require publicly accessible open space in new large developments and develop set standards for new public open space.

The Applicant is proposing a mixed-use project with housing, employment, retail, and restaurants. Reduced parking ratios are proposed in conjunction with shared parking, shuttle buses, and shared vehicles.

See Comment 9.1 above.

9.13 Utilize Design to Encourage Active Community Life

- Work with businesses to increase transparency at street level.
- Work with property owners to activate the Greenway and its edges with art installations, access to abutting shops, direct entries, public gathering spaces, etc.
- Work with businesses to implement clear wayfinding signage.

The Applicant is providing new connections to the Upper Falls Greenway.

Comment 9.11: **Indicate if pedestrians can enter retail shops and restaurants directly from Needham Street. Also, see Comment 9.1 above.**

9.14 Design Principles

- Design public open space as an extension of the streetscape and maximize comfort and visual access.

- Design sidewalks with active building fronts to enhance the pedestrian experience.

See Comment 9.11 above.

Overall, the Applicant has incorporated many elements of the Needham Street Area Vision Plan 2018 into the Northland Newton Development.

10.0 OTHER COMMENTS

Comment 10.1: On October 6, 2017, The Executive Office of Energy and Environmental Affairs submitted a Certificate of The Secretary of Energy and Environmental Affairs on the Environmental Notification Form for the Needham Street Redevelopment project (EEA #15757). The Certificate states, "I have reviewed the Environmental Notification Form (ENF) and hereby determine that this project requires the preparation of a Mandatory Environmental Impact Report (EIR). The Proponent should submit a Draft EIR (DEIR)…" **The Applicant should provide information on the status of the required DEIR.**

Comment 10.2: As proposed, the Applicant is looking to include a shuttle bus program with direct connections to nearby transit stations and to Cambridge and Boston. The intent of this transportation management technique is to encourage residents, employees, and patrons to use the shuttle service instead of driving to the site. **As such, a monitoring program is recommended to be conducted as the level of success for the shuttle system is unknown. In accordance with MassDOT guidelines, the monitoring program should include, but not limited to, the following:**

- **Monitoring of trip-making and mode share relative to the mode share assumptions and goals in the traffic study (to both the Existing Mode Share and the Robust Shuttle Service).**
- **Verification of infrastructure elements, including transportation system improvements (on-site and off-site), parking accommodations, and on-site amenities, as well as measures of infrastructure utilization.**
- **Incentive- and education-based measures, including measures provided, uptake/participation by on-site residents/employees/patrons, and outcomes of measures implemented.**

If the transportation monitoring program indicates that the shuttle service system is not as effective as evaluated (to both the Existing Mode Share and the Robust Shuttle Service), the Applicant should be held responsible for: (1) identifying and implementing operational improvements at constrained locations, or (2) providing a financial contribution to the City of Newton for improvements. The improvements could involve capacity and mobility measures, traffic signal timing and phasing modifications and further refinement of the transportation management program to reduce vehicle trips to/from the site. The Applicant should submit annual transportation monitoring program reports to the City of Newton on the implementation of the program full project occupancy. Upon review, the City will

provide necessary adjustment recommendations for the Applicant to implement or require the Applicant to conduct appropriate improvement measures.

APPENDIX A

QUEUE ANALYSIS FINDINGS

APPENDIX A

QUEUE ANALYSIS FINDINGS

As defined in the Synchro User Guide, the 50th percentile and 95th percentile maximum queue lengths exceed capacity when the "~" and "#" are shown, respectively, to indicate those conditions when traffic volumes exceed capacity. These queue lengths could be longer with the blocking and spillover problems. Based on a review of the signalized intersection analyses (Tables 16 and 18 and in the Appendix), the following locations are identified with these footnotes:

- Chestnut Street and Elliot Street:
  - 50th Percentile Queues:
    - Elliot Street eastbound approach under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours.
  - 95th Percentile Queues:
    - Elliot Street eastbound approach under 2018 Existing, 2025 No-Build, 2025 Build, and 2025 Build with Mitigation traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
    - Chestnut Street southbound approach under 2018 Existing, 2025 No-Build, 2025 Build, and 2025 Build with Mitigation traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
- Chestnut Street and Oak Street:
  - 95th Percentile Queues:
    - Oak Street northbound approach under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
- Needham Street, Oak Street, and Christina Street:
  - 50th Percentile Queues:
    - Oak Street eastbound shared left-turn/through lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours.
    - Christina Street westbound left-turn lane under 2025 No-Build traffic-volume conditions during the Weekday PM peak hour.
    - Needham Street southbound shared through/right-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday PM and Saturday Midday peak hours.

- 95th Percentile Queues:
  - Oak Street eastbound shared left-turn/through lane under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
  - Christina Street westbound approach under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
  - Christina Street westbound left-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
  - Needham Street northbound left-turn lane under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
  - Needham Street northbound shared through/right-turn lane under 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
  - Needham Street southbound through/right-turn lane under 2018 Existing traffic-volume conditions during the Saturday Midday peak hour, as well as under 2025 No-Build and 2025 Build conditions during the Weekday PM and Saturday Midday peak hours.

- Needham Street, Charlemont Street, and North Site Driveway:
  - 50th Percentile Queue:
    - Needham Street southbound shared through/right-turn lane under 2025 Build traffic-volume conditions during the Saturday Midday peak hour.
  - 95th Percentile Queues:
    - North Site Driveway eastbound left-turn lane under 2025 Build traffic-volume conditions during the Weekday PM and Saturday Midday peak hours.
    - Needham Street northbound shared through/right-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Saturday Midday peak hours, as well as under 2025 Build conditions during the Weekday PM peak hour.
    - Needham Street southbound shared through/right-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.

- Needham Street, Columbia Avenue, and Avalon Driveway:
  - 95th Percentile Queues:
    - Needham Street northbound shared through/right-turn lane under 2025 No-Build during the Saturday Midday peak hour, as well as under 2025 Build conditions during the Weekday PM and Saturday Midday peak hours.
    - Needham Street southbound shared through/right-turn lane under 2025 Build traffic-volume conditions during the Weekday AM peak hour.

- Winchester Street, Needham Street, and Dedham Street:
  - 50th Percentile Queue:
    - Needham Street eastbound left-turn lane under 2018 Existing traffic-volume conditions during the Weekday AM and Saturday Midday peak hours.
    - Needham Street eastbound shared left-turn/through lane under 2018 Existing traffic-volume conditions during the Weekday AM and Saturday Midday peak hours.
    - Dedham Street westbound approach under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday midday peak hours, as well as under 2025 No-Build and 2025 Build conditions during the Weekday PM and Saturday Midday peak hours.
    - Winchester Street northbound approach under 2018 Existing traffic-volume conditions during the Weekday AM and Saturday Midday peak hours.
    - Winchester Street southbound shared left-turn/through lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday PM peak hour.
  - 95th Percentile Queues:
    - Needham Street eastbound left-turn lane under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours, as well as during the 2025 No-Build conditions during the Saturday Midday peak hour and during the 2025 Build conditions during the Weekday PM and Saturday Midday peak hours.
    - Needham Street eastbound shared left-turn/through lane under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
    - Dedham Street westbound approach under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
    - Winchester Street northbound approach under 2018 Existing traffic-volume conditions during the Saturday Midday peak hour.
    - Winchester Street southbound shared left-turn/through lane under 2018 Existing traffic-volume during the Weekday PM and Saturday Midday peak hours, as well as under 2025 No-Build and 2025 Build conditions during the Weekday AM and Weekday PM peak hours.
- Winchester Street and Route 9 Eastbound Service Road:
  - 50th Percentile Queue:
    - Winchester Street northbound through lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours.
  - 95th Percentile Queue:
    - Winchester Street northbound through lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours, as well as under 2025 Build conditions during the Saturday Midday peak hour.

- Winchester Street and Route 9 Westbound Service Road:
  - 50th Percentile Queue:
    - Route 9 service road westbound left-turn lane under 2025 No-Build traffic-volume conditions during the Weekday AM peak hour, as well as under 2025 Build conditions during the Weekday AM and Saturday Midday peak hours.
    - Winchester Street northbound left-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM peak hour.
    - Winchester Street southbound approach under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours, as well as under 2025 Build conditions during the Saturday Midday peak hour.
  - 95th Percentile Queue:
    - Route 9 service road westbound left-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
    - Winchester Street northbound left-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Saturday Midday peak hours.
    - Winchester Street southbound approach under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.

