King Street Common

Draft Environmental Impact Report
EEA #16921

Submitted to:
Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Submitted by:
Lupoli Development
280 Merrimack Street
Lawrence, MA 08413

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

In Association with:
The Engineering Corp
PCA Architecture

June 2, 2025

Epsilon
ASSOCIATES INC.

BUILDING A: 272,619 GSF COMMERCIAL | 3 STORIES
BUILDING B: 272,901 GSF COMMERCIAL | 3 STORIES
BUILDING C: 173 UNITS | 173K GSF | 5 STORIES OVER PODIUM
BUILDING D: 173 UNITS | 173K GSF | 5 STORIES OVER PODIUM
BUILDING E: 149 UNITS | 8,000 SF RETAIL | 173K GSF | 5 STORIES
BUILDING F: 151 UNITS | 173K GSF | 5 STORIES
BUILDING G: 150 HOTEL ROOMS | 4,200 FOOD SERVICE/BAR | 111K GSF | 5 STORIES
BUILDING H: 11,799 SF RETAIL | 12,288 GSF | 1 STORY
BUILDING I: 13,039 SF RETAIL | 9 UNITS | 33,153 GSF | 2.5 STORIES
BUILDING J: 10,479 SF RETAIL | 11 UNITS | 30,209 GSF | 2.5 STORIES
BUILDING K: 20,757 SF RETAIL | 42 UNITS | 92,860 GSF | 3 STORIES
BUILDING L: 10,772 SF RETAIL | 11 UNITS | 31,029 GSF | 2.5 STORIES

BUILDING M: 19,000 SF | OFFICE | 3 STORIES
BUILDING N: 9,514 SF RETAIL | 8 UNITS | 21,326 GSF | 2 STORIES
BUILDING O: 13,420 SF RETAIL | 12 UNITS | 36,628 STORIES
BUILDING Q: 13,020 GSF RETAIL | 1 STORY
BUILDING R: 65 UNITS | 70K GSF | 5 STORIES OVER PODIUM
BUILDING S: 285 UNITS | 290K GSF | 6 STORIES

TOTAL RESIDENTIAL: 804 + 285 = 1089 UNITS
TOTAL RETAIL: 115K GSF
TOTAL LAB/OFFICE/R&D: 564,520 GSF

King Street Common Littleton, Massachusetts

Epsilon ASSOCIATES INC.

Figure 1-3
Current Proposed Project

Chapter 7.0

Transportation

7.0 TRANSPORTATION

This Chapter of the Draft Environmental Impact Report (DEIR) includes important updates to the transportation operational and safety analysis generated by TEC, Inc. (TEC) based on comments received on the Environmental Notification Form (ENF) from the Massachusetts Environmental Policy Act (MEPA) office, state agencies, municipalities, and other stakeholders. It considers the coordination that has occurred with the Proponent, the Town of Littleton, and the Massachusetts Department of Transportation (MassDOT) on the scope, traffic impacts, and parking impacts associated with the Project. Furthermore, it provides clarity on the process to identify transportation impacts within and provides mitigation for both the Town of Littleton and MassDOT off-site infrastructure.

The DEIR provides detailed aspects supplementing the Traffic Impact, Access, and Parking Study (TIAPS), prepared using MassDOT and the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) standard guidelines, which outline the traffic related impacts and mitigation measured for all study area roadways and intersections. The comments received on the ENF demonstrate that the King Street Common site is situated in an ideal location when considering the ability to distribute the impacts of motor vehicle traffic and create an efficient and attractive opportunity for future walkers, bicyclists, and public transportation users. This chapter provides further detail on the proposed improvements and operational measures that the King Street Common will employ to monitor traffic and parking facilities and reduce the reliance on automobile use by patrons, employees, and visitors.

7.1 Chapter Summary

The Project Site (the "Site") is located across two (2) distinct areas at 550 King Street and 410 Great Road as part of 47.4 acres. For the purposes of this TIAPS, the project is evaluated as a single project; however, particular existing and proposed traffic patterns and parking characteristics are specific to each distinct development location.

7.1.1 Requirement of State Action

The project directly abuts State Highway Layout (SHLO) along King Street (Route 110), Great Road (Route 2A / Route 119), and Interstate 495 (I-495) and therefore requires a Permit to Access State Highway through MassDOT's District 3 Office as a "State Action". Whereas the project is anticipated to generate 15,740 new unadjusted vehicle trips per day from a single location with 1,060 new parking spaces from a single location, the project is subject to review by MEPA through the following transportation related thresholds:

- [301 CMR 11.03(6)(a)(6)] -- Generation of 3,000 or more new ADT on roadways providing access to a single location.
- [301 CMR 11.03(6)(a)(7)] -- Construction of 1,000 or more new parking spaces at a single location.

- [301 CMR 11.03(6)(b)(13)] -- Generation of 2,000 or more new ADT on roadways providing access to a single location.
- [301 CMR 11.03(6)(b)(14)] -- Generation of 1,000 or more new ADT on roadways providing access to a single location and construction of 150 or more new parking spaces at a single location.
- [301 CMR 11.03(6)(b)(15)] -- Construction of 300 or more new parking spaces at a single location.

7.1.1.1 Transportation Scoping Coordination

The Project submitted a Transportation Scoping Letter (TSL) to the MassDOT Public/Private Development Unit (PPDU) on December 16, 2024 which outlined the building program, MEPA applicability, projected study area, projected trip generation and distribution, parking estimates, and an outline of off-site mitigation philosophy. MassDOT provided a response to the TSL on January 2, 2025 which generally confirmed the scope of the TIAPS as presented in the TSL. The MassDOT response did not require a specific Traffic Scoping Meeting in conjunction with MassDOT PPDU and MassDOT 3 prior to submission of the DEIR; however, further coordination with MassDOT was encouraged and has been completed as described in this Chapter.

7.1.1.2 Changes Since the ENF and TSL Related to Transportation

There have been no substantial changes to the Project in terms of transportation impact since the filing of the ENF or TSL. TEC has updated calculations related to site trip generation and trip distribution to provide both clarity and newly obtained information; however, the overall trip impact as described in the ENF and the TSL is generally unchanged. Specifically, the total number of vehicle trips per day is currently projected at 20,328 unadjusted as compared to 21,020 reported in the ENF. In addition, the total number of new vehicle trips per day, as adjusted for mode share, internal capture, and pass-by rate is currently projected at 13,338 as compared to 13,998 reported in the ENF. The trip distribution across the study area network for both the residential and commercial related trips has also been updated since the TSL based on the most up-to-date data published by the US Census Bureau through its interactive "On the Map" database. These minor changes are reflected in this TIAPS.

7.1.1.3 Coordination with MassDOT District 3 Office

Prior to the issuance of the DEIR, representatives of the project team met with the MassDOT PPDU and MassDOT District 3 Office virtually on Tuesday May 20, 2025 to discuss the scope of project, the scope of the TIAPS, and the commitments to off-site mitigation proposed by the Proponent and as described in this DEIR. The discussion also included a review of the MassDOT Intersection Control Evaluation (ICE) Applicability Form as drafted; but not submitted to MassDOT to date. A copy of the ICE Applicability Form is provided in Appendix E-1. Although further detail as to the intricacies of the off-site mitigation proposed will be developed as part of the FEIR and the future MassDOT Permit to Access State Highway process, MassDOT generally provided a conceptual

level understanding of the order of magnitude scope of off-site mitigation. The following provides a summary of the key outcomes / actions of this discussion beyond the general scope of the TIAPS included in this DEIR:

- The Proponent should further evaluate opportunities to limit the number of site-related driveways along King Street where the site plan shows five (5) driveway locations.
    - Initial Response: The Proponent has provided a level of access management along King Street based on the overall nature of the property layout. Although the site plan generally appears to be a single location (550 King Street), the site plan covers multiple property parcels, such as the Tuttle House parcel and the parcel which includes Building Q. Overall, the project only seeks to add a single curb cut location along the corridor which is also centered on the project to assist in site access/egress and circulation. For the purposes of this conversation, the Proponent has included in alternative discussion, described in Chapter 2 of this DEIR, which contemplates the removal of the existing / future Building Q Driveway at the north end of the site which currently services the 584 King Street property and is currently vacant.
- The Proponent should further evaluate the opportunity to limit the egressing left-turn movement from both the Site Driveway West and 410 Great Road driveways along Great Road. This would result in a full access / right-out driveway for each site location along this corridor.
    - The Proponent has shown a condition in the 2034 Build scenario with these two driveways operating with full access / egress. A sensitivity analysis for this could be developed as part of the FEIR; however, the driveway access/egress scheme notes that these represent the single driveway location for each site location along Great Road and mimic the access/egress scheme formerly in place while IBM was in operation and as exists today. The traffic operational analysis provided in this DEIR does not include a meaningful number of vehicles taking these left-turn movements specifically because the Proponent understands the difficulty of the movement even under existing conditions; however, is programming it's development to maintain the current access/egress scheme for these driveways.
- The Proponent should seek to lessen the extent of traffic signal infrastructure upgrades at the intersection of King Street / Great Road whereas much of the signal equipment is less than 15-years old. The Proponent had noted its intent to reconstruct the traffic signal in its entirety as a project off-site mitigation commitment.
    - The Proponent has no objection to this; however, the specific details on the overall infrastructure upgrades would be determined at the time of 25% Design during the Permit to Access State Highway process.

- The Proponent should further evaluate the overall parking space count within the site.
    - The DEIR includes a detailed description of the site's parking layout and sizing to be comparable to shared-use demand in order to limit the overall number of parking spaces on the site.
- MassDOT agrees that the finalized ICE Applicability Form and ICE Stage 1 – "Initial Screening" should be submitted following the DEIR as the number of site driveways presented in the DEIR may be further commented on prior to the FEIR. MassDOT also agrees that the levels of driveway / intersection modifications at the intersection of Great Road / Site Driveway West would not qualify for further ICE evaluation unless the commitments are changed beyond the DEIR's description.
    - The Proponent has included a draft ICE Applicability Form to the DEIR but will further discuss with MassDOT during the DEIR comment process.

7.1.2 Building Program & Access

Existing Conditions

The existing 550 King Street location consists of two (2) multi-story buildings with ±485,504 square feet (SF) of office space and associated surface parking historically occupied by the International Business Machines Corporation (IBM). Since the departure of IBM, the buildings have experienced various tenants which have occupied varying small to large portions of the overall space. As of the filing of this DEIR, 72,500 SF of the two (2) buildings is currently occupied with commercial tenants with an additional 20,000 SF under contract for occupancy and currently being fitted for the future tenant. The 550 King Street location is currently accessed via Auman Street, a full access/egress driveway along the northerly side of Great Road, approximately 280-feet west of King Street and two (2) full access/egress driveways along the westerly side of King Street generally adjacent to the IBM buildings. The southerly driveway along King Street noted above is also signed as Auman Street. An additional full access/egress driveway servicing parking for the existing Tuttle House historical property (534 King Street) is also provided and will be inclusive of the project area.

The existing 410 Great Road location consists of several interconnected multi-story mill factory buildings with ±79,456 SF of finished floor area and associated surface parking which are currently occupied by various industrial tenants, namely firearm tenants. The 410 Great Road location is accessed via several driveways and open curb-cuts all along the southerly side of Great Road; including three (3) distinct full access/egress driveways and a single open curb cut to an open pavement area utilized for minimal parking needs.

Proposed Conditions

The Proponent proposes to construct the Project as a dynamic mixed-use housing, commercial, and retail redevelopment, intended as a "Live | Work | Play" mix of uses to bolster the surrounding Littleton Common Central Business District while utilizing the site's proximity to regional access points on I-495. The Project consists of redeveloping the two (2) existing

development locations including repurposing the two (2) former IBM office buildings, demolishing the various mill structures at 410 Great Road, and constructing several other buildings throughout the site with associated surface and structured parking. The proposed mixed-use development program includes ±545,520 SF of research & development space (former IBM buildings), ±19,000 of general office space, ±90,800 SF of retail space, ±20,000 SF of restaurant space, a 150-room hotel with 4,200 SF food service/bar, and 1,089 units of multifamily housing. For the multifamily housing component, 804 units will be located within the 550 King Street location and 285 units will be located within the 410 Great Road location. The 410 Great Road location will be solely for residential use.

The 550 King Street location proposes retaining, albeit slightly shifted, access/egress to the site via Auman Street along the northerly side of Great Road. In addition, the Project proposes to retain the two (2) driveway locations along the westerly side of King Street and construct an additional two (2) full access/egress driveways along the westerly side of King Street. The project will also maintain the existing driveway to the Tuttle House historical property parking lot which will be inclusive of the project area.

The 410 Great Road location will terminate access/egress from all of its existing driveway locations along the southerly side of Great Road and provide full access/egress via a single driveway along the southerly side of Great Road slightly offset from the opposing Auman Street driveway to the 550 King Street location. A second full access/egress driveway will be constructed along the westerly side of King Street within the existing vacant 450 King Street property just south of Dunkin Donuts.

7.1.3 Parking

The existing site currently includes 1,950 off-street surface parking spaces to service the existing uses in both site locations. The Project looks to significantly increase the parking at the site and will provide 3,010 parking spaces to service the redevelopment area (358 parking spaces at the 410 Great Road location and 2,652 parking spaces at the 550 King Street location). A total of 1,446 parking spaces will be in structured parking (garages, decks, parking under podiums) and the remainder at grade.

7.1.4 Methodology

TEC has evaluated the traffic operations and safety characteristics for the study area under existing and future conditions consistent with the *Transportation Impact Assessment (TIA) Guidelines* issued by MassDOT[1] and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports. The future planning horizon examines traffic operations under existing conditions (2024), as well as a 10-year planning horizon (2034)

[1] *Transportation Impact Assessment (TIA) Guidelines*; Massachusetts Department of Transportation; March 13, 2014.

for traffic-volume projections, which includes an evaluation of the No-Build conditions (without the proposed project), Build conditions (with the proposed project), and Build with Mitigation conditions (with the proposed project and any proposed mitigation). The findings and recommendations for the improvements are based on the detailed traffic analyses included in this report.

7.2 Existing Conditions

7.2.1 Traffic Study Area

A comprehensive field inventory of existing traffic conditions on the study area roadways was conducted by TEC, Inc. staff through May 2025. The field investigations consisted of existing roadway geometrics, operating characteristics, study area safety concerns, and multi-modal accommodations. The study area was selected to contain the major roadways providing local access to the project site.

7.2.1.1 Study Area Intersections

The study area was selected to contain the major roadways providing local access/egress to/from the project site. This includes an evaluation of intersection in which the site-generated trips increase the peak hour traffic volume between the No-Build (with full reoccupancy) and Build condition by more than 5 percent and/or by more than 100 vehicles per hour per MassDOT's TIA Guidelines (Section 3.I.C). The following intersections were therefore evaluated as part of the study area:

1. Great Road (Route 119) / Russell Street / Constitution Avenue
2. Great Road (Route 119) / I-495 Southbound (SB) Ramps
3. Great Road (Route 119) / White Street
4. Great Road (Route 119) / I-495 Northbound (NB) Ramps
5. Great Road (Route 119) / Auman Street (IBM West Driveway)
    - *FUTURE: Great Road (Route 119) / Site Driveway West*
6. Great Road (Route 2A / 119) / King Street (Route 2A / 110)
7. Great Road (Route 2A /119) / Stevens Street / Adams Street / Meetinghouse Road
8. *FUTURE: King Street (Route 2A / 119) / 410 Great Road Driveway*
9. King Street (Route 2A / 110) / Goldsmith Street / Stevens Street / 476 King Street Driveway
10. King Street (Route 110) / Meetinghouse Road
11. King Street (Route 110) / Tuttle House Driveway

12. King Street (Route 110) / Auman Street (IBM South Driveway)
    - *FUTURE: King Street (Route 110) / Site Driveway South*
13. *FUTURE: King Street (Route 110) / Site Driveway Middle*
14. King Street (Route 110) / IBM North Driveway
    - *FUTURE: King Street (Route 110) / Site Driveway North*
15. *FUTURE: King Street (Route 110) / Building Q Site Driveway*
16. *FUTURE: Great Road (Route 119) / 410 Great Road Driveway*

The study area intersections and project limits are shown graphically in Figure 7-1.

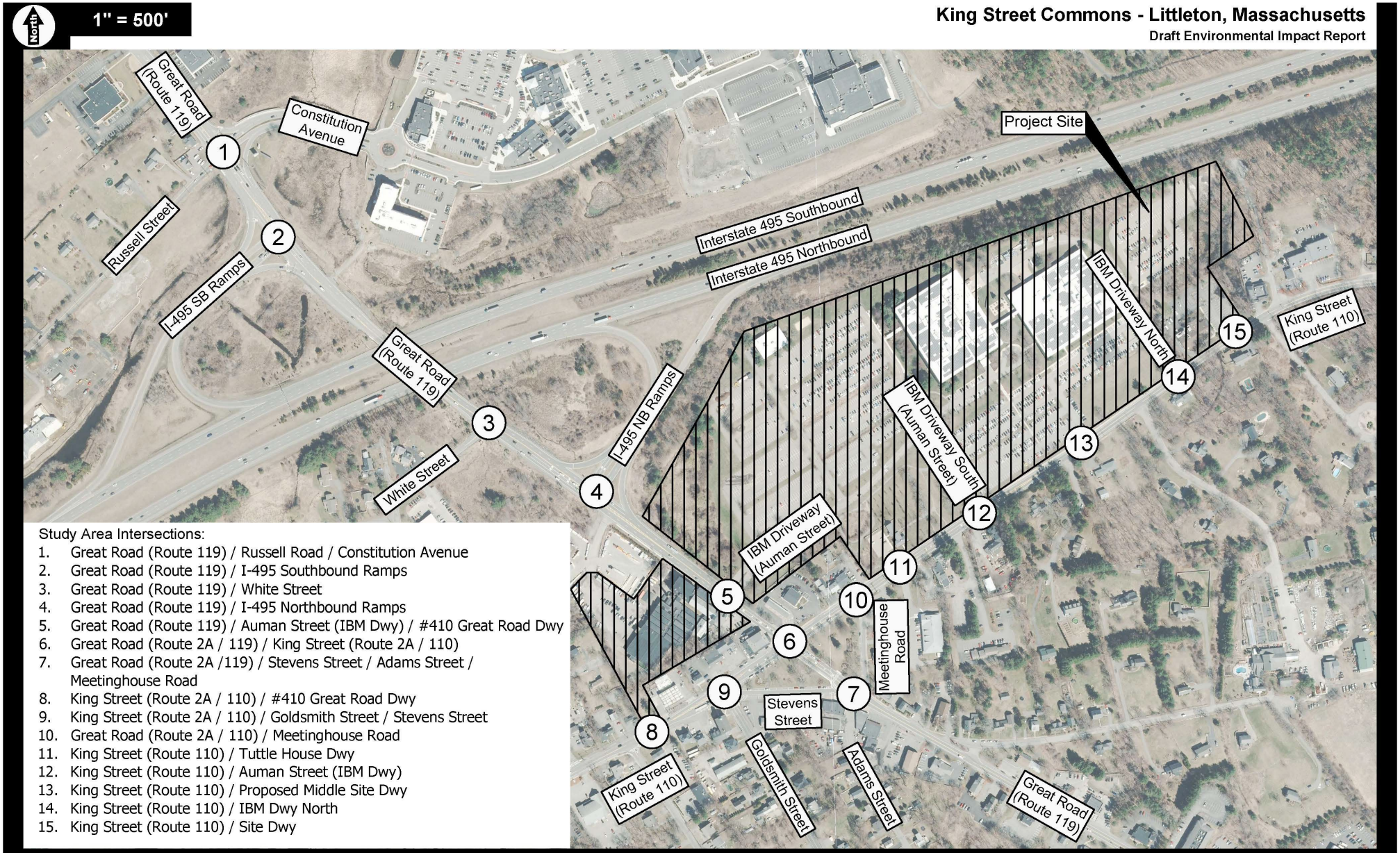
7.2.2 Geometric Conditions

The field inventory included a collection of existing roadway geometrics, pedestrian and bicycle accommodations, traffic volumes, sight distances, and safety data for the existing study area. A description of the existing roadway and intersection inventory is provided within this section.

7.2.2.1 Roadways

Great Road

Great Road is a two-lane, northwest-southeast National Highway System (NHS) urban principal arterial roadway under the jurisdiction of MassDOT within the study area. For the purposes of this document, the cardinal direction of Great Road is noted as east-west. Great Road carries the highway designation of Route 119 west of King Street and both Route 119 and Route 2A east of King Street. The roadway provides a regional connection to Groton to the west and Acton to the east. In the vicinity of the study area, Great Road varies from approximately 85 to 40 feet wide with directional flow separated by a marked centerline. The posted speed limit is 45 miles per hour (mph) west of Littleton Common, 25 mph in the vicinity of Littleton Common, and 35 mph east of Littleton Common. No on-street parking is permitted or provided along the roadway. Sidewalks are provided along the southerly side of the roadway west of King Street and along both sides of the roadway east of King Street within the study area. No formal bicycle accommodation is provided along the corridor. Land use along the roadway within the project area is generally industrial, commercial, municipal, and recreational in nature.



Study Area Intersections:

1. Great Road (Route 119) / Russell Road / Constitution Avenue
2. Great Road (Route 119) / I-495 Southbound Ramps
3. Great Road (Route 119) / White Street
4. Great Road (Route 119) / I-495 Northbound Ramps
5. Great Road (Route 119) / Auman Street (IBM Dwy) / #410 Great Road Dwy
6. Great Road (Route 2A / 119) / King Street (Route 2A / 110)
7. Great Road (Route 2A /119) / Stevens Street / Adams Street / Meetinghouse Road
8. King Street (Route 2A / 110) / #410 Great Road Dwy
9. King Street (Route 2A / 110) / Goldsmith Street / Stevens Street
10. Great Road (Route 2A / 110) / Meetinghouse Road
11. King Street (Route 110) / Tuttle House Dwy
12. King Street (Route 110) / Auman Street (IBM Dwy)
13. King Street (Route 110) / Proposed Middle Site Dwy
14. King Street (Route 110) / IBM Dwy North
15. King Street (Route 110) / Site Dwy

Figure 7-1
Locus Map

King Street

King Street is a two-lane, southwest-northeast NHS (south of Great Road only) urban principal arterial roadway under the jurisdiction of MassDOT within the study area. For the purposes of this document, the cardinal direction of King Street is noted as north-south. King Street carries the highway designation of Route 110 north of Great Road and both Route 110 and Route 2A south of Great Road. The roadway provides a regional connection to Chelmsford / Westford to the north and Harvard to the south. In the vicinity of the study area, King Street varies from approximately 50 to 55 feet wide with directional flow separated by a marked centerline. The posted speed limit is 35 mph south of Littleton Common, 25 mph in the vicinity of Littleton Common, and 40 mph north of Littleton Common. No on-street parking is provided along the roadway. Sidewalks and on-road bicycle lanes are provided along both sides of King Street. Land uses along the roadway within the project area are primarily residential, commercial, and municipal in nature.

7.2.2.2 Intersections

Great Road / Russell Street / Constitution Avenue

Russell Street and Constitution Avenue intersect Great Road to form a four-legged, signalized intersection. The Russell Street northbound approach consists of a single general-purpose lane with directional flow separated by a marked centerline. The Constitution Avenue southbound approach consists of a left-turn lane, a shared left-turn / through lane, and a channelized right-turn lane under yield-control with directional flow separated by a raised median. The Great Road eastbound approach provides an exclusive left-turn lane, a through lane, and a shared through / right-turn lane with directional flow separated by a marked centerline. The Great Road westbound approach provides an exclusive left-turn lane, two through lanes, and a channelized right-turn lane with directional flow separated by a marked centerline.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the northerly side of Great Road west of the intersection, along the southerly side of Great Road east of the intersection, and the westerly side of Constitution Avenue north of the intersection. Crosswalks are provided across both the Constitution Avenue southbound and Great Road westbound approaches. Accessible pedestrian ramps, in above-average condition, are provided on each end of each crosswalk. There are no formal bicycle accommodations at the intersection; however, bikeable shoulders along Great Road are present more than 4-feet in width.

Great Road / Interstate 495 Southbound Ramps

The I-495 SB Ramps intersects Great Road from the south to form a three-legged, signalized intersection. The I-495 SB Ramps northbound approach provides two exclusive left-turn lanes and a channelized right-turn lane under a signal control with directional flow separated by a raised median. The Great Road eastbound approach provides two through lanes and a channelized right-

turn lane under yield-control with directional flow separated by a painted median. The Great Road westbound approach provides an exclusive left-turn lane and two through lanes with directional flow separated by a marked centerline.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the southerly side of Great Road through the intersection with crosswalks across the various openings of the I-495 SB Ramps. Accessible pedestrian ramps, in above-average condition, are provided on each end of each crosswalk. There are no formal bicycle accommodations at the intersection; however, bikeable shoulders along Great Road are present more than 4-feet in width.