- Centre Street and Walnut Street:
  - 50th Percentile Queue:
    - Centre Street south-westbound approach under 2025 No-Build, 2025 Build, and 2025 Build Mitigated traffic-volume conditions during the Weekday AM and Weekday PM peak hours.
    - Walnut Street south-eastbound right-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours, as well as under 2025 Build Mitigated conditions during the Weekday AM and Weekday PM peak hours.
  - 95th Percentile Queue:
    - Centre Street south-westbound approach under 2018 Existing, 2025 No-Build, 2025 Build, and 2025 Build Mitigated traffic-volume conditions during the Weekday AM and Weekday PM peak hours, as well as under 2025 Build and 2025 Build Mitigated conditions during the Saturday Midday peak hour.
    - Walnut Street south-eastbound right-turn lane under 2018 Existing traffic-volume conditions during the Weekday PM peak hour, as well as under 2025 No-Build, 2025 Build, and 2025 Build Mitigated traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
    - Centre Street north-eastbound left-turn lane under 2025 No-Build, 2025 Build, and 2025 Build Mitigated traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.

        - Walnut Street north-westbound approach under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Saturday Midday peak hour, as well as under 2025 Build Mitigated conditions during the Weekday AM and Saturday Midday peak hours.

- Nahanton Street, Wells Avenue, and JCC Driveway:
    - 50th Percentile Queue:
        - Nahanton Street westbound shared through/right-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday PM peak hour.
    - 95th Percentile Queue:
        - Nahanton Street eastbound through lane under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday PM peak hour.
        - Nahanton Street westbound left-turn lane under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM peak hour.
        - Nahanton Street westbound shared through/right-turn lane under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday PM peak hour.
        - Wells Avenue northbound left-turn lane under 2018 Existing, 2025 No-Build, and 2025 Build traffic-volume conditions during the Weekday PM and Saturday Midday peak hours.

- Highland Avenue, 2nd Avenue, and Staples Driveway:
    - 50th Percentile Queue:
        - Highland Avenue westbound approach under 2025 Build traffic-volume conditions during the Weekday AM and Weekday PM peak hours.
        - 2nd Avenue northbound left-turn lane under 2018 Existing traffic-volume conditions during the Weekday PM peak hour.
        - 2nd Avenue northbound shared left-turn/through lane under 2018 Existing traffic-volume conditions during the Weekday PM peak hour.
        - Staples Driveway southbound shared left-turn/through lane under 2018 Existing traffic-volume conditions during the Weekday PM and Saturday Midday peak hours.
    - 95th Percentile Queue:
        - Highland Avenue westbound approach under 2025 No-Build and 2025 Build traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
        - 2nd Avenue northbound left-turn lane under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.
        - 2nd Avenue northbound shared left-turn/through lane under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.

- Staples Driveway southbound shared left-turn/through lane under 2018 Existing traffic-volume conditions during the Weekday AM, Weekday PM, and Saturday Midday peak hours.

Source: BETA Group, Inc.

APPENDIX B

MITIGATION – IMPACTED INTERSECTION

APPENDIX B

MITIGATION – IMPACTED INTERSECTION

In accordance with MassDOT guidelines, a development would be considered to have an impact at an intersection **if the added site trips result in a degradation in level of service**. In addition, MassDOT guidelines state that a development may be considered to have a significant **impact if post-development trips result in a delay of 10 seconds or more** even if there is no degradation in level of service. Based on a review of the 2025 No-Build, 2025 Build with Existing Mode Share, and 2025 Build with Robust Shuttle Service intersection operational results (shown in Tables 16-18 and in the Appendix), the following off-site study area intersections were noted to satisfy these MassDOT criteria and thus are required to assess options to mitigate those impacts.

- **Chestnut Street and Route 9 Westbound Service Road:**
  - Weekday PM Peak Hour:
    - Chestnut Street southbound approach:
      - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 24 seconds
      - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 23 seconds
  - Saturday Midday Peak Hour:
    - Route 9 westbound service road eastbound approach:
      - 2025 Build with Existing Mode Share: LOS A to LOS B
    - Chestnut Street southbound approach:
      - 2025 Build with Existing Mode Share: LOS C to LOS D
- **Chestnut Street and Route 9 Eastbound Service Road:**
  - Weekday AM Peak Hour:
    - Chestnut Street northbound approach:
      - 2025 Build with Existing Mode Share: LOS D to LOS E
  - Saturday Midday Peak Hour:
    - Chestnut Street northbound approach:
      - 2025 Build with Existing Mode Share: LOS C to LOS D
      - 2025 Build with Robust Shuttle Service: LOS C to LOS D
- **Chestnut Street and Elliot Street (No-Build and Build with Mitigation):**
  - Weekday AM Peak Hour:
    - Chestnut Street northbound approach:
      - 2025 Build with Existing Mode Share: LOS C to LOS C, delay increase = 14 seconds

        - Chestnut Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 17 seconds
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D, delay increase = 17 seconds
    - Weekday PM Peak Hour:
        - Chestnut Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 14 seconds
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D, delay increase = 14 seconds
        - Elliot Street eastbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 48 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 48 seconds
        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 11 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 10 seconds
    - Saturday Midday Peak Hour:
        - Elliott Street westbound approach:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
            - 2025 Build with Robust Shuttle Service: LOS B to LOS C

- **Chestnut Street and Oak Street:**
    - Weekday PM Peak Hour:
        - Oak Street northbound approach:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
            - 2025 Build with Robust Shuttle Service: LOS B to LOS C

- **Needham Street, Oak Street, and Christina Street:**
    - Weekday AM Peak Hour:
        - Oak Street eastbound left-turn/through lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 21 seconds
    - Weekday PM Peak Hour:
        - Oak Street eastbound right-turn lane:
            - 2025 Build with Existing Mode Share: LOS B to LOS B, delay increase = 10 seconds
        - Needham Street northbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 17 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 13 seconds

        - Needham Street southbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 10 seconds
        - Needham Street southbound through/right-turn lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 18 seconds
    - Saturday Midday Peak Hour:
        - 2025 Build with Existing Mode Share:
        - Oak Street eastbound left-turn/through lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 42 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 41 seconds
        - Christina Street westbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 11 seconds
        - Needham Street northbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS C to LOS D
        - Needham Street northbound through/right-turn lane:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
        - Needham Street southbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
        - Needham Street southbound through/right-turn lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 31 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 30 seconds
        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 17 seconds
            - 2025 Build with Robust Shuttle Service: LOS E to LOS F, delay increase = 16 seconds

- **Needham Street and South Site Driveway:**
    - Saturday Midday Peak Hour:
        - Site Driveway eastbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 116 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 102 seconds

- **Needham Street, Tower Road, and Industrial Place:**
    - Weekday AM Peak Hour:
        - Tower Road eastbound approach:
            - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 126 seconds
            - 2025 Build with Robust Shuttle Service: LOS E to LOS F, delay increase = 82 seconds

- Weekday PM:
  - Tower Road eastbound approach and Industrial Place westbound approach:
    - 2025 Build with Existing Mode Share: experience capacity constraints under both No-Build and Build conditions, such that delay values exceed 300 seconds.
    - 2025 Build with Robust Shuttle Service: experience capacity constraints under both No-Build and Build conditions, such that delay values exceed 300 seconds.
- Saturday Midday Peak Hours:
  - Tower Road eastbound approach and Industrial Place westbound approach:
    - 2025 Build with Existing Mode Share: experience capacity constraints under both No-Build and Build conditions, such that delay values exceed 300 seconds.
    - 2025 Build with Robust Shuttle Service: experience capacity constraints under both No-Build and Build conditions, such that delay values exceed 300 seconds.

- **Needham Street and Jaconnet Street:**
  - Weekday PM Peak Hour:
    - Jaconnet Street westbound approach:
      - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 104 seconds
      - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 83 seconds
  - Saturday Midday Peak Hour:
    - Jaconnet Street westbound approach:
      - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 80 seconds
      - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 66 seconds

- **Needham Street and Rockland Street:**
  - Weekday AM Peak Hour:
    - Rockland Street westbound approach:
      - 2025 Build with Existing Mode Share: LOS D to LOS E
      - 2025 Build with Robust Shuttle Service: LOS D to LOS E
  - Weekday PM Peak Hour:
    - Rockland Street westbound approach:
      - 2025 Build with Existing Mode Share: LOS D to LOS E
      - 2025 Build with Robust Shuttle Service: LOS D to LOS E
  - Saturday Midday Peak Hour:
    - Rockland Street westbound approach:
      - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 35 seconds

        - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 32 seconds

- **Needham Street, Columbia Avenue, and Avalon Driveway:**
    - Saturday Midday Peak Hour:
        - Needham Street northbound through/right-turn lane:
            - 2025 Build with Existing Mode Share: LOS A to LOS B