Great Road / White Street

White Street intersects Great Road from the south to form a three-legged, unsignalized intersection. The White Street northbound approach is under stop-control and consists of a single general-purpose travel lane with directional flow marked with a short 80-feet long centerline. The Great Road eastbound approach consists of a single general-purpose lane while the westbound approach consists of a shared left-through lane and a through lane. Both approaches are under free-flow conditions with directional flow separated by a marked centerline.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the southerly side of Great Road through the intersection with a crosswalk across the White Street northbound approach. There are no formal bicycle accommodations at the intersection; however, bikeable shoulders along Great Road are present more than 4-feet in width.

Great Road / I-495 Northbound Ramps

The I-495 NB Ramps intersects Great Road from the north to form a three-legged, signalized intersection. The I-495 NB Ramps southbound approach provides two exclusive left-turn lanes and a channelized right-turn lane under a yield-control with directional flow separated by a raised median. The Great Road eastbound approach provides two exclusive left-turn lanes and a through lane with directional flow separated by a marked centerline. The Great Road westbound approach provides two through lanes and a channelized right-turn lane under yield-control with directional flow separated by painted median.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the southerly side of Great Road through the intersection. There are no formal bicycle accommodations at the intersection; however, bikeable shoulders along Great Road are present more than 4-feet in width. A private industrial driveway is present along the southerly side of Great Road between the principal I-495 NB ramp opening and the Great Road westbound channelized right-turn lane's diverge point. This driveway does connect to the

Project's 410 Great Road property; however, it is located on the adjacent parcel and not specifically designated as a site driveway. The driveway is not part of the traffic signal phasing and generally experiences negligible traffic.

Great Road / Auman Street (IBM West Driveway)

The former IBM West Driveway, also signed Auman Street, intersects Great Road from the north to form a three-legged, unsignalized intersection. The IBM West Driveway southbound approach consists of a single general-purpose travel lane under stop-control with directional flow separated by a raised median. The approach width allows for exiting vehicles to stack side-by-side during periods of peak demand. Traditionally, the approach would operate with an exclusive left-turn lane and an exclusive right-turn lane although no pavement markings delineated this lane configuration. The Great Road eastbound approach consists of a shared left-turn / through lane and a through lane under free-flow conditions with directional flow separated by a marked centerline. The Great Road westbound approach consists of a single general-purpose travel lane under free-flow conditions with directional flow separated by a marked centerline.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the southerly side of Great Road through the intersection. There is no formal bicycle accommodation at the intersection.

Great Road / King Street

Great Road and King Street intersect to form a four-legged, signalized intersection. All intersection approaches consist of an exclusive left-turn lane and a shared through / right-turn lane with directional flow separated by a marked centerline. On-street parking is provided on the easterly side of King Street south of the intersection. Sidewalks are provided along the southerly side of Great Road through the intersection, along the westerly side of King Street through the intersection with crosswalks provided across all four intersection approaches. Accessible apex pedestrian ramps are provided on each end of each crosswalk; however, the ramp on the southwest corner of the intersection appear visible to be out of compliance with Americans with Disabilities Act (ADA) / Architectural Access Board (AAB) standards and Public Right-of-Way Accessibility Guidelines (PROWAG). Marked bicycle lanes are provided along both sides of King Street through the intersection.

Great Road / Stevens Street / Adams Street / Meetinghouse Road

Meetinghouse Road, Adams Street, and Steven Street intersect Great Road from the north, south and southwest, respectively to form a five-legged unsignalized intersection. Stevens Street is one-way flow entering the intersection while Meetinghouse Road is one-way flow exiting the intersection. Both Adams Street northbound and Stevens Street northeastbound approaches are under stop-control while both the Great Road eastbound and westbound approaches are free-flowing. All approaches to the intersection consist of a single general-purpose travel lane;

however, Great Road immediately west of the intersection opens to two travel lanes. The directional flow along Great Road is separated by a marked centerline while directional flow along Adams Street is unmarked.

On-street parking is provided on both sides of Stevens Street and on the westerly side of Meetinghouse Road. Sidewalks are present along the southerly side of Great Road west of the intersection, along both sides of Great Road east of the intersection, and along the easterly sides of Meetinghouse Road and Stevens Street. Crosswalks are provided across all five intersection approaches. Pedestrian ramps are provided at the end of each crosswalk; however, many of the ramps are visibly out of compliance with ADA / AAB / PROWAG standards. A marked bicycle lane is provided along the easterly side of Stevens Street.

King Street / Goldsmith Street / Stevens Street / 476 King Street Driveway

Goldsmith Street, the driveway for 476 King Street, and Steven Street intersect King Street from the east, west, and northeast, respectively to form a five-legged unsignalized intersection. The Stevens Street leg of the intersection is one-way flow exiting the intersection to the northeast. Both the 476 King Street Driveway eastbound and Goldsmith Street westbound approaches consist of a single general-purpose travel lane under stop-control. The stop-control along the 476 King Street Driveway eastbound approach is assumed based on configuration; however, no stop signs or stop line is present. Directional flow along Goldsmith Street is separated by a marked centerline. The King Street northbound approach consists of a through lane and a shared bear-right / hard-right lane while the southbound approach consists of single general-purpose travel lane. Both approaches have directional flow separated by a painted median.

On-street parking is provided on both sides of Stevens Street and on the easterly side of King Street north of the intersection. Sidewalks are provided on both sides of King Street south of the intersection, along the westerly side of King Street north of the intersection, along the northerly side of Goldsmith Street, and the easterly side of Stevens Street. Crosswalks are present across the King Street northbound and Goldsmith westbound approaches. Accessible pedestrian ramps are provided at each end of each crosswalk. The ramps appear to be in fair condition and include tactile warning panels; however, compliance with current ADA / AAB / PROWAG standards in terms of grading was unchecked. Sidewalks are also present along the north side of Goldsmith Street and along the east side of Stevens Street and the northern leg of King Street. A marked bicycle lane is provided on both sides of King Street through the intersection and along the easterly side of Stevens Street.

King Street / Meetinghouse Road

Meetinghouse Road intersects King Street from the east to form a three-legged unsignalized intersection. Meetinghouse Road is one-way flow entering the intersection within an exclusive right-turn lane. The Meetinghouse Road westbound approach is under stop control while both the King Street northbound and southbound approaches are free flowing. Both the King Street

northbound and southbound approaches consist of a through lane with directional flow separated by a painted median; however, King Street immediately south of the intersection opens to two travel lanes with a two-way left-turn lane (TWLTL) marked directly north of the intersection.

On-street parking is provided along the southerly side of Meetinghouse Road east of the intersection. Sidewalks are provided along the westerly side of King Street through the intersection and along the northerly side of Meetinghouse Road. A crosswalk is present at the intersection across the King Street southbound approach with accessible pedestrian ramps at each end of the crosswalk. A marked bicycle lane is provided on both sides of King Street through the intersection.

King Street / Tuttle House Driveway

The driveway for the Tuttle House (534 King Street) intersects King Street from the west to form a three-legged unsignalized intersection. The Tuttle House Driveway eastbound approach is under stop control while both the King Street northbound and southbound approaches are free flowing. The Tuttle House Driveway eastbound approach consists of a single general-purpose travel lane with directional flow unmarked. Both the King Street northbound and southbound approaches consist of a through lane with directional flow separated by a marked TWLTL. No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the westerly side of King Street through the intersection with no crosswalk painted across the Tuttle House Driveway approach. A marked bicycle lane is provided on both sides of King Street through the intersection.

King Street / Auman Street (IBM South Driveway)

The IBM South Driveway, also signed Auman Street, intersects King Street from the west to from a three-legged, unsignalized intersection. The IBM Driveway South eastbound approach is under stop control while both the King Street northbound and southbound approaches are free flowing. The IBM South Driveway eastbound approach consists of a single general-purpose travel lane with directional flow separated by a marked centerline. The King Street northbound approach consists of an exclusive left-turn lane and a through lane with directional flow separated by a marked centerline. The King Street southbound approach consists of a single general-purpose travel lane with directional flow separated by a painted median.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the westerly side of King Street through the intersection with no crosswalk painted across the IBM South Driveway South. A marked bicycle lane is provided on both sides of King Street through the intersection.

King Street / IBM North Driveway

The IBM North Driveway intersects King Street from the west to form a three-legged, unsignalized intersection. The IBM North Driveway eastbound approach is under stop control while both the King Street northbound and southbound approaches are free flowing. The IBM North Driveway eastbound approach consists of a single general-purpose travel lane with directional flow separated by a marked centerline. Both the King Street northbound and southbound approaches consist of a single general-purpose travel lane with directional flow separated by a marked centerline.

No on-street parking is provided on the intersection approaches in the vicinity of the intersection. A sidewalk is provided along the westerly side of King Street south of the intersection with a pedestrian ramp and landing provided on the intersection's northwest corner. There is no crosswalk painted across the IBM North Driveway approach. A marked bicycle lane is provided on both sides of King Street through the intersection.

7.2.3 Existing Public Transportation

The Lowell Regional Transit Authority (LRTA) currently operates a bus service along King Street terminating at the site. Bus route and schedule data are included in Appendix E-2 and a summary of the routes is provided below:

- *LRTA Bus Route #15*: This bus route generally runs in a southwest-northeast direction between Kennedy Center in Lowell with a connection to the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail Line and the Site identified as IBM (55 King Street). The bus operates through Lowell, Chelmsford, Billerica, Westford, and Littleton with key internal stops at Atrius Health Center in Chelmsford, Chelmsford Center, Nashoba Valley Technical High School in Westford, and Westford Valley Market Place in Westford. The bus stop within the site represents the terminus bus stop (Bus Stop #372) and provides a bus shelter within the parking field. A schedule outline for the bus route is provided below:
    - *Monday to Friday:* Inbound 7:30 AM-7:45 PM - Outbound 6:45 AM-7:00 PM | Headways – 90 minutes
    - *Saturday:* Inbound 7:30 AM-6:30 PM - Outbound 6:45 AM-5:45 PM | Headways – 75 to 90 minutes

The MBTA currently operates a heavy rail service along the Fitchburg Commuter Rail Line between Wachusett Station in Fitchburg and North Station in Boston. Route and schedule data are included in Attachment A and a summary of the route is provided below:

- *Fitchburg MBTA Commuter Rail*: This rail generally runs in an east-west direction between Wachusett Station in Fitchburg and North Station in Boston with stops at Porter Square in Cambridge, Belmont, Waverly in Watertown, Waltham, Brandeis/Roberts in Waltham,

Kendel Green in Weston, Silver Hill in Weston, Lincoln, Concord, West Concord, South Acton, Littleton / I-495, Ayer, Shirley, North Leominster, Fitchburg ITC, and Wachusett Station. Littleton / I-495 MBTA Commuter Rail Station is located 2.5 miles south of the Project site along Foster Street. A schedule outline for the bus route is provided below:

- *Monday to Friday: Inbound 4:25 AM to 12:31 AM & Outbound 5:40 AM to 1:26 AM | Headways – 35 minutes to 2 hours*
- *Saturday to Sunday: Inbound 5:00 AM to 10:31 PM & Outbound 7:45 AM to 1:16 AM | Headways – 2 to 3 hours*

7.2.4 Existing Traffic Volumes

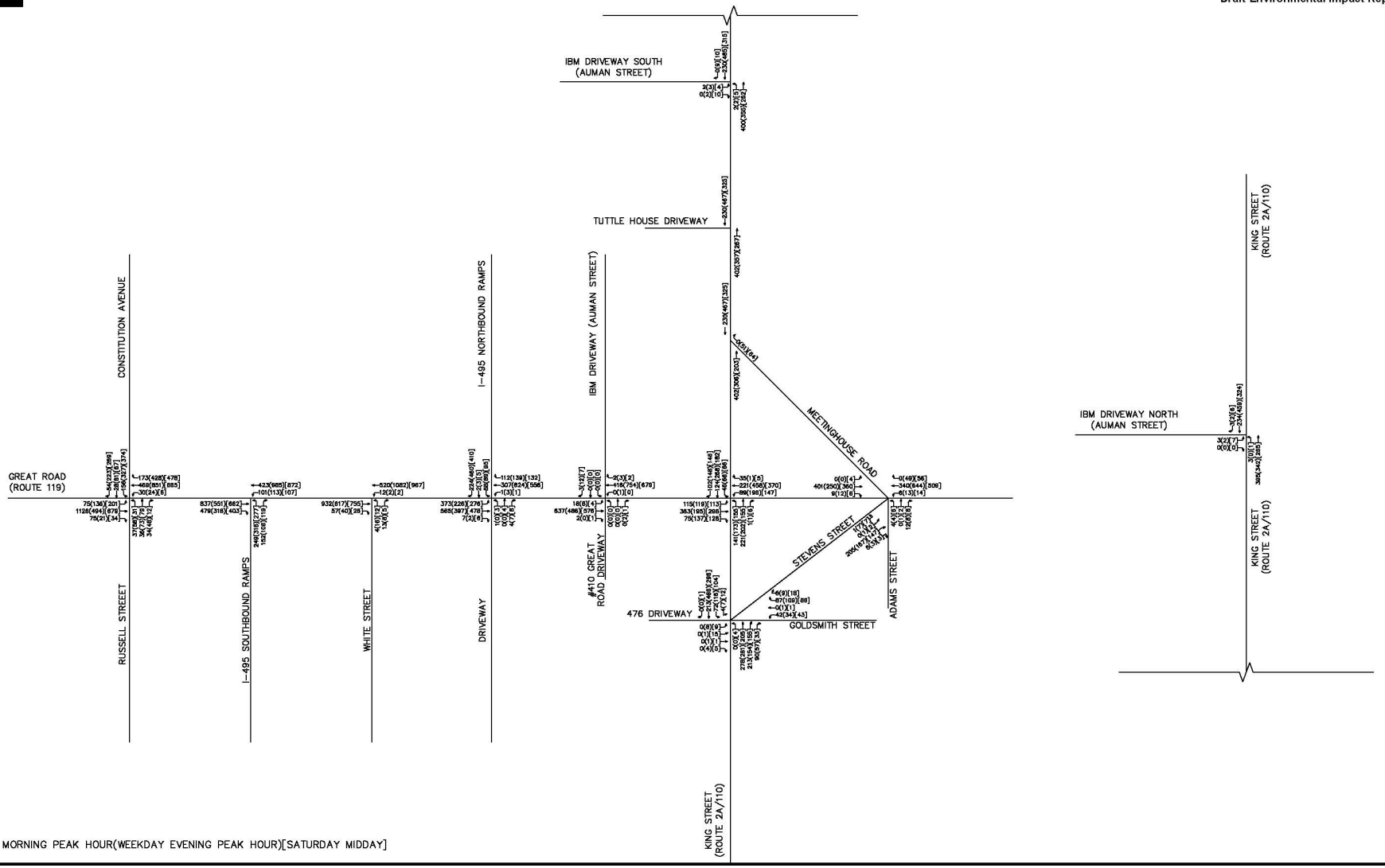
Traffic volume data for this report was obtained from Manual Turning Movement Counts (TMCs) and supplemented with Automatic Traffic Recorder (ATR) counts conducted at the study area intersections. The details of the data collection effort for this project are described below.

7.2.4.1 Turning Movement Counts

To establish existing traffic-volume conditions within the study area, manual TMCs were conducted at study area intersections on multiple dates during the typical weekday and the typical Saturday including traffic volumes within the defined weekday morning (7:00 AM to 9:00 AM), weekday evening (4:00 PM to 6:00 PM), and Saturday midday (11:00 AM to 2:00 PM) peak periods. A majority of the TMCs were completed on Wednesday, December 4, 2024 between 7:00 AM and 7:00 PM and on Saturday, December 7, 2024 between 11:00 AM and 2:00 PM. TMCs at the two (2) existing IBM driveway locations along King Street were conducted subsequently on Tuesday, December 17, 2024 due to minor utility work that was being completed along King Street near the driveways. Areas schools were in regular session during the dates on which the weekday TMCs were collected. A detailed summary of the TMCs, partitioned into 15-minute intervals, is provided within Appendix E-3.

To account for seasonal adjustment for the localized roadways around the site, TEC utilized MassDOT's weekday seasonal and axle correction factors as published in 2024 (year of traffic volume counts). For urban principal arterial roadways and Worcester-area Interstates (King Street, Great Road, and I-495), traffic volumes in the month of December represent the average-month condition (factor of 1.00). Therefore, the December 2024 traffic volumes were left unadjusted to reflect an average-month analysis condition. The compiled seasonal adjustment data is provided in Appendix E-4. The resulting 2024 Existing Conditions weekday morning, weekday evening, and Saturday midday peak hour traffic volume network is illustrated in Figure 7-2.

Not to Scale



King Street Common **Littleton, Massachusetts**

Figure 7-2
2024 Existing Condition Traffic Volumes

TEC The Engineering Corp

7.2.4.2 Automatic Traffic Recorder Counts

ATR counts were conducted concurrently with the TMCs on Great Road at two locations west of Auman Street and east of Adams Street from Wednesday, December, 2024 to Thursday, December 5, 2024 and along King Streett between the two (2) IBM Driveways from Wednesday, January 8, 2025 to Thursday January 9, 2025 to gather daily traffic-volume, vehicle classification, and speed data for the study area roadways during a continuous 48-hour time period. A summary of the weekday ATR traffic data is presented in Table 7-1. A detailed summary of the ATR counts, partitioned into 15-minute intervals, are provided in Appendix E-5.

Table 7-1 Existing Weekday Traffic Volume Summary

Location	Weekday Traffic Volume [a]	Peak Hour Traffic Volume [b]	K Factor [c]	Directional Distribution [d]
Great Road – west of Auman Street	15,861	Weekday Morning Peak Hour		
		1,143	7.2 %	54.2 % EB
		Weekday Evening Peak Hour		
		1,324	8.3 %	62.2 % WB
Great Road – east of Adams Street	13,288	Weekday Morning Peak Hour		
		988	7.4 %	66.3 % EB
		Weekday Evening Peak Hour		
		1,132	8.5 %	61.7 % WB
King Street – btw IBM Driveways	7,434	Weekday Morning Peak Hour		
		579	7.8 %	58.7 % NB
		Weekday Evening Peak Hour		
		755	10.2 %	59.5 % SB

[a] Daily traffic expressed in vehicles per day

[b] Hourly traffic expressed in vehicles per hour

[c] Percent of daily traffic volumes which occurs during the peak hour

[d] Percent of peak hour volume in the predominant direction of travel

Great Road carries a range of traffic within the study area between approximately 13,290 vehicles per day (vpd) and approximately 15,860 vpd on a typical weekday with the upper limit of traffic volumes to the west of the King Street corridor. The peak hours represent between 7.2% and 8.5% of daily traffic with the directional distribution along the roadway weighted in the eastbound and westbound direction during the weekday morning and weekday evening peak hours, respectively. Each represents the typical commuter flows to/from I-495 during each of the respective peak periods.

Speed data indicates that the average speed and 85th percentile speed along Great Road, west of Auman Street, are 27 mph and 33 mph in the eastbound direction, respectively, and 37 mph and 46 mph in the westbound direction, respectively. Based on the location of the ATR, both the average speeds and 85th percentile speeds are lower than the 45 mph speed limit except for the 85th percentile speed for the westbound direction. Speed data also indicates that the average speed and 85th percentile speed along Great Road, east of Adams Street, are 30 mph and 37 mph in the eastbound direction, respectively, and 30 mph and 38 mph in the westbound direction, respectively. Based on the location of the ATR, the average speeds are consistent with the posted speed limit and the 85th percentile speeds much higher than the posted speed. Note that the speed limit increases from 30 mph to 35 mph near the location of the ATR.

King Street carries approximately 7,430 vpd on a typical weekday. The peak hours represent between 7.8% and 10.2% of daily traffic with the directional distribution along the roadway weighted in the northbound and southbound direction during the weekday morning and weekday evening peak hours, respectively. Similarly, each represents commuter flows to/from I-495 during each of the respective peak periods. Speed data indicates that the average speed and 85th percentile speed along King Street is 37 mph and 42 mph in the northbound direction, respectively, and 36 mph and 42 mph in the southbound direction, respectively. Based on the location of the ATR, the average speeds measured are generally lower and the 85th percentile speeds slightly higher than the posted 40 mph speed limit.

7.2.5 Safety Analysis and Review

A comprehensive traffic safety analysis was conducted for the study area intersections. The traffic safety analysis included sight distance measurements, the compilation and examination of study intersection crash data, and a general safety review with consideration given to items on the MassDOT Safety Review Prompt List. Details of each step in the traffic safety analysis are described in the following section.

7.2.5.1 Sight Distance Measurements

TEC measured the available sight distances at the key study area intersections. The available sight lines were compared to minimum requirements established by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distance represents the length of roadway that is visible to a driver traveling within the roadway. Two types of sight distance are typically evaluated for driveways and intersections: stopping sight distance (SSD) and intersection sight distance (ISD). SSD is the minimum distance required for a driver traveling along a roadway to perceive an object in the roadway and stop safely in advance of the object when traveling on a wet pavement surface. SSD is measured from an eye height of 3.5-feet to an object height of 2-feet above the ground, which is equivalent to a driver viewing the taillight of a vehicle ahead. SSD is measured along the centerline of the travel lane approaching the driveway or intersection.

ISD represents the length of the roadway visible to a driver waiting to exit a driveway or minor street. Minimum ISD requirements are based on the distance required for a driver to exit a minor street onto a major street without requiring an approaching vehicle to reduce its speed from the design speed to less than 70 percent of the design speed. ISD is measured from an eye height of 3.5-feet to an object height of 3.5-feet and is measured from a distance 14.5-feet beyond the edge of the travel-way of the major roadway to represent a driver waiting to exit a driveway or minor roadway.

SSD is typically considered the critical sight distance, as it represents the minimum distance required for safe stopping, while ISD represents an acceptable speed reduction for approaching vehicles. The ISD, however, must be at least equal to the minimum required SSD in order to prevent a driver from entering the roadway when an approaching vehicle is too close to safely stop. The guidance provided by AASHTO states:

"If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road."

Roadway grades entering the intersection from each approach were approximated based on a mix of obtained survey and Town of Littleton AxisGIS web database (https://next.axisgis.com/LittletonMA/). Tables 7-2 and 7-3 provide a summary of the available SSD and ISD at the various study area intersections, respectively.

Table 7-2 Existing Stopping Sight Distance Measurements

Approach	Operating Speed [a]	AASHTO Recommended Minimum	Measured Stopping Sight Distance
Great Road at Auman Street:			
Great Road eastbound	33 MPH	215 FT	>500 FT
Great Road westbound	46 MPH	415 FT	275 FT [b]
King Street at FUTURE #410 Great Road Dwy:			
King Street northbound	42 MPH	325 FT	>500 FT
King Street southbound	42 MPH	335 FT	>500 FT
King Street at Tuttle House Dwy:			
King Street northbound	42 MPH	330 FT	>500 FT
King Street southbound	42 MPH	335 FT	>500 FT
King Street at FUTURE Site Dwy South:			
King Street northbound	42 MPH	310 FT	>500 FT
King Street southbound	42 MPH	330 FT	>500 FT
King Street at FUTURE Site Dwy Middle:			
King Street northbound	42 MPH	320 FT	>500 FT
King Street southbound	42 MPH	320 FT	>500 FT

Table 7-2 Existing Stopping Sight Distance Measurements (Continued)

Approach	Operating Speed [(a)]	AASHTO Recommended Minimum	Measured Stopping Sight Distance
King Street at FUTURE Site Dwy North:			
King Street northbound	42 MPH	335 FT	>500 FT
King Street southbound	42 MPH	325 FT	>500 FT
King Street at FUTURE Building Q Dwy:			
King Street northbound	42 MPH	330 FT	>500 FT
King Street southbound	42 MPH	325 FT	>500 FT

[a] Operating speeds calculated as 85th percentile speed from ATR counts in December 2024 and January 2025.

As shown in Table 7-2, the SSD at each of the Project driveway locations exceeds AASHTO minimum recommendations except for Great Road westbound approaching Auman Street as the sight distance is metered by the upstream intersection with King Street 275 feet to the east. Whereas the intersection provides a flatter pavement surface and serves as a crest in the vertical curvature of Great Road, the sight line does not extend any substantial distance past the signalized intersection.