- **Winchester Street, Needham Street, and Dedham Street:**
    - Weekday AM Peak Hour:
        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS C to LOS D
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D
    - Weekday PM Peak Hour:
        - Dedham Street westbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E
        - Winchester Street southbound left-turn/through lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 19 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 14 seconds
    - Saturday Midday Peak Hour:
        - Needham Street eastbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS C to LOS D
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D
        - Dedham Street westbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 11 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 11 seconds

- **Winchester Street and Route 9 Eastbound Service Road:**
    - Weekday AM Peak Hour:
        - Winchester Street northbound through lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 14 seconds
    - Weekday PM Peak Hour:
        - Winchester Street northbound through lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 30 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 23 seconds

        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 13 seconds
            - 2025 Build with Robust Shuttle Service: LOS E to LOS E, delay increase = 10 seconds
    - Saturday Midday Peak Hour:
        - Route 9 eastbound service road eastbound right-turn lane:
            - 2025 Build with Existing Mode Share: LOS A to LOS B
            - 2025 Build with Robust Shuttle Service: LOS A to LOS B
        - Winchester Street northbound through lane:
            - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 18 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 15 seconds
        - Winchester Street northbound right-turn lane:
            - 2025 Build with Existing Mode Share: LOS A to LOS B
        - Winchester Street southbound through lane:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 29 seconds
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D, delay increase = 26 seconds
        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 17 seconds
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D, delay increase = 14 seconds

- **Winchester Street and Route 9 Westbound Service Road:**
    - Weekday AM Peak Hour:
        - Winchester Street northbound through lane:
            - 2025 Build with Existing Mode Share: LOS D to LOS D, delay increase = 14 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS D, delay increase = 11 seconds
        - Winchester Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 13 seconds
        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 10 seconds
    - Weekday PM Peak Hour:
        - Route 9 westbound service road westbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 48 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 48 seconds
        - Winchester Street northbound through lane:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 26 seconds

        - 2025 Build with Robust Shuttle Service: LOS C to LOS D, delay increase = 20 seconds
    - Winchester Street southbound approach:
        - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 32 seconds
        - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 30 seconds
    - Overall Intersection:
        - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 28 seconds
        - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 24 seconds

- **Centre Street and Walnut Street (No-Build and Build with Mitigation):**
    - Weekday AM Peak Hour:
        - Walnut Street south-eastbound right-turn lane:
            - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 19 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 19 seconds
        - Walnut Street north-westbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E
    - Weekday PM Peak Hour:
        - Walnut Street south-eastbound right-turn lane:
            - 2025 Build with Existing Mode Share: LOS E to LOS E, delay increase = 12 seconds
            - 2025 Build with Robust Shuttle Service: LOS E to LOS E, delay increase = 12 seconds
        - Walnut Street north-westbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E
    - Saturday Midday Peak Hour:
        - Centre Street north-eastbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
            - 2025 Build with Robust Shuttle Service: LOS B to LOS C

- **Nahanton Street and Winchester Street:**
    - Saturday Midday Peak Hour:
        - Nahanton Street westbound left-turn lane:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
            - 2025 Build with Robust Shuttle Service: LOS B to LOS C

- **Nahanton Street, Wells Avenue, and JCC Driveway:**
  - Weekday PM Peak Hour:
    - Nahanton Street eastbound through lane:
      - 2025 Build with Existing Mode Share: LOS D to LOS E
      - 2025 Build with Robust Shuttle Service: LOS D to LOS E
- **Highland Avenue and Riverside Street:**
  - Weekday AM Peak Hour:
    - Rockland Street north-westbound approach:
      - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 23 seconds
      - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 11 seconds
  - Weekday PM Peak Hour:
    - Rockland Street north-westbound approach:
      - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 15 seconds
      - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 11 seconds
    - Highland Avenue south-westbound left turns:
      - 2025 Build with Existing Mode Share: LOS A to LOS B
  - Saturday Midday Peak Hour:
    - Rockland Street north-westbound approach:
      - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 35 seconds
      - 2025 Build with Robust Shuttle Service: LOS E to LOS E, delay increase = 12 seconds
- **Highland Avenue, Highland Terrace, and Highland Circle:**
  - Weekday PM Peak Hour:
    - Highland Terrace north-westbound approach:
      - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 14 seconds
      - 2025 Build with Robust Shuttle Service: LOS E to LOS F, delay increase = 10 seconds
    - Highland Circle south-eastbound left turns:
      - 2025 Build with Existing Mode Share: LOS D to LOS E
  - Saturday Midday Peak Hour:
    - Highland Avenue north-eastbound left turns:
      - 2025 Build with Existing Mode Share: LOS A to LOS B
    - Highland Terrace south-westbound left-turn lane:
      - 2025 Build with Existing Mode Share: LOS A to LOS B
      - 2025 Build with Robust Shuttle Service: LOS A to LOS B

        - Highland Terrace north-westbound approach:
            - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 17 seconds
            - 2025 Build with Robust Shuttle Service: LOS E to LOS F, delay increase = 14 seconds
        - Highland Circle south-eastbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E

- **Highland Avenue, 2nd Avenue, and Staples Driveway:**
    - Weekday AM Peak Hour:
        - Highland Avenue westbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 20 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS D, delay increase = 14 seconds
    - Weekday PM Peak Hour:
        - Highland Avenue westbound approach:
            - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 26 seconds
            - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 17 seconds
        - Overall Intersection:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 11 seconds
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D
    - Saturday Midday Peak Hour:
        - Highland Avenue westbound approach:
            - 2025 Build with Existing Mode Share: LOS C to LOS D, delay increase = 13 seconds
            - 2025 Build with Robust Shuttle Service: LOS C to LOS D
- **Highland Avenue and Charles Street:**
    - Weekday AM Peak Hour:
        - Highland Avenue eastbound left turns:
            - 2025 Build with Existing Mode Share: LOS A to LOS B
    - Weekday PM Peak Hour:
        - Charles Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 25 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 17 seconds
    - Saturday Midday Peak Hour:
        - Charles Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS E to LOS F, delay increase = 34 seconds

        - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 26 seconds

- **Highland Avenue and Wexford Street:**
    - Weekday AM Peak Hour:
        - Wexford Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 28 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 17 seconds
    - Weekday PM Peak Hour:
        - Highland Avenue eastbound left turns:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
            - 2025 Build with Robust Shuttle Service: LOS B to LOS C
        - Wexford Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase ≥78 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase = 61 seconds
    - Saturday Midday Peak Hour:
        - Wexford Street southbound approach:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase = 104 seconds
            - 2025 Build with Robust Shuttle Service: LOS F to LOS F, delay increase =96 seconds

- **Highland Avenue and I-95 Northbound Ramps:**
    - Weekday AM Peak Hour:
        - I-95 off-ramp northbound right turns:
            - 2025 Build with Existing Mode Share: LOS F to LOS F, delay increase ≥183 seconds
    - Saturday Midday Peak Hour:
        - I-95 off-ramp northbound right turns:
            - 2025 Build with Existing Mode Share: LOS B to LOS C
            - 2025 Build with Robust Shuttle Service: LOS B to LOS C

- **Highland Avenue and I-95 Southbound Ramps:**
    - Weekday AM Peak Hour:
        - I-95 southbound off-ramp northbound right turns:
            - 2025 Build with Existing Mode Share: experience capacity constraints under both No-Build and Build conditions, such that delay values exceed 300 seconds.
            - 2025 Build with Robust Shuttle Service: experience capacity constraints under both No-Build and Build conditions, such that delay values exceed 300 seconds.

- Weekday PM Peak Hour:
  - I-95 off-ramp northbound right turns:
    - 2025 Build with Existing Mode Share: LOS D to LOS E, delay increase = 15 seconds
    - 2025 Build with Robust Shuttle Service: LOS D to LOS E, delay increase = 10 seconds
- Saturday Midday Peak Hour:
  - I-95 off-ramp northbound right turns:
    - 2025 Build with Existing Mode Share: LOS C to LOS D
    - 2025 Build with Robust Shuttle Service: LOS C to LOS D

Source: BETA Group, Inc.

APPENDIX C

PARKING SUMMARY

APPENDIX C

PARKING SUMMARY

Multi-City/Town Parking Summary Table

LAND USES	BUILDING PROGRAM	CITY/TOWN															
		Newton		Quincy		Brookline		Boston		Cambridge		Watertown		Waltham		Somerville	
		Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required
Residential	822 units	1.25 (special permit) **2 per unit (standard)**	1644	1.25 per unit	1028	2.0 per unit < 3 BR 2.33 per unit > 3 BR	1656	0.7 per unit	575	1.0 per unit	822	Min 2.0/unit 0.75/studio 1.00/1 BR 1.50/2 BR 2.00/3+ BR	1006	2.0 per unit	1644	1.0/studio 1.5/1-2 BR 2.0/ 3+BR PLUS 1/every 6 units for visitors/service vehs	1349
Retail (Bank, Retail Store, and Service Establishment)	105,200 square feet 200 employees	1 per 300 SF plus 1 per 3 employees	417	1 per 400 SF	263	Ground Floor = 1 per 350 GFA Other = 1 per 600 GFA	301	Ground Floor = 1 per 500 SF Other = 1 per 1,000 SF	210	**1 per 500 SF** 1 per 250 SF	210	Ground Floor = 1 per 350 SF Above Ground Floor = 1 per 400 SF	301	6 per 1,000 SF	631	1 per 425 SF	248
Restaurant	50,000 square feet 1,595 seats 148 employees	1 space/3 patron seats PLUS 1 space/every 3 employees during largest shift	581	See Note 1.	125	See Note 1.	143	See Note 1.	100	**1 per 10 seats** 1 per 2.5 seats	160	1 per 4 seats and 1 per every 4 linear feet of standing table space	399	**11 per 1,000 SF of GFA of interior area and** **1 space for every 6 seasonal outdoor seats** Fast-food - The greater of 1 parking space for every 3 seats or 6 spaces per 1,000 SF of GFA	550	1 per 110 SF	455
Medical Office	10,000 square feet, no lab, and no pharmacy	1 space per 200 SF	50	1 per 400 SF	25	1 per 250 SF	40	Ground Floor = 1 per 500 SF Other = 1 per 1,000 SF	20	**1 per 400 SF** 1 per 200 SF	25	See Note 11.	29	1 per 150 SF	67	1 per 400 SF	25

LAND USES	BUILDING PROGRAM	CITY/TOWN															
		Newton		Quincy		Brookline		Boston		Cambridge		Watertown		Waltham		Somerville	
		Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required	Parking Space Requirements	Number of Parking Spaces Required
Office	180,000 square feet	1 per 250 SF up to 20,000 SF 1 per 333 SF over 20,000 SF	560	1 per 400 SF	450	Ground Floor = 1 per 350 SF Other = 1 per 600 SF	399	Ground Floor = 1 per 500 SF Other = 1 per 1,000 SF	258	1 per 800 SF 1 per 400 SF	225	Ground Floor = 1 per 350 SF Above Ground Floor = 1 per 400 SF	506	1 per 300 SF	600	1 per 500 SF	360
Health Club	20,000 square feet 24 employees	1 per 150 SF PLUS 1 space/every 3 employees during largest shift	142	See Note 2.	142	See Note 2.	142	See Note 2.	142	See Note 2.	142	1 per 400 SF	50	See Note 2.	142	1 per 500 SF	40
Community (Personal Service and Post Office)	4,000 square feet 3 employees	1 space/300 square feet PLUS 1 space/every 3 employees during largest shift	15	See Note 2.	15	See Note 2.	15	See Note 2.	15	See Note 2.	15	See Note 2.	15	See Note 2.	15	See Note 2.	15
Shared/Mixed Use	See Note 3.			See Note 4.		See Note 5.		See Note 6.		See Note 7.		See Note 8.		See Note 9.		See Note 10.	
		TOTAL (Unadjusted)	**3409**		**2048**		**2695**		**1320**		**1599**		**2305**		**3649**		**2491**
		TOTAL (Adjusted for shared as applicable)	**1953 (SP*)**		**2047**		**SP**		**1319**		**SP**		**SP**		**2820**		**SP**

Notes:

1 - Retail parking space requirements were used since the City/Town does not have Restaurant specific parking space requirements.
2 - City of Newton parking space requirements were used since the applicable City/Town does not have land use specific parking space requirements
3 - Per the City of Newton Zoning Ordinance - In the case of a combination, in a single integrated development, of 3 or more uses listed in the table above, the City Council may grant as special permit, to reduce the sum total of stalls required for each of the uses involved, but in no case may such a reduction exceed 1/3 of such total.
4 - Per the City of Quincy Zoning Code - Two or more uses. Where a building or land area is used by two or more activities that fall into different classes of use, the facilities required shall be the sum of the requirements for the individual establishments.
5 - Per the Town of Brookline Zoning By-Law - The number of spaces required in a common parking facility may be reduced below the individual total number of spaces by special permit if it can be demonstrated to the ZBA that the hours or days of peak parking need for the uses are so different that a lower total will provide adequately for all uses served by the facility.
6 - Per the City of Boston Zoning Code - If a lot by reason of a diversity of occupancies is subject to more than one of the first five sections of the Article, the number of car spaces required by each section for the occupancies subject to it shall be determined, and then such numbers totaled; and off-street parking facilities with such total number of car spaces shall be provided.
7 - Per the City of Cambridge Zoning Ordinance - Reduction of Required Parking - Any minimum required amount of parking may be reduced only upon issuance of a special permit from the ZBA. Shared use of off street parking spaces serving other uses having peak user demands at different times, provided that no more than seventy-five (75) percent of the lesser minimum parking requirements for each use shall be satisfied with such shared spaces and that the requirements of Subsection 6.23 are satisfied.
8 - Per the City of Watertown Zoning Ordinance - The parking space requirement may be reduced by special permit.
9 - Per the City of Waltham Zoning Ordinance - When any land or building is used for two or more distinguishable purposes, the minimum total number of parking spaces required to serve the combination of all uses shall be determined by using the Parking Credit Schedule Chart. This was used to calculate the total adjusted parking spaces required.
10 - Per the City of Somerville Zoning Ordinance - Where two or more activities or uses provide the required parking in a common parking facility, the parking requirement may be reduced by special permit.
11 - Office parking space requirements were used since the City does not have Medical Office specific parking space requirements.
12 - The bolded parking space requirements were those used to calculate the number of parking spaces.

SP = Special Permit is required for reduction of parking spaces.
Source: BETA Group, Inc.

APPENDIX D

PARKING ROUTE 9/ CHESTNUT STREET SAFETY EVALUATION

ENVIRONMENTAL PARTNERS

JUNE 19, 2018

Environmental Partners
A partnership for engineering solutions

Memorandum

To: Mr. Jason Sobel, P.E., PTOE, Director of Transportation
Department of Public Works
110 Crafts Street
Newton, MA 02460

Attn: Stephen Smoglou, P.E.

From: James D. Fitzgerald, P.E., LEED AP

Date: June 19, 2018

Subject: Traffic Safety Evaluation of Boylston Street at Chestnut Street

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Introduction

Environmental Partners Group, Inc. (Environmental Partners) has been retained by the City of Newton to expand upon previously performed traffic investigations performed at the two intersections that make up the Boylston Street/Chestnut Street location. The two Boylston Street access roads located along either side of Route 9 intersect Chestnut Street forming two closely spaced intersections, separated by the Route 9 overpass with limited sight lines. It is our understanding that the intersections have experienced an increase in crashes and excessive queues have been encountered. Environmental Partners performed an initial assessment of the intersection including documenting existing conditions and observations, assessing crash history, and comparing sight distance requirements; the findings were summarized in a Memorandum dated November 9, 2017. The following describes additional evaluations that were performed at the City's request.

For ease of reference, the northern intersection will be referred to as "Intersection 1" and the southern intersection will be referred to as "Intersection 2" as shown below.

Traffic Counts & Observations

As part of this traffic assessment, traffic counts were performed for a 13-hour period from 6:00 a.m. to 7:00 p.m. on Wednesday, May 16, 2018. The morning and evening peak commuter hours for the study location occurred from 7:15 to 8:15 a.m. and from 5:00 to 6:00 p.m. Turning movement diagrams for the morning and evening peak hour are provided in Figure 1.

Environmental Partners also conducted observations of queues and circulation during morning and afternoon peak hours from 7 to 9 a.m. and 4 to 6 p.m. on Wednesday, May 30, 2018.

It should be noted that during both the morning and evening periods there were a few instances when collisions almost occurred at the northwest corner of Intersection 2, as shown below. Southbound Chestnut Street vehicles traveling under the bridge approaching Intersection 2 sometimes stopped, causing confusion for the eastbound Boylston Street vehicles and driver frustration by motorists behind the southbound vehicle.

Morning Peak Period

During the morning peak hour, the heaviest traffic volume approached the intersections via southbound and northbound Chestnut Street, 462 v.p.h. and 452 v.p.h. respectively, with the majority of traffic traveling straight. The eastbound Boylston Street approach to Intersection 2 also carried significant volume (409 v.p.h.), the great majority of which (87%) turns left under the bridge. This circulation resulted in the heaviest movement being the northbound approach to Intersection 1 from Intersection 2.

During the morning peak hour, the longest queues were observed along the eastbound Boylston Street approach to Intersection 2, often queuing back through the Ellis Street intersection to Route 9, a distance of almost 800 feet. As reflected in the traffic counts discussed above, most of these eastbound vehicles turned left under the bridge to continue northbound along Chestnut Street.