Table 7-3 Existing Intersection Sight Distance Measurements

Approach	Operating Speed [(a)]	AASHTO Recommended Minimum	AASHTO Desired Minimum	Measured Intersection Sight Distance
Great Road at Auman Street				
Auman Street looking east	46 MPH	415 FT	560 FT	240 FT [c,d]
Auman Street looking west	33 MPH	215 FT	330 FT	>500 FT
Great Road at FUTURE 410 Great Road Dwy:				
#410 Dwy looking east	46 MPH	415 FT	560 FT	275 FT [b]
#410 Dwy looking west	33 MPH	215 FT	330 FT	>500 FT
King Street at FUTURE 410 Great Road Dwy:				
#410 Dwy looking north	42 MPH	335 FT	465 FT	210 FT [c]
#410 Dwy looking south	42 MPH	325 FT	465 FT	>500 FT
King Street at Tuttle House Dwy:				
Tuttle House Dwy looking north	42 MPH	335 FT	465 FT	>500 FT
Tuttle House Dwy looking south	42 MPH	330 FT	465 FT	>500 FT
King Street at FUTURE Site Dwy South:				
Site Dwy looking north	42 MPH	330 FT	465 FT	>500 FT
Site Dwy looking south	42 MPH	310 FT	420 FT	>340 FT [e]
King Street at FUTURE Site Dwy Middle:				
Site Dwy looking north	42 MPH	320 FT	465 FT	>500 FT
Site Dwy looking south	42 MPH	320 FT	465 FT	>500 FT
King Street at FUTURE Site Dwy North:				
Site Dwy looking north	42 MPH	325 FT	465 FT	>500 FT
Site Dwy looking south	42 MPH	335 FT	465 FT	>500 FT

Table 7-3 Existing Intersection Sight Distance Measurements (Continued)

Approach	Operating Speed [a]	AASHTO Recommended Minimum	AASHTO Desired Minimum	Measured Intersection Sight Distance
King Street at FUTURE Building Q Dwy:				
Site Dwy looking north	42 MPH	325 FT	465 FT	>500 FT
Site Dwy looking south	42 MPH	330 FT	465 FT	>500 FT

[a] Operating speeds calculated as 85th percentile speed from ATR counts in December 2024 and January 2025.
[b] ISD extends to adjacent controlled intersection
[c] ISD obstructed by vegetation
[d] ISD obstructed by the earth embankment
[e] ISD restricted by the stone wall

Table 7-3 indicates the ISD at each of the study area intersections exceeds AASHTO minimum recommendations except for the following locations:

- The ISD along Auman Street at Great Road looking east is obstructed by a large tree and grading of the embankment along the northerly side of Great Road. Some of this aera is on the adjacent private parcel. Upon removal of the trees and regrading, the ISD would still be less than the AASHTO minimum recommendation as the crest in the vertical curvature of Great Road further limits the sight line past the signalized intersection with King Street.
- The ISD along the future location of the 410 Great Road Driveway looking east along Great Road is obstructed by the crest in the vertical curvature of Great Road which limits the sight line past the signalized intersection with King Street.
- The ISD along the future location of the 410 Great Road Driveway looking north along King Street is obstructed by landscaped plantings along neighboring properties on the westerly side of King Street. Relocation of these plantings would generally result in a sight line that meets AASHTO minimum recommendation.

7.2.5.2 Crash History

Crash data for the study area intersections was compiled and analyzed for the most recent consecutive five-year period (2017-2021), which includes the most recent three-year period (2019–2021) of complete data identified by MassDOT through the Interactive Mapping Portal for Analysis and Crash Tracking (IMPACT) database. The motor vehicle crash data was reviewed to determine if any crash trends exist within the study area. A summary of the vehicle crash data and intersection crash rates are provided in Table 7-4. A detailed compilation of the crash data is provided in Appendix E-6.

High Crash Location Evaluation

Based on the MassDOT Top Crash Location database, there are currently no intersections within the study area that are designated as high crash locations within the boundaries of the Metropolitan Area Planning Council (MAPC). Whereas the study area includes a freeway interchange, TEC contacted the MassDOT Traffic Safety Section in Boston on March 22, 2025 to inquire about the Highway Safety Improvement Program (HSIP) eligibility of the Great Road surface intersections with the I-495 ramps. Ramp terminals, roundabouts, and rotary intersections are not included on MassDOT's Interactive Crash Cluster Map due to geocoding issues. HSIP eligibility is determined based on the Equivalent Property Damage Only (EPDO) score on a location basis where a property damage crash is scored as "1" and an injury / fatal crash is scored as "21". Those locations are deemed eligible if the EPDO score is within the Top 5% of locations within the boundaries of the subject Municipal Planning Organinzation (MPO), in this case the MAPC. The Top 5% threshold for MAPC in the 2019-2021 HSIP year (current year of eligibility) is published as greater than or equal to 109.

MassDOT's Traffic Safety Section provided electronic versions of the crash reports for the two (2) surface intersections as part of the evaluation on May 8, 2025. TEC examined each of the crash reports including any crash that were adjacent to the intersection location and could be interpreted to be within the sphere of influence of the traffic signal control; but not those crashes related to the freeway merge or diverge or along the ramp outside the sphere of influence. Based upon the crash report data, both surface intersections did meet the threshold for 2019-2021 HSIP eligibility for the MAPC. No Road Safety Audit (RSA) is therefore required for these ramp terminal locations. MassDOT has not provided confirmation of this evaluation prior to the submission of the DEIR.

Crash Rate Worksheet

In addition to examining the number of crashes at the study intersections, an intersection crash rate was calculated to compare the occurrence of crashes to the volume of traffic passing through the study intersections. The crash rate per million entering vehicles (MEV) was calculated using the evening peak hour volumes from the TMCs, a calculated K-factors obtained from ATR counts, and the total years of completed crash data. The crash rate at the intersections were compared to the statewide and district-wide averages published by MassDOT in June 2018 to determine the significance of the crash occurrence. The statewide average for signalized intersections is 0.78 crashes per MEV, and the District 3 average is 0.89 crashes per MEV. The statewide average for unsignalized intersections is 0.57 crashes per MEV, and the District 3 average is 0.61 crashes per MEV.

Crash History Summary

Great Road / Russell Street / Constitution Avenue

The signalized intersection of Great Road / Russell Street / Constitution Avenue experienced thirty-three (33) or an average more than six (6) crashes per year over the five-year study period. The crash rate was calculated at 0.55 crashes per MEV which is lower than the statewide and district-wide averages for signalized intersections. Over 40% (or 14 of 33) of the crashes were rear-end crashes of which eight (8) occurred between 3 PM and 7 PM indicating that the commuter congestion and queueing may be a contributing factor. In addition, one-quarter (or 8 or 33) of crashes were sideswipe crashes and over 20% (or 7 of 33) were angle type crashes. Four (4) of the crashes that occurred at the intersection resulted in non-fatal injuries. Approximately 30% (or 10 of 33) crashes occurred during periods of dark-sky, dawn, or dusk which may denote a deficiency in street lighting near the intersection.

Great Road / I-495 Southbound Ramps

As crash reports for this location were directly obtained from MassDOT for the 2019-2021 HSIP evaluation, this location was only assessed for a three-year study period. The signalized intersection of Great Road / I-495 SB Ramps experienced eighteen (18) or six (6) crashes per year over the three-year study period. The crash rate was calculated at 0.58 crashes per MEV which is significantly lower than the statewide and district-wide averages for signalized intersections. The intersection experienced six (6) rear-end crashes, six (6) sideswipe crashes, and four (4) angled crashes. One-third (or 6 of 18) of the crashes at this location occurred atop wet or snow-covered pavement. There were four (4) injury crashes reported at the intersection.

Great Road / White Street

The unsignalized intersection of Great Road / White Street experienced eight (8) or an average of less than two (2) crashes per year over the five-year study period. The crash rate was calculated at 0.21 crashes per MEV which is significantly lower than the statewide and district-wide averages for unsignalized intersections. Seven (7) crashes were rear-end crashes which may suggest that crashes at this location are more related to the congestion along Great Road as opposed to the intersection conflict points with White Street. while the remaining two (2) crashes were sideswipe crashes. The intersection experienced no crashes that resulted in non-fatal injury. Three quarters (or 6 of 8) of the crashes occurred between 3 PM and 7 PM indicating that commuter congestion and queueing may be a contributing factor.

Great Road / I-495 Northbound Ramps

As crash reports for this location were directly obtained from MassDOT for the 2019-2021 HSIP evaluation, this location was only assessed for a three-year study period. The signalized intersection of Great Road / I-495 NB Ramps experienced twenty-five (25) or an average of more than eight (8) crashes per year over the five-year study period. The crash rate was calculated at

0.98 crashes per MEV which is higher than the statewide and district-wide averages for signalized intersections. More than 60% (or 16 of 25) of the crashes were rear-end crashes of which ten (10) occurred between 3 PM and 7 PM indicating that the commuter congestion and queueing may be a contributing factor. An additional seven (7) crashes were sideswipe crashes where each approach consists of multiple travel lanes in each direction. There were three (3) injury crashes reported at the intersection.

Great Road / IBM West Driveway (Auman Street)

The unsignalized intersection of Great Road / IBM West Driveway (Auman Street) experienced twenty-two (22) or an average less than (5) crashes per year over the five-year study period. The crash rate was calculated at 0.80 crashes per MEV which is significantly higher than the statewide and district-wide averages for unsignalized intersections. The crash rate at this location may be misleading as the crash years included in the evaluation were during a period when the IBM buildings were fully occupied and the traffic volume at this location would have been higher; thereby lowering the crash rate from the value calculated with 2024 traffic volumes. More than half (or 12 of 22) of the crashes were rear-end crashes of which five (5) occurred between 3 PM and 7 PM indicating that the commuter congestion and queueing may be a contributing factor. Seven (7) of these rear-end crashes indicated driver inattention or distraction as the contributing factor in the crash. There were four (4) angled crashes at this location of which two (2) crashes note obstructed visibility as a contributing factor. Only one (1) injury crash was reported at the intersection.

Great Road / King Street

The signalized intersection of Great Road / King Street including the immediate vicinity experienced seventy-nine (79) or an average of less than sixteen (16) crashes per year over the five-year study period. The crash rate was calculated at 1.85 crashes per MEV which is significantly higher than the statewide and district-wide averages for signalized intersections. The crash data downloaded from the MassDOT IMPACT database is non-specific as to the exact location of crashes for this location where many of the crashes are noted to have occurred along the intersection approaches without identifying the traffic signal as the control method. This would indicate that many of these crashes occurred at the adjacent commercial driveways (e.g., Mobil Gas Station) where the IMPACT database does not specifically call out crashes. It is likely that the number of crashes related to the principal intersection is much lower than reported. Nearly 40% (or 31 of 79) of the crashes were rear-end crashes with more than one-quarter (or 22 of 79) crashes being angled type crashes. Fourteen (14) of the crashes in the vicinity of this location were sideswipe crashes. There was one (1) reported bicycle crash. Nearly 40% (or 33 of 79) of the crashes occurred between 3 PM and 7 PM indicating that commuter congestion and queueing may be a contributing factor. An additional ten (10) crashes between 6 AM and 9 AM for the morning commuter peak period. Although the number of overall crashes was elevated, only six (6) crashes were reported that resulted in an injury. More than one-third (27 of 79) of crashes noted driver inattention or distraction as the contributing factor in the crash, while nine (9) crashes noted visibility obstruction or glare as the contributing factor in the crash.

Great Road / Stevens Street / Adams Street / Meetinghouse Road

The unsignalized intersection of Great Road / Stevens Street / Adams Street / Meetinghouse Road experienced eleven (11) or an average of more than two (2) crashes per year over the five-year study period. The crash rate was calculated at 0.44 crashes per MEV which is significantly lower than the statewide and district-wide averages for unsignalized intersections. Nearly half (or 5 of 11) of the crashes were rear-end crashes likely due to the congestion along the Great Road mainline and unrelated to the operations of the subject intersection. The intersection experienced two (2) crashes that resulted in an injury. Almost half (5 of 11) of crashes noted driver inattention or distraction as the contributing factor in the crash.