Just before 8:00 a.m., traffic volumes along the eastbound Boylston Street approach to Intersection 2 were observed to subside a bit while the southbound Chestnut Street approach to Intersection 1 began to grow. By 8:15 a.m. (the start of the morning peak hour for Intersection 1), queues along the southbound Chestnut Street approach to Intersection 1 were observed to

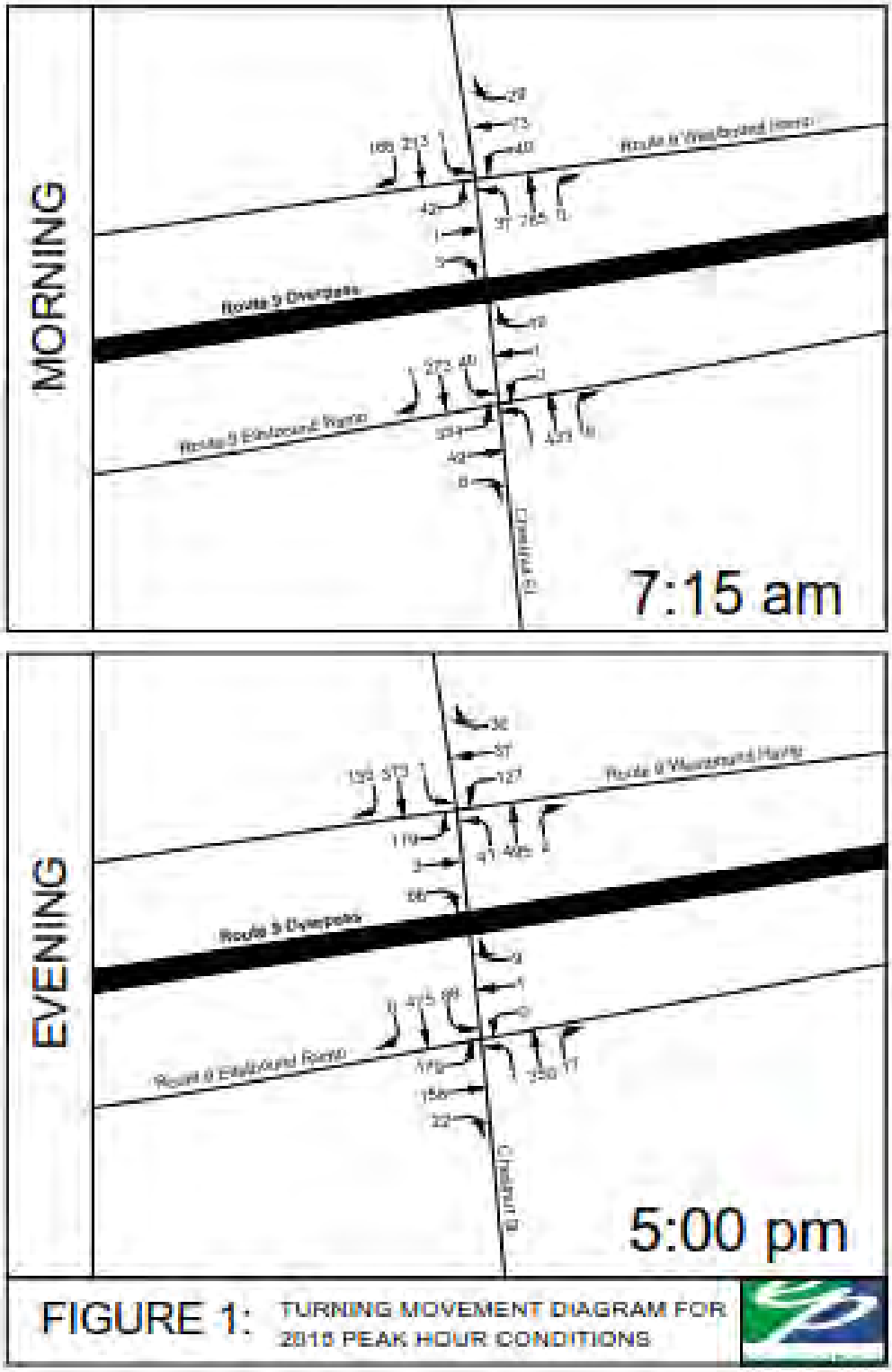


FIGURE 1: TURNING MOVEMENT DIAGRAM FOR 2015 PEAK HOUR CONDITIONS

extend as far back as Oliver Road, a distance of almost 1,000 feet. However, shortly thereafter, these queues shortened to 300 feet for a remainder of the peak period. Although a significant traffic flow was observed traveling northbound from Intersection 2 to Intersection 1, traffic consistently flowed due to the lack of stop-sign control.

Evening Peak Period

During the evening peak hour, the heaviest traffic volume approaching the intersections was found to be the southbound Chestnut Street approach to Intersection 1, with 510 v.p.h. Also noteworthy was the eastbound Boylston Street approach and the northbound Chestnut Street approach to Intersection 2, both over 350 v.p.h. The circulation resulted in substantial traffic traveling both northbound and southbound under the bridge between the two intersections (538 v.p.h. and 561 v.p.h. respectively).

The longest queues were observed along the southbound Chestnut Street approach to Intersection 1, extending as far back as Wyman Street during the peak 15 minutes, a distance of over a half mile. Lengthy queues along this approach persisted for the entire peak hour and longer, with delays upwards of seven minutes at times.

Notable queues were also observed along the eastbound Boylston Street approach to Intersection 2. During the peak 15 minutes, queues extended as far back as beyond the Ellis Street intersection. During the remainder of the peak hour, queues were generally no more than 6 or 7 cars along this approach. Most of the remaining approaches to the intersections had steady traffic, but did not have lengthy queues.

Crash History

More extensive crash data was provided for this evaluation than originally evaluated in the November 9, 2017 memorandum. Crash data for the study intersections was provided by the Newton Police Department for 2013 through present day, with the most recent crash recorded on March 29, 2018. Although the crash data dated back to 2013, there were no crash reports found for the study intersections until September 1, 2015. However, according to the MassDOT crash portal there were two crashes that occurred at Intersection 1 during this time period (one in 2013 and one in 2014). Therefore two crashes were added to the total number of crashes at Intersection 1 as part of these evaluations.

There were 11 collisions reported at Intersection 1 between the 5.25 year period of 2013 and 2018, and 9 collisions reported at Intersection 2.

Data	Route 8 Westbound Ramp at Chestnut Street	Route 9 Eastbound Ramp at Chestnut Street	Unknown intersection	Total
Year:				
2013	1	-	-	5%
2014	1	-	-	5%
2015	2	-	-	10%
2016	8	2	-	38%
2017	8	6	1	48%
2018 (3 months)	1	1	-	10%
Total	21	9	1	100%
Average number of crashes per year	3.5	3.7	-	-
Crash Rate	0.35	0.24	-	-
Significant	No	no	-	-
Type:				
Angle	9	8	1	81%
Sideswipe	-	1	-	5%
Fixed object	2	-	-	10%
Single Vehicle	2	-	-	5%
Total	21	9	1	100%

The crash rate at Intersection 1 was found to be 0.35 crashes per million entering vehicles (C/MEV), and the crash of Intersection 2 was found to be 0.32 C/MEV. Both crash rates are significantly lower than the State and District 6 averages of 0.58 C/MEV and 0.53 C/MEV respectfully for unsignalized intersections. Although this location would typically be viewed as two (closely spaced) intersections, if one were to evaluate the location as one large intersection given the existing configuration, comparing total crashes with total entering traffic, a crash rate of 0.58 is calculated, slightly greater than the District 6 crash rate average.

Regardless of the crash rate findings however, safety concerns remain given the near misses that are observed and the unexpected intersection control (one of the four approaches being uncontrolled) in a location of limited sight lines between bridge abutments. As reiterated in a crash report from March 24, 2016 for instance, drivers are unaware that the intersection is not a 4-way stop. This is consistent with the fact that over 80% of all crashes recorded at these intersections were angle-type collisions.

Traffic Signal Warrants

A traffic signal warrants analysis is an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of a location to help determine if a traffic signal installation is justified at an intersection. Traffic signal warrants are defined in the Manual on Uniform Traffic Control Devices (MUTCD), 2009 Edition published by Federal Highway Administration. Nine warrants are presented in the MUTCD:

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour
- Warrant 4, Pedestrian Volume
- Warrant 5, School Crossing
- Warrant 6, Coordinated Signal System
- Warrant 7, Crash Experience

- Warrant 8, Roadway Network
- Warrant 9, Intersection Near a Grade Crossing

Each warrant analysis compares existing conditions at the study location with established thresholds or criteria to establish whether the installation of a traffic signal is warranted. Although satisfaction of one warrant may be sufficient to justify a signal installation, the MUTCD states "the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." Furthermore, before and after studies of unwarranted traffic signals typically indicate that an unjustified signal installation causes an increase in the number of crashes at the intersection.