King Street / Goldsmith Street / Stevens Street / 476 King Street Driveway

The unsignalized intersection of King Street / Goldsmith Street / Stevens Street / 476 King Street Driveway experienced eighteen (18) crashes or an average of less than four (4) crashes per year over the five-year study period. The crash rate was calculated at 0.68 crashes per MEV which is higher than the statewide average and district-wide average for unsignalized intersections. Almost half (or 8 of 18) of the crashes were angled type crashes. The intersection experienced one (1) crash that resulted in an injury. Almost one-third (or 5 of 18) of crashes noted driver inattention or distraction as the contributing factor in the crash.

Other King Street Study Area Intersections

The intersection of King Street with Meetinghouse Road, the Tuttle House, the IBM North Driveway, and IBM South Driveway experienced no crashes during the five-year study period.

Table 7-4 Crash Data Summary

Parameter		Great Road / Russell Street / Constitution Avenue	Great Road / I-495 Southbound Ramps	Great Road / White Street
Crash Year	2017	10	-	3
	2018	7	-	2
	2019	5	9	1
	2020	4	3	2
	2021	7	6	0
	TOTAL	***33***	***18***	***8***

Table 7-4 Crash Data Summary (Continued)

Parameter		Great Road / Russell Street / Constitution Avenue	Great Road / I-495 Southbound Ramps	Great Road / White Street
Average Annual Crashes		***6.6***	***6.0***	***1.6***
Rate per MEV		***0.55***	***0.58***	***0.21***
Manner of Crash	Angle	6	4	0
	Rear-end	14	6	7
	Single Vehicle	2	1	0
	Sideswipe	8	6	1
	Head-on	1	0	0
	Pedestrian / Cyclist	0	0	0
	Other / Not Reported	2	1	0
	TOTAL	***33***	***18***	***8***
Road Surface Conditions	Dry	23	12	5
	Wet	7	5	3
	Snow / Ice	2	1	0
	Other / Unknown	1	0	0
	TOTAL	***33***	***18***	***8***
Injury Status (Crash Severity)	Property Damage	28	14	8
	Non-Fatal Injury	4	4	0
	Not Reported	1	0	0
	TOTAL	***33***	***18***	***8***
Day of Week	Monday-Friday	24	15	7
	Saturday-Sunday	9	3	1
	TOTAL	***33***	***18***	***8***
Time of Day	6:00AM-9:00AM	2	2	0
	9:00AM-12:00PM	5	6	0
	12:00PM-3:00PM	7	2	2
	3:00PM-6:00PM	8	4	5
	6:00PM-9:00PM	6	1	1
	9:00PM-6:00AM	5	3	0
	TOTAL	***33***	***18***	***8***

Table 7-4 Crash Data Summary (Continued)

Parameter		Great Road / I-495 Northbound Ramps	Great Road / IBM West Driveway	Great Road / King Street
Crash Year	2017	-	4	22
	2018	-	5	12
	2019	13	6	19
	2020	9	3	13
	2021	3	4	13
	TOTAL	***25***	***22***	***79***
Average Annual Crashes		***8.3***	***4.3***	***15.8***
Rate per MEV		***0.98***	***0.80***	***1.85***
Manner of Crash	Angle	2	4	22
	Rear-end	16	12	31
	Single Vehicle	0	0	3
	Sideswipe	7	3	14
	Head-on	0	0	2
	Pedestrian / Cyclist	0	0	1
	Other / Not Reported	0	3	6
	TOTAL	***25***	***22***	***79***
Road Surface Conditions	Dry	21	18	64
	Wet	3	4	12
	Snow / Ice	1	0	2
	Other / Unknown	0	0	1
	TOTAL	***25***	***22***	***79***
Injury Status (Crash Severity)	Property Damage	22	21	72
	Non-Fatal Injury	3	1	6
	Not Reported	0	0	1
	TOTAL	***25***	***22***	***79***
Day of Week	Monday-Friday	20	22	65
	Saturday-Sunday	5	0	14
	TOTAL	***25***	***22***	***79***
Time of Day	6:00AM-9:00AM	1	2	8
	9:00AM-12:00PM	4	3	10
	12:00PM-3:00PM	6	6	24
	3:00PM-6:00PM	12	8	25
	6:00PM-9:00PM	1	3	6
	9:00PM-6:00AM	1	0	6
	TOTAL	***25***	***22***	***79***

Table 7-4 Crash Data Summary (Continued)

Parameter		Great Road / Adams Street / Stevens Street	King Street / Goldsmith Street / Stevens Street
Crash Year	2017	3	2
	2018	2	7
	2019	2	1
	2020	1	3
	2021	3	5
	TOTAL	***11***	***18***
Average Annual Crashes		***2.2***	***3.6***
Rate per MEV		***0.44***	***0.68***
Manner of Crash	Angle	2	8
	Rear-end	5	3
	Single Vehicle	1	3
	Sideswipe	1	2
	Head-on	0	0
	Pedestrian / Cyclist	0	0
	Other / Not Reported	2	2
	TOTAL	***11***	***18***
Road Surface Conditions	Dry	10	15
	Wet	0	3
	Snow / Ice	1	0
	Other / Unknown	0	0
	TOTAL	***11***	***18***
Injury Status (Crash Severity)	Property Damage	9	17
	Non-Fatal Injury	2	1
	Not Reported	0	0
	TOTAL	***11***	***18***
Day of Week	Monday-Friday	10	14
	Saturday-Sunday	1	4
	TOTAL	***11***	***18***
Time of Day	6:00AM-9:00AM	0	2
	9:00AM-12:00PM	3	3
	12:00PM-3:00PM	3	2
	3:00PM-6:00PM	4	5
	6:00PM-9:00PM	1	5
	9:00PM-6:00AM	0	1
	TOTAL	***11***	***18***

7.3 Future Conditions

Traffic volumes in the study area were projected to the year 2034, which reflects a 10-year planning horizon in accordance with MassDOT guidelines. The traffic conditions for the year 2034**,** under No-Build conditions, were developed to document the operating conditions independent of the potential development, including all existing traffic, new traffic resulting from background growth, and traffic from specific developments in the vicinity of the site. Anticipated site generated traffic volumes for the mixed-use development were superimposed upon the No-Build traffic networks to reflect the Build conditions with the potential new development traffic.

7.3.1 Background Traffic Growth

Traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an ambient growth rate for the area roadways and applies that percentage to all mainline and side street traffic volumes. The drawback to such a procedure is that some turning volumes may grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

7.3.1.1 General Ambient Growth

To determine future traffic growth projections, TEC then utilized MassDOT published year-by-year annual growth data between 2016 and 2019 (most recent published data without COVID influence) to approximate annual growth in the area. The data indicates that for urban principal arterials, traffic volumes between 2016 and 2017 grew 1.1 percent, between 2017 and 2018 grew 1.4 percent, and between 2018 and 2019 grew 0.4 percent. This represents an approximate 0.97 percent increase in traffic per year on urban principal arterials. The data indicates that for urban minor arterials and collectors, traffic volumes between 2016 and 2017 grew 1.7 percent, between 2017 and 2018 grew 0.3 percent, and between 2018 and 2019 decreased by 0.4 percent. This represents an approximate 0.53 percent increase in traffic per year on urban principal arterials. To provide a consistent analysis scenario, a 1.0% per year compounded annual background growth rate was used to account for potential future traffic growth external to the study area and any unforeseen development. The MassDOT annual growth data is provided in Appendix E-7.

7.3.1.2 Specific Developments by Others

TEC contacted the Town of Littleton Planning Department to identify nearby private and public development projects in the vicinity of the study area that were either in the planning process or were approved by the Planning Board at the time of the traffic volume counts. Based on these discussions, the Town of Littleton identified three (3) projects that are in the vicinity of the study area not yet occupied following the planning process or approval by the Planning Board.

- *531 King Street Animal Care Center* – The project includes renovation and relocation of the building within the property and convert the property's multi-unit office condo to the proposed animal care center. The project is not anticipated to result in any substantial change in traffic volumes or traffic patterns and therefore any change in traffic is considered inclusive to the 1.0% per year background growth rate. The project was approved by the Planning Board with a Decision posted on February 13, 2025.
- *600 Great Road Tendercrop Farm Building* – The project includes the expansion of the existing farmstand building to include more retail space and relocated greenhouse space on-site. As an existing farmstand use, the project is not anticipated to result in any substantial change in traffic volumes or traffic patterns within the study area and therefore any change in traffic is considered inclusive to the 1.0% per year background growth rate. The project is still within the Planning Board process at the time of DEIR submittal.
- *265/289 Great Road (Northern Bank), Mix-Used Development* – The project includes the construction of five (5) buildings including a 4,006 SF Bank, a 6,574 SF grocery store, 13,400 SF of office space, and 13,900 SF of retail space. TEC projected site generated traffic through the study area based on trip generation and distribution data provided within the project's *Response to Peer Review Comments on the Traffic Impact Report* prepared by Vanasse and Associates, Inc. (VAI) in December 2022. The project is currently under construction.

Trip generation data related to these specific developments by others is provided in Appendix E-8. The resulting Specific Developments by Others weekday morning, weekday evening, and Saturday midday peak hour traffic volume networks are illustrated in Figure 7-3.

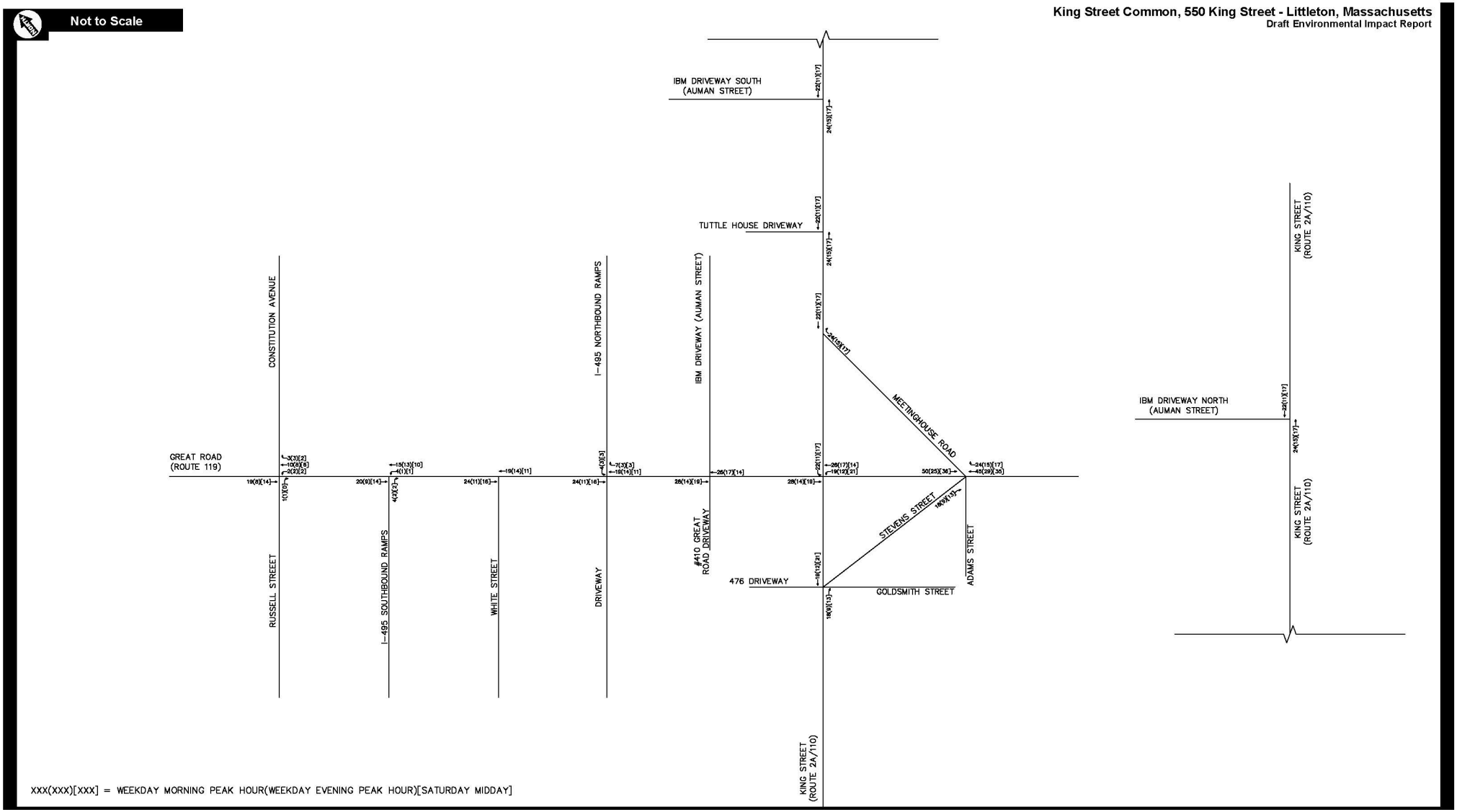


Figure 7-3

2024 Specific Developments by Others Peak Hour Traffic Volumes

7.3.1.3 Area Roadway Projects

TEC coordinated with MassDOT and the Town of Littleton to identify nearby public roadway improvement projects in the vicinity of the study area that were in the design or planning process that may alter traffic flow at the intersection. Based on these discussions, MassDOT identify one (1) project within the project area.