In Massachusetts the MassDOT views Warrant 1, Eight-Hour Vehicular Volume, as paramount when justifying a traffic control signal based on vehicular traffic flow. While other volume warrants such as four hour and peak hour are considerations, the MassDOT expects that Warrant 1 be satisfied.

A traffic signal warrants analysis was conducted to evaluate the need for traffic control at the study intersections. Based on the analysis of the existing traffic volumes, the signal warrant thresholds for Warrants 1, 2, and 3 were met for both of the intersections. Since warrants have been met, traffic signals may be considered at this location upon further evaluation.

Multi-Way Stop Applications

The unconventional traffic control that exists at both intersections- with three of the four approaches under stop-sign control and the fourth approach (from under the bridge) uncontrolled- causes confusion for drivers. Uncertain drivers travelling under the bridge often stop (despite the lack of a stop sign) causing delays and driver frustration.

A potential alternative under consideration to address this confusion includes providing all-way stop control at both intersections since this condition is already anticipated by many. In considering such an option, the MUTCD identifies a number of criteria that should be met. In Section 2B.07 of the MUTCD, *Multi-Way Stop Applications* it says that, *"Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal."* Although some of the approaches to the two intersections experience approximately equal traffic volumes, fluctuations in traffic are experienced along the other approaches.

The MUTCD also says:
The decision to install multi-way stop control should be based on an engineering study.
04 *The following criteria should be considered in the engineering study for a multi-way STOP sign installation:*
A. *Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.*

B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

C. Minimum volumes:

1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and

2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but

3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.

Based on these considerations:

A. Per the above traffic signal warrant analysis, traffic control signals are justified at this location. In the event it is determined that traffic signals are to be installed, the additional stop signs (for a multi-way stop) could be used as an interim measure while waiting for their installation.

B. At Intersection 2, six crashes occurred in 2017, five of which were angle collisions and likely to be rectified by a conventional multi-way stop control. At Intersection 1, based on the provided crash data, a maximum of three crashes occurred during a one-year period, less than the five crash threshold identified in MUTCD although near-miss collisions appear to be a somewhat regular occurrence at the location.

C. Regarding minimum volumes:

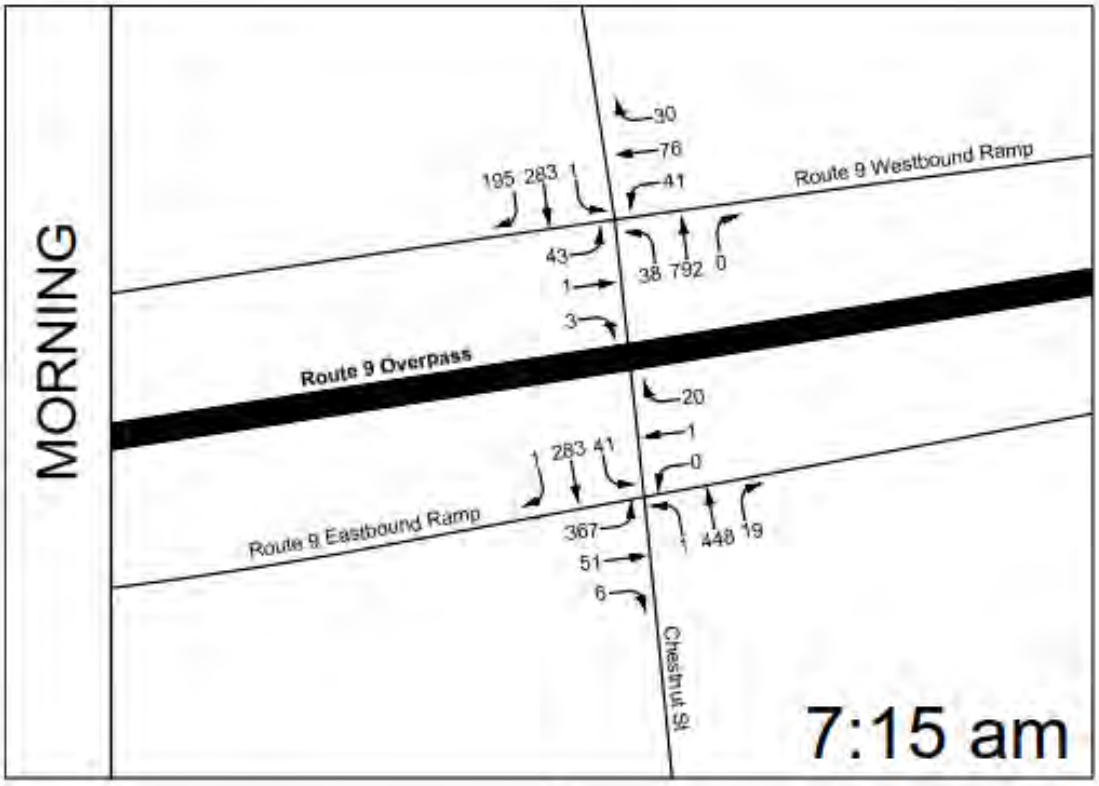
1. The vehicular volume on Chestnut Street averages well above 300 vehicles per hour according to the 13 hours of turning movement counts that were done on May 16, 2018.

Based on the above considerations, it appears that a conventional multi-way stop control at the intersections (installing an additional stop sign at the currently uncontrolled approaches) may be appropriate. However, given the volume of traffic traveling between the intersections that would be faced with new stop-sign control, caution is raised regarding the potential for grid-lock. Traffic modeling has been outline below to anticipate potential impacts to delay and queues.

Traffic Volume Projections

In order to evaluate future operations of the intersection and/or to make design improvements that will be beneficial for future growth as well as present conditions, existing traffic volumes were projected 7 years to a future design year of 2025. (See Figure 2.)

To develop 2025 design year volumes, existing volumes were increased by an annual growth rate based on historical traffic volume data. According to traffic count data for Boylston Street from MassDOT, the ADT has actually decreased in recent years. In order to remain conservative, a



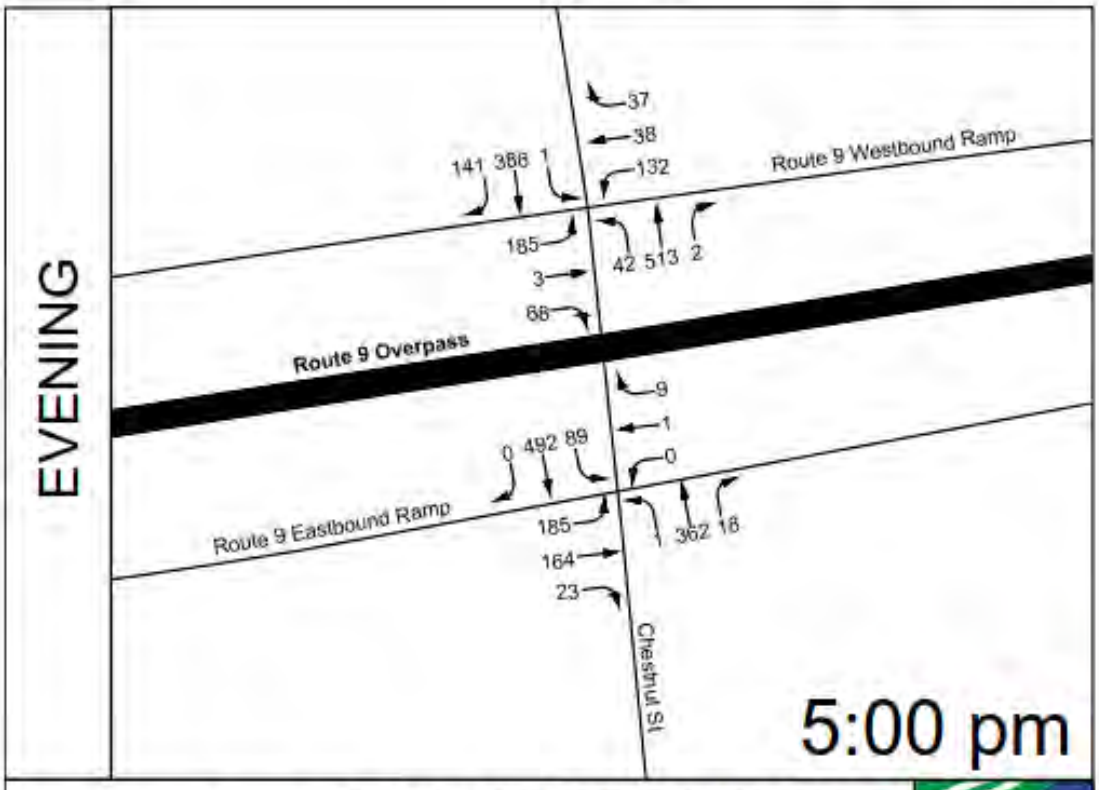


FIGURE 2: TURNING MOVEMENT DIAGRAM FOR 2025 PEAK HOUR CONDITIONS

0.5% per year compounded growth rate was selected and applied to the existing traffic volumes to develop the 2025 design year traffic volumes.