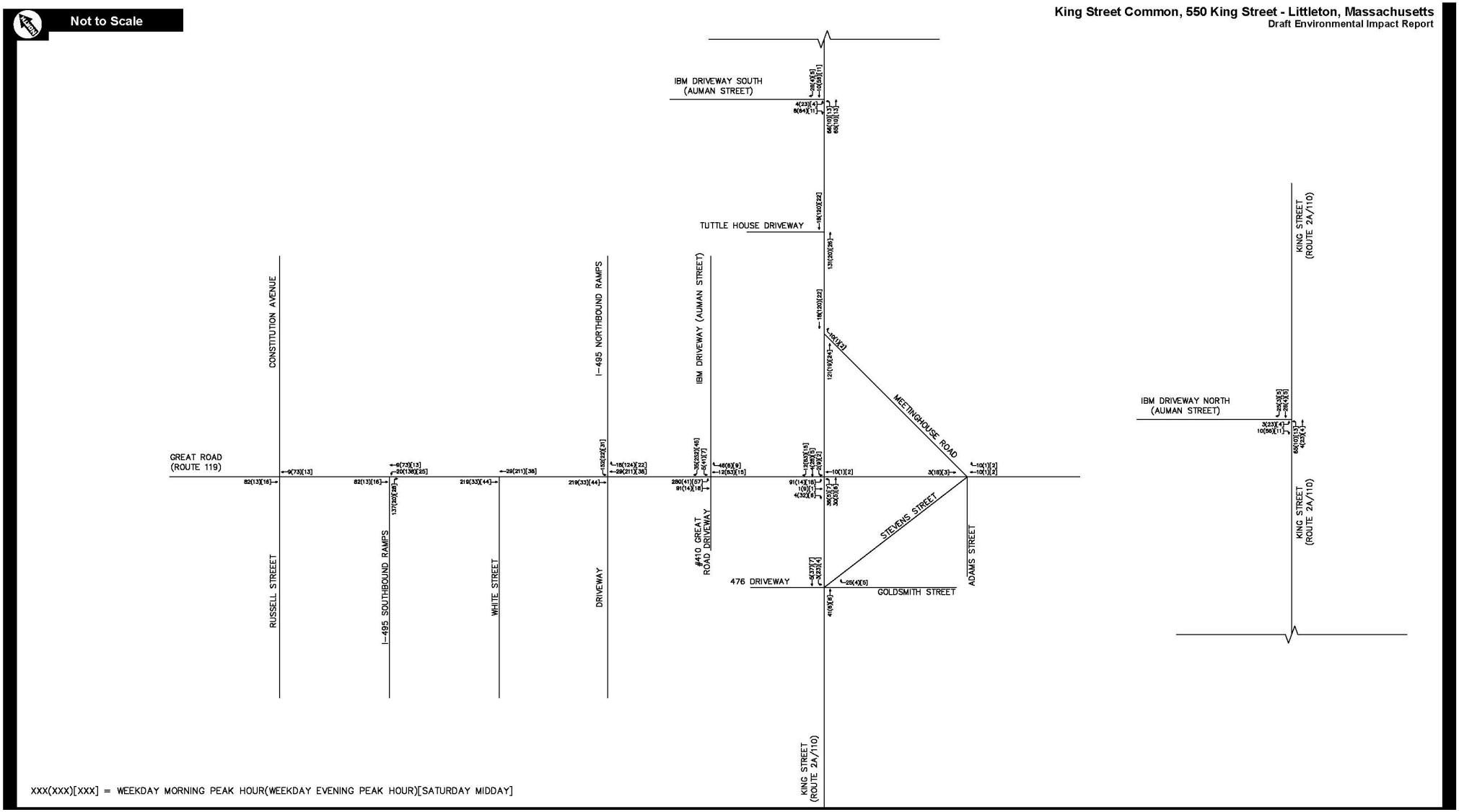
- *MassDOT Project File No. 613111 – Deck Replacement Route 119 over Interstate 495 (L-13-030)* – MassDOT seeks to complete a full replacement of the reinforced concrete deck of the Route 119 over I-495 bridge. The project design submitted its 25% design package on December 13, 2024. There is currently no specified Transportation Improvement Program (TIP) year identified although MassDOT notes that the original TIP identification was for prior to 2029. The project will not change the transportation or cross-sectional characteristics of the bridge.

7.3.2 Reoccupancy of Existing Office Space

The existing site consists of ±485,504 SF office space previously occupied by the IBM Corporation. Since the departure of IBM, the buildings have experienced various tenants which have occupied varying small to large portions of the overall space. As of the filing of this DEIR, 72,500 SF of the two (2) buildings is currently occupied with various commercial tenants with an additional 20,000 SF under contract for occupancy and currently being fitted for the future tenant. It is reasonable to anticipate that these two (2) buildings could be fully reoccupied at a future date with minimal permitting. As such, a projection of the fully occupied site has been included in the No-Build scenario with credit for the existing traffic volumes/trip generation currently accessing the various 550 King Street driveway locations along Great Road and King Street. To determine the future operation of the site driveways and adjacent roadway system with the full reoccupation of the building, traffic volumes were projected for a general office building use which would be a typical traffic generator for the site under the current building footprints and internal layouts. TEC estimated the number of vehicle trips to be generated by the office building using the industry standard trip rates published in the ITE publication *Trip Generation, 11th Edition* for LUC 710 – General Office Building. Detailed trip generation calculation worksheets related to the full reoccupancy are provided in Appendix E-9. The resulting Site Reoccupancy weekday morning, weekday evening, and Saturday midday peak hour traffic volume networks are illustrated in Figure 7-4.

7.3.3 2034 No-Build Traffic Volumes

The 2034 No-Build Condition weekday morning, weekday evening, and Saturday midday peak hour traffic volume networks were developed by applying the 1.0% per year compounded annual background traffic growth rate on the 2024 Existing Year Condition peak hour traffic volumes over the 10-year design horizon, the addition of known traffic by the defined specific development by



King Street Common **Littleton, Massachusetts**

Figure 7-4

Reoccupancy of Existing Office Peak Hour Traffic Volumes

others expected to be completed by 2034, and the full reoccupation of the former IBM buildings at the 550 King Street location. The resulting 2034 No-Build Condition weekday morning, weekday evening, and Saturday midday peak hour traffic volume networks are illustrated in Figure 7-5.

7.3.4 Site Generated Traffic

The proposed mixed-use development program includes ±545,520 SF of research & development space (renovations of the former IBM buildings), ±19,000 of general office space, ±90,800 SF of retail space, ±20,000 SF of restaurant space, a 150-room hotel, and 1,089 units of multifamily housing. For the multifamily housing, 804 units will be located within the 550 King Street location and 285 units will be located within the 410 Great Road location. TEC estimated the site generated traffic based on industry standard trip rates published in the ITE publication, *Trip Generation, 11th Edition* for LUC 221 – Multifamily Housing (Mid-Rise), LUC 310 – Hotel, LUC 710 – General Office Building, LUC 760 – Research and Development Center, LUC 821 – Shopping Plaza (40-150k), and LUC 932 – High-Turnover (Sit-Down) Restaurant. Note that the 4,200 SF food service/bar within the hotel is not expected to generate separate traffic from the hotel's use based on the LUC 310 – Hotel description provided in the ITE publication. Detailed trip generation calculation worksheets are provided in Appendix E-9.

7.3.4.1 Mode Share

Public Transportation Trips

LRTA Bus Route 15 provides direct access to/from the site and the service will be enhanced to include two (2) dedicated bus stops within the 550 King Street location. The availability, proximity, and robustness of public transportation for access to the site will result in a noticeable shift of potential trips generated by passenger vehicles traveling to/from the site to public transportation trips. A reduction in site-generated traffic volumes is expected.

Based on United States (US) Census Bureau American Community Survey Five Year Estimates for 2019 – 2023 on commuting to work mode splits, approximately 3.0% of Littleton Common Census Designated Places (CDP) residents will utilize public transportation for commuting to work.[2] It is important to note that this mode split for public transportation utilization included residents for this section of Littleton which has existing access to public transportation along the same bus route. This percentage was projected onto both residential, office, and research & development land uses. It is likely that the public transportation usage for all land uses on site will be greater than 3.0% as the US Census estimation is based on existing conditions where Littleton Common CDP does not currently include the fully reoccupied IBM buildings within the census survey projections nor does a shuttle service exist to the Littleton / I-495 MBTA Commuter Rail Station

[2] *2019-2023 American Community Survey 5-Year Estimates*; United States Census Bureau; Washington, D.C.; downloaded on May 2, 2025.

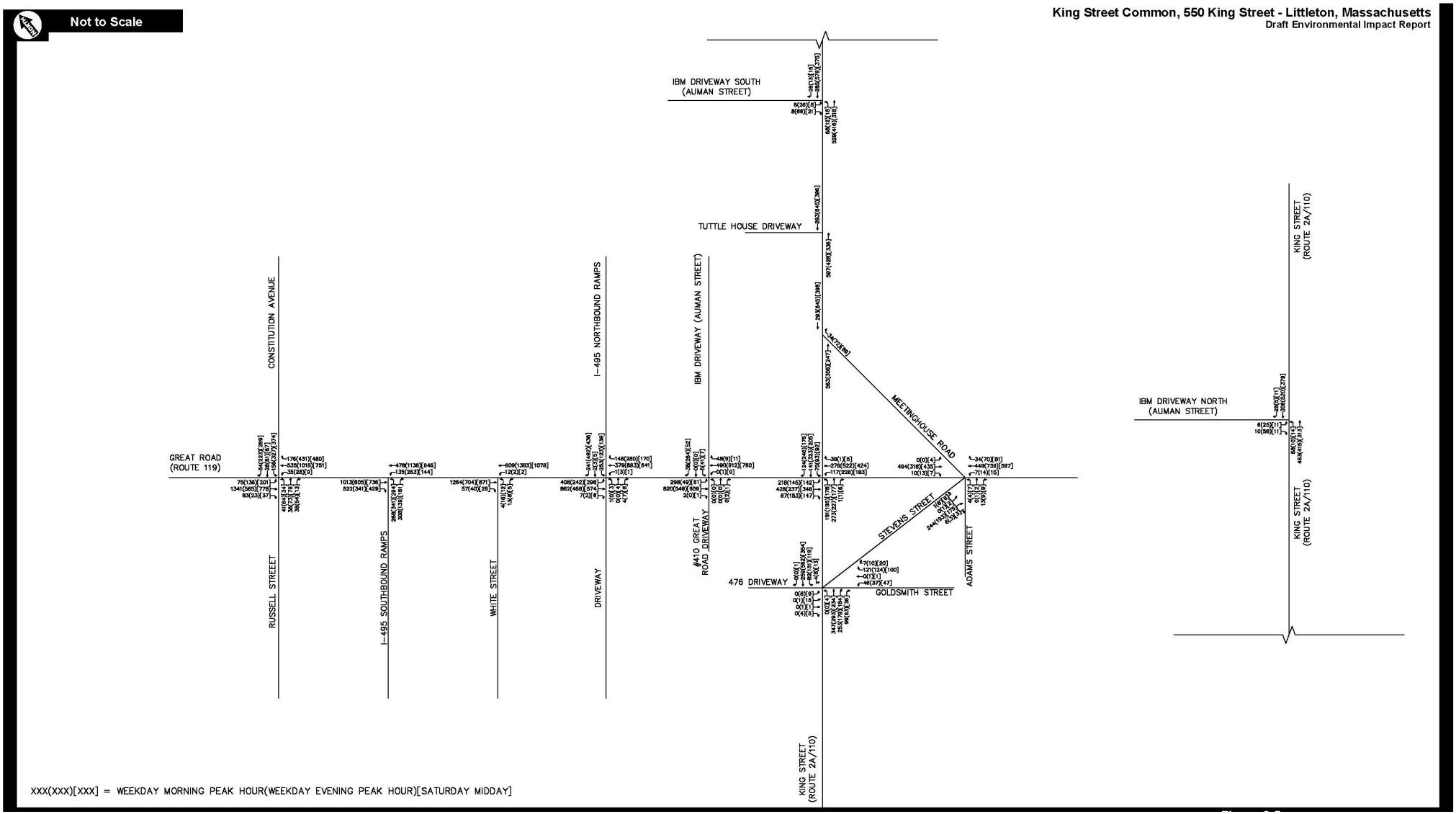


Figure 7-5
2034 No-Build Peak Hour Traffic Volumes

which is a Transportation Demand Management (TDM) measure that will be employed by the Proponent for the site. For the purpose of this TIAPS, the lower 3.0% transit trip rate was utilized to present a conservative analysis. A copy of the US Census data is provided in Appendix E-10.