Capacity Analysis Methodology

The capacity analysis methodology is based on the concepts and procedures described in the 2000 *Highway Capacity Manual* (HCM), Transportation Research Board, Washington, DC. A capacity analysis is used to assess the quality of traffic operations on a roadway or intersection as a result of traffic volume demands placed on the respective facility. The primary result of a capacity analysis is a level of service (LOS) assignment to the traffic operations of the respective facility. A LOS analysis results in assigning a letter index of A through F to describe the quality of traffic operations at a facility in terms of such factors as speed, traffic interruptions, freedom to maneuver, comfort, convenience and safety. The six letter designations of A through F define the operating conditions from best to worst, respectively. In general, a LOS C is used as the minimum design criteria although D is acceptable at urban, high volume locations.

LOS for either signalized or unsignalized intersections can be computed by the described methodology. LOS for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption and lost travel time. The delay experienced by a motorist is made of factors that relate to intersection control, geometrics and traffic volumes. This delay is called "control delay" or "signal delay". Control delay includes initial deceleration delay, queue move-up time, stopped delay and final acceleration delay. Specifically, LOS criteria at an intersection with traffic signals are stated in terms of the average control delay per vehicle.

The LOS for an unsignalized intersection is defined for each minor movement, not for the intersection as a whole. The LOS criteria for the unsignalized intersections are somewhat different from the criteria for the signalized intersections. The primary reason for the difference is that motorists expect different levels of performance from the two facilities. Due to these expectations, the control delay threshold for any given LOS is less for an unsignalized intersection than it is for a signalized intersection. Table 5 below summarizes the LOS criteria associated with the letter index and the relationship between signalized and unsignalized intersections.

Table 5
Intersection Level of Service Criteria[1]

Level of Service	Average Stopped Delay per Vehicle (seconds)	
	Signalized Intersection	Unsignalized Intersection
A	0 - 10	0 - 10
B	>10 - 20	>10 - 15
C	>20 - 35	>15 - 25
D	>35 - 55	>25 - 35
E	>55 – 80	>35 - 50
F	>80	>50

[1] 2000 *Highway Capacity Manual*, Transportation Research Board, Washington, DC.

The LOS delay criteria may be applied to individual lane groups, to individual intersection approaches or to the entire signalized or unsignalized intersections.

Due to the unusual existing stop-sign control at the study intersections, the commonly used Synchro traffic analysis software was not able to accurately model intersection operations. Therefore, SimTraffic was used to analyze the existing operations of the intersection. SimTraffic is a microscopic model used to simulate a wide variety of traffic controls. Each vehicle is tracked through the simulation and comprehensive measures of effectiveness such as stopped delay and queue length are collected. However, since driver behavior is one of the greatest challenges that traffic analysts face with computer simulation, actual operations are subject to fluctuate and field verification after implementation is recommended. A series of runs were performed with their results averaged and summarized. The following chart outlines the findings:

SimTaffic Summary

Location	Peak Period	Approach	2018 Existing			2018 4-Way			2025 4-Way		
			Average 95th percentile Queue Length (ft)	Average Stopped Delay/Vehicle (Seconds)	LOS	Average 95th percentile Queue Length (ft)	Average Stopped Delay/Vehicle (Seconds)	LOS	Average 95th percentile Queue Length (ft)	Average Stopped Delay/Vehicle (Seconds)	LOS
Intersection 1: Boylston Street Westbound Ramp at Chestnut Street	AM	EB Left/Thru/Right	92	36.9	E	55	5.0	A	56	5.8	A
		WB Left/Thru/Right	397	132.2	F	83	5.4	A	83	5.3	A
		NB Left/Thru/Right	17	0.9	A	119	8.6	A	119	8.6	A
		SB Left/Thru/Right	359	29.8	D	164	6.5	A	148	6.8	A
		All	N/A	24.2	C	N/A	7.5	A	N/A	7.6	A
	PM	EB Left/Thru/Right	147	17.6	C	110	8.9	A	114	9.8	A
		WB Left/Thru/Right	162	24.1	C	108	9.3	A	103	9.6	A
		NB Left/Thru/Right	9	0.8	A	130	10.4	B	134	11.3	B
		SB Left/Thru/Right	721	83.2	F	408	43.9	E	343	95.1	F
		All	N/A	34.7	D	N/A	23.2	C	N/A	39.2	E
Intersection 2: Boylston Street Eastbound Ramp at Chestnut Street	AM	EB Left/Thru/Right	701	106.2	F	380	134.3	F	927	152.9	F
		WB Left/Thru/Right	39	8.7	A	42	8.7	A	40	9.4	A
		NB Left/Thru/Right	450	50.4	F	931	167.6	F	937	174.3	F
		SB Left/Thru/Right	12	0.6	A	96	7.1	A	98	7.5	A
		All	N/A	55.8	F	N/A	109.5	F	N/A	117.4	F
	PM	EB Left/Thru/Right	972.0	295.9	F	141	9.8	A	150	10.8	B
		WB Left/Thru/Right	29.2	6.1	A	29	7.4	A	30	7.9	A
		NB Left/Thru/Right	193.6	15.6	C	251	23.0	C	317	31.9	D
		SB Left/Thru/Right	6.0	0.7	A	123	10.3	B	120	11.2	B
		All	N/A	88.3	F	N/A	13.7	B	N/A	16.8	C
		AM Total	2068	364		2351	343		2408	371	
		PM Total	2240	448		1375	123		1810	188	
		Total	4308	812		3725	466		4218	558	

In general, SimTraffic shows that queue length and delay is expected to improve as 4-way stop controlled intersections. However, as anticipated, adding stop sign control for the Chestnut Street approaches traveling between the two intersections will increase delay and queues. With only approximately 90 feet of queue storage available along both approaches (under the bridge) and the above SimTraffic findings of 95th percentile queues as high as 130 feet under 2018 volumes, there is concern for grid-lock between the two closely spaced intersects.

Conclusion and Recommendation

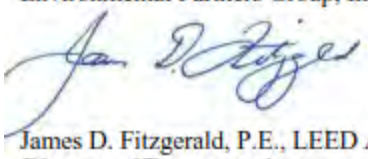
Based on considerations set forth in the MUTCD, multi-way (four-way) stop control appears to be a reasonable treatment to improve safety at the two intersections. However, a concern for grid-lock exists between the two intersections given their close spacing and the heavy traffic flow between locations. Treatments such as "do not block the intersection" signage and pavement markings should be considered to encourage courteous driver behavior. While the

computer traffic modeling shows the potential for grid-lock with queues exceeding storage length, traffic modeling is not a precise representation of real-world conditions and operations are ultimately dictated by actual driver behavior and their willingness to not block the intersection.

Based on traffic signal warrant analysis, traffic signals may be considered at the intersections. Under such a scenario, the two intersections should operate together as one system to ensure intersection clearing. Additional evaluations including operational analysis under signalized control and other options may be performed at the city's request.

We appreciate the opportunity to be able to assist you with this project. Please feel free to contact me at (617) 657-0256 or jdf@envpartners.com with any questions or concerns.

Very Truly Yours,
Environmental Partners Group, Inc.



James D. Fitzgerald, P.E., LEED AP
Director of Transportation

ATTACHMENT C

SCHLESINGER AND BUCHBINDER, LLP
ATTORNEYS AT LAW

STEPHEN J. BUCHBINDER
ALAN J. SCHLESINGER
LEONARD M. DAVIDSON
A. MIRIAM JAFFE
SHERMAN H. STARR, JR.
JUDITH L. MELIDEO-PREBLE
BARBARA D. DALLIS
PAUL N. BELL
KATHERINE BRAUCHER ADAMS
FRANKLIN J. SCHWARZER
RACHAEL C. CARVER
ADAM M. SCHECTER

1200 WALNUT STREET
NEWTON, MASSACHUSETTS 02461-1267
TELEPHONE (617) 965-3500
www.sab-law.com

January 4, 2019

aschlesinger@sab-law.com

Jennifer Caira
Director of Current Planning
City of Newton
1000 Commonwealth Avenue
Newton, MA 02459

Re: Northland Newton Development – BETA Group Draft Peer Review

Dear Jen;

Thank you for sharing the draft BETA Group Peer Review. We understand this is a draft and that there may be changes, but to expedite your process, we want to summarize our thoughts on the peer review. As you might expect from this detailed review, there are large and small issues, some on which VHB, 128 Business Council and BETA Group agree or disagree, and other issues which require clarification.

Major Areas of Agreement

- There is agreement on the scope of the study area as the Planning Department had designated (p 3);
- VHB provided additional mid-day data based on BETA Group's request and the peak numbers have been adjusted to that data (p 9);
- There is agreement on the most important issue of trip generation (p 19);
- There is agreement on the methodology of person trips and internal capture trips (p 20);
- There is agreement on the methodology for trip distribution (p 21).

Responses to Certain Questions

- Comment 2.11 (p 11) – VHB has confirmed that the additional developments in the area have been accounted for in either the existing or the "no-build" conditions;
- Comment 10.2 (p 59) suggests a monitoring program. Attached as Attachment A is a draft monitoring proposal based on prior approvals granted

by the City Council, and this language may be adapted as a condition of the Council Order.

Design Issues

- Section 4 of the review (pp 28-30) notes that plans will need to be developed in further detail, in particular for the pedestrian and bicycle pathways. Northland will take each of the suggestions under advisement, but the actual final design will be prepared in the course of plan development;
- Comment 5.3 (p 33) appropriately proposed markings to prevent blocking the intersection of Charlemont Street and Unnamed Street;
- Comments 5.4 – 5.9 (pp 33-34) relate to traffic. Northland will take each of the suggestions under advisement, but the actual final design will be prepared in the course of plan development;
- Comments 5.12 – 5.17 (p 41) relate to parking design and layout. Northland will take each of the suggestions under advisement, but the actual final design will be prepared in the course of plan development;
- Comments 6.1 – 6.11 (pp 42-43) relate to loading areas, Northland will take each of the suggestions under advisement, but the actual final design will be prepared in the course of plan development;
- Section 8.0 Street Design (pp 52-55) – Northland will take each of the suggestions under advisement, but the actual final designs will be prepared in the course of plan development.

Operational Issues To Be Reviewed

- The shuttle connections at Newton Highlands should be reviewed (p 4). We are aware of accessibility improvements to be undertaken at the Newton Highlands T, and we know that Councilor Rice has been involved in preventing engine idling in the neighborhood. Shuttle routes are subject to Council approval;
- Comment 2.31 (p 25) – The Construction Management Plan for the site should contain traffic control elements and in particular provisions for a Temporary Traffic Control Plan;
- Comment 7.1 (p 43) – The staffing of the Mobility Hub will be determined operationally. The proposal does have wi-fi in the building as well as rest rooms and transit information;
- Comment 7.2 (p 44-52) – The operations of the shuttle, including its fare structure, will be set and adjusted as advisable to create sufficient demand. Northland is aware that the shuttles will operate at a loss and hopes and intends that employers at the development will participate in a series of TDM

programs to create alternatives to driving. The 128 Business Council has considerable long term experience operating a shuttle service in the area, and Northland will be relying on its experience 4-5 years from now as to the operational elements of the shuttle service;

- Comment 7.14 (p 48) – Alternative fuel vehicles are aspirational for the future but not practical at this time. Monica Tibitts-Nutt of the 128 Business Council is on the Board of the MBTA which is very conscious of these issues and has advised us that there is not sufficient infrastructure in place to make this work, but she is hopeful of change in the future;
- Comment 7.15 (p 49) – The peer review notes that the proposed shuttle does not serve Route 128 north or south. The 128 Business Council has reviewed this route and currently runs extensive service to Alewife from Route 128 North in Waltham. Based on their experience they do not believe that scheduled service from Needham Street north or south would be either sufficiently regular or convenient to serve a market today;
- Comment 7.16 (p 49) – The shuttle system is privately funded by Northland. Any fares collected reduce the cost to the operator, but the system is not designed as a break-even. Fares will be set so that in coordination with other TDM measures the overall program will be impactful. It is premature at this time to propose specific fares, but the 128 Business Council Implementation Plan has estimated the number of bus-hours for the proposed service;
- Comment 7.17 (p 49) – The monitoring of service, usage and performance is a critical element of the 128 Business Council program. The shuttle services are data-driven, and each route is monitored daily. The Council maintains protocols for quarterly re-evaluation of all routes and services.

Further Review Requested

- Chestnut Street and Route 9 (pp 4-5) – This intersection can be reviewed further, and the operation may have changed since the closure of the Route 9 access to Wellesley Office Park;
- Comment 2.12 (p 11) – VHB will confirm the background growth rate along Needham Street;
- Comment 2.14 (p 14) – The Centre Street/Walnut Street intersection will be reviewed in Northland's MEPA filing;
- Comment 2.15 (p 14) – VHB will ask Planning what actions are appropriate for the Oak Street/Chestnut Street intersection;
- Comment 2.19 (p 20) and 3.2 (p 27) – The 2015 census data indicates a smaller private vehicle mode share than the 2010 data VHB used. Presumably

this will result in a lower level of traffic generation from the project. This can be recalculated if the Planning Department requests revised projections;

- Comment 2.25, 2.25 (p 23) requests revised analysis during the AM peak at the Staples/Highland Avenue intersection;
- Comment 2.30 (p 25) – Northland is willing to coordinate with the Planning Department appropriate review of potential traffic calming measures on Chestnut Street;
- Comment 4.17 (p 32) – Northland will work with the Planning Department to consider improvements to the Chestnut Street/Oak Street intersection;
- Section 5.2.2 (p 37) and 5.2.3 (p 38) relative to the shared parking ask for confirmation if the 2,283 parking spaces would be required per ITE and ULI methodologies. VHB will review those numbers;
- Comment 9.4 (p 56) suggests a speed study on various Upper Falls streets. VHB will undertake this study if the Planning Department deems it advisable.

Certain Suggestions We Do Not Think Are Appropriate

- Comments 2.16 (p 15) and 2.24 (p 22) – We do not believe that the different computer modelling will provide useful additional information. There is no dispute that the corridor is saturated at certain hours, so differing opinions on how much are not useful;
- Comments 2.20 and 2.21 (p 20) – VHB did not find reliable published baseline data for mode share and has acknowledged that this is its internal estimate based upon their experience and professional opinion;
- Comments 2.27 and 2.28 (p 24-25) – BETA Group proposes mitigation at each of the 20 listed intersections. Northland is taking a different approach from traditional intersection geometry or signal issues. The project proposes a broader mitigation plan of aggressively reducing transportation demand, and the TDM program including the proposed shuttle system and other measures, is intended to address this issue;
- Comment 2.29 (p 25) – Northland believes it would be inappropriate after years of design to re-open the Needham Street Improvements project. The design of that project is complete, and the City is waiting for the start of construction;
- Section 4.4 (p 31) – relates to the DOT design. We do not think this is advisable at this time;
- Comment 4.19 (p 32) – Northland believes that the Mobility Hub is appropriately located to provide the correct traffic pattern and visibility from Needham Street;

Jennifer Caira
January 4, 2018

- Comment 5.3 (p 33) – Main Street has been planned as two-way in and out. The left turn out of Main Street is significant for the project, and while VHB understands that the turn may be delayed at certain hours, nonetheless the traffic light at Charlemont Street will provide sufficient breaks in the southbound traffic to permit egress at most times of the day.

We look forward to a continual dialogue on this matter.

Very truly yours,

Alan J. Schlesinger

AJS:sjk

cc: Land Use Committee
Planning Board

APPENDIX A

One year after issuance of a final certificate of occupancy for the Project Northland will conduct a post-occupancy traffic study to document and assess (i) the actual traffic characteristics, volumes, and operating conditions of the Project, including safety and crash results; (ii) evaluate the success of and refine the elements of the TDM Plan, including parking utilization and residential and commercial tenant mode shares; and (iii) assess traffic volumes and operating conditions at the Project site. Traffic counts will be performed under "average month" conditions while public schools are in regular session. The results will be submitted to the City prior to the end of the calendar year in which the study is completed and analyzed to review the actual traffic and parking characteristics of the Project, and to assess traffic volumes and operating conditions at the Project. The results of the traffic study and peer review will be provided to the Director of Planning and Development and the Director of the Transportation Division of Public Works for review.

If the results of the traffic study indicate that the actual measured traffic volumes associated with the Project as constructed and occupied exceed the trip estimates presented in the Traffic Impact Assessment by more than 10 percent of the projected trip generation for the then occupied uses, as measured at the Needham Street driveways serving the Project, other than through matters changing the "no-build' condition through unanticipated additional development, then Northland shall meet with the Director of the Planning and Development Department and the Director of Transportation for the Department of Public Works to discuss expansion or modification of the TDM in order to increase use of public transportation, or other alternatives to automobile travel.