Walking / Bicycle Trips

While a significant number of residents, patrons, and employees are expected to enter and exit the Project Site using a personal vehicle or utilize public transportation, pedestrian and bicycle amenities will have a measurable impact of reducing external automobile trips. Generally, the standard trip rates published in the ITE publication *Trip Generation, 11th Edition* do not specify the number of pedestrian and bicycle related trips to/and from each data point site.

Retail / Restaurant / Hotel Uses

The ITE publication *Trip Generation Handbook, 3rd Edition - Appendix D* provides mode share related data for pedestrian and bicycle trips for urban infill development sites which are defined as a site for which the surrounding area within a one-half mile radius is mostly developed (i.e. central business district or urban center). Infill sites will typically exhibit areas of higher walkability and bike-friendly, provide multiple different land uses, and have public transportation access; all of which meet the characteristics of this section of Littleton. For retail uses in a suburban business district, infill sites would be expected to generate 8.0% of weekday morning peak hour and 4.0% of weekday evening peak hour traffic for combined pedestrian and bicycle use. The lower percentages, 4.0%, was assessed for all over time period scenarios. These percentages were also assessed for all restaurant uses as the publication does not provide specific restaurant data for suburban business districts. Excerpts from the Trip *Generation Handbook, 3rd Edition - Appendix D* is provided in Appendix E-10.

Residential / Office Uses

The Littleton Common area does provide walkability and bike-friendly areas; however, the level of development currently present outside of the King Street Common development in terms of commuting to work characteristics is limited. For the purpose of this analysis, TEC researched the walking and bicycle use trends for means of commuting to work within other similar town center areas in close proximity to Littleton Common; including, Clinton CDP, West Concord CDP, and Maynard CDP based on US Census Bureau American Community Survey Five Year Estimates for 2019 – 2023 on commuting to work mode splits. The results of the community comparison are shown in Table 7-5.

Table 7-5 Walk & Bike Trip Community Comparison

Community	Walk	Bike	Total
Clinton CDP, Massachusetts	3.2%	0.0%	3.2%
West Concord CDP, Massachusetts	3.9%	0.8%	4.7%
Maynard CDP, Massachusetts	1.6%	0.0%	1.6%
Average Walk / Bike Means of Transportation			**3.2%**

The community data comparison indicates that neighboring communities with similar built-up town center areas with multiple land uses experience 3.2% of commuting to work trips as pedestrian and bicycle trips on average. For the purpose of this TIAPS, the lower 3.0% pedestrian / bicycle trip rate was utilized to present a conservative analysis. A copy of the US Census data is provided in Appendix E-10.

7.3.4.2 Internal Capture

It is reasonable to expect that some site-generated trips to the site will be shared amongst multiple land uses. For example, someone living on-site may choose to visit the retail buildings within the Project site without entering/exiting to/from the public roadway network. As a result, a reduction in the overall external trips experienced at the site driveways can be anticipated because of multi-use, or shared, trips that include stops at more than one use on the site. Based on information contained in the industry standard ITE publication *Trip Generation Handbook, 3rd Edition*, multi-use trips were assigned for trip sharing amongst the office, hotel, residential, restaurant, and the retail uses. Note that the residential traffic for the 410 Great Road location is not included in the internal capture rate calculations as any trip to/from this location would be required to enter/exit to/from the public roadway network. Internal capture is anticipated to account for between 19.7% and 27.7% of all trips, depending on time period, which is a testament of the multi-use nature of the site. The internal capture trip generation worksheets are included in Appendix E-9.

7.3.4.3 Pass-By Trips

Not all of the trips generated by the proposed mixed-use redevelopment will be new to the roadway network. Many of the trips generated by the proposed redevelopment are already present in the existing traffic flow passing by the site and may decide to visit the site on their way to another destination. For example, a driver travelling along King Street on the way home from work in Westford may stop at the on-site neighborhood retail and then continue their trip home. These vehicle trips are known as "pass-by" trips and are subtracted from the total trips to calculate the total primary (or "new") trips that affect the volume of traffic within the study area away from the site. Based on information contained in the industry standard ITE publication *Trip Generation 11th Edition*, approximately 31% to 40% of the general retail and 43% of the restaurant site-generated traffic is expected to be pass-by traffic.

Tables 7-6 and 7-7 provide a summary of the resulting trip generation estimate separated by LUC and the total trip generation separated by internal capture, walk/bike, public transit, pass-by, and primary trips.

Table 7-6 Total New Trip Generation (Unadjusted) Summary by Land Use

Time Period	Housing	Hotel	Office	R&D	Retail	Restaurant	Total Trips
Weekday Daily							
Entering	2,552	601	103	2,770	3,066	1,072	**10,164**
Exiting	2,552	601	103	2,770	3,066	1,072	**10,164**
TOTAL	5,104	1,202	206	5,540	6,132	2,144	**20,328**
Weekday Morning							
Entering	105	38	26	418	97	105	**789**
Exiting	351	30	3	92	60	86	**622**
TOTAL	456	68	29	510	157	191	**1,411**
Weekday Evening							
Entering	260	42	5	77	231	110	**725**
Exiting	165	41	22	406	240	71	**945**
TOTAL	425	83	27	483	471	181	**1,670**
Saturday Daily							
Entering	2,334	564	21	392	3,681	1,224	**8,216**
Exiting	2,334	564	21	392	3,681	1,224	**8,216**
TOTAL	4,668	1,128	42	784	7,362	2,448	**16,432**
Saturday Midday							
Entering	224	61	5	47	315	114	**766**
Exiting	215	48	5	47	290	110	**715**
TOTAL	439	109	10	94	605	224	**1,481**

Table 7-7 External Trip Generation Summary

Time Period	Total Trips [(a)]	Walk/Bike Trips	Transit Trips	Internal Capture	Pass-by Trips	Primary Trips [(b)]
Weekday Daily						
Entering	10,164	377	163	2,005	925	**6,694**
Exiting	10,164	377	163	2,005	925	**6,694**
TOTAL	20,328	754	326	4,010	1,850	**13,388**
Weekday Morning						
Entering	789	37	17	151	32	**552**
Exiting	622	28	14	151	32	**397**
TOTAL	1,411	65	31	302	64	**949**
Weekday Evening						
Entering	725	26	10	231	71	**387**
Exiting	945	35	18	231	71	**590**
TOTAL	1,670	61	28	462	142	**977**
Saturday Daily						
Entering	8,216	312	83	2,022	1,145	**4,654**
Exiting	8,216	312	83	2,022	1,145	**4,654**
TOTAL	16,432	624	166	4,044	2,290	**9,308**

Table 7-7 External Trip Generation Summary (Continued)

Time Period	Total Trips [(a)]	Walk/Bike Trips	Transit Trips	Internal Capture	Pass-by Trips	Primary Trips [(b)]
Saturday Midday						
Entering	766	30	8	163	97	**468**
Exiting	715	28	8	163	97	**419**
TOTAL	1,481	58	16	326	194	**887**

[a] From Table 7-6.

[b] Primary Trips = Total Trips minus Walk/Bike Trips minus Transit Trips minus Internal Capture minus Pass-by Trips.

As shown in Table 7-7, the project is anticipated to generate approximately 13,388 new vehicle trips during the average weekday, with 949 vehicle trips (552 entering and 397 exiting) during the weekday morning peak hour and 977 vehicle trips (387 entering and 590 exiting) during the weekday evening peak hour. Approximately 9,308 new vehicle trips are anticipated during the average Saturday with 887 new vehicle trips (468 entering and 419 exiting) during the Saturday midday peak hour.

Compared to the potential full reoccupancy of the existing IBM Corporation buildings, the project is anticipated to NET 9,098 new vehicle trips during the average weekday, with 340 new vehicle trips (16 entering and 324 exiting) during the weekday morning peak hour and 401 vehicle trips (289 entering and 112 exiting) during the weekday evening peak hour. Approximately 8,304 NET new vehicle trips are anticipated during the average Saturday with 647 new vehicle trips (338 entering and 309 exiting) during the Saturday midday peak hour. These NET trips are for comparison purposes only and are not accessed further as part of this TIAPS.

7.3.5 Site Traffic Distribution

The 550 King Street location proposes to retain access/egress to the site via Auman Street along the northerly side of Great Road. In addition, the Project proposes to retain the two (2) driveway locations along the westerly side of King Street and construct an additional two (2) full access/egress driveways along the westerly side of King Street. The project will also maintain the existing driveway to the Tuttle House historical property parking lot which will be inclusive of the project area.

The 410 Great Road location will terminate access/egress from all of its existing driveway locations along the southerly side of Great Road and provide full access/egress via a single driveway along the southerly side of Great Road slightly offset from the opposing Auman Street driveway to the 550 King Street location. A second full access/egress driveway will be constructed along the westerly side of King Street within the existing vacant 450 King Street property just south of Dunkin Donuts.

7.3.5.1 Calculating Distribution by Land Use

Residential Uses

The distribution of all the residential site-generated traffic volumes was based on gravity models using 2022 U.S. Census Bureau Journey-to-Work/Home data through it's "On the Map" database for the Town of Littleton. The residential distribution models the commutes of residents from Littleton to the top 25 workforce cities and towns, which represent approximately 71% of total Littleton residents. The top 73% of workforce communities generally allow for an approximation of overall distribution of traffic. Additional communities at this level each contribute less than 0.96% of the Littleton residents each, which is deemed to not change the distribution of traffic calculations significantly.

Office and R&D Uses

The distribution of the office and research & development site-generated traffic volumes were based on gravity models using 2022 U.S. Census Bureau Journey-to-Work/Home data through it's "On the Map" database for the Town of Littleton. The office and research & development distribution models the commutes of workers to Littleton from the top 25 residential cities and towns, which represent approximately 53 percent of total Littleton workforce. The top 53 percent of resident communities generally allow for an approximation of overall distribution of traffic. Additional communities at this level each contribute less than 0.96 percent of the Littleton workforce each which is deemed to not change the distribution of traffic calculations significantly.

Retail and Restaurant Uses

The distribution of retail and restaurant site-generated traffic volumes was based on a gravity model using 2020 U.S. Census Bureau estimated population data, location of competing opportunities, and travel time for the surrounding communities within a 7.5-mile radius of the Project site. The retail distribution models the commutes of residents from the Town of Littleton and nine (9) adjacent communities to/from the Project site after weighing each community based on total census population.

Hotel Uses

Hotel uses typically generate a widely different form of trip distribution than other land uses. The distribution of site-generated traffic-volumes for hotel trips was based on anticipated travel patterns and the proximity to I-495 whereas the hotel patron is typically distributing trips more regionally than locally. A limited volume of trips (5%) was assigned to various other network entrance/exit points due to unfamiliarity with local roads.

7.3.5.2 Trip Distribution Summary

The resulting primary trip distributions for land use groupings are shown in Table 7-8. Trip distribution gravity models are included in Appendix E-11. The weekday morning, weekday evening, and Saturday midday site-generated traffic-volume networks are presented in Figures 7-6, 7-7, and 7-8, respectively.

Table 7-8 Trip Distribution Summary

Network Direction	Housing	Hotel	Office / R&D	Retail / Restaurant
Interstate 495 to/from NORTH	33%	40%	27%	6%
Interstate 495 to/from SOUTH	27%	40%	30%	26%
Goldsmith Street to/from SOUTH	4%	5%	5%	12%
Great Road (Route 119) to/from WEST	7%	5%	16%	24%
Great Road (Route 119/2A) to/from EAST	13%	5%	4%	12%
King Street (Route 110) to/from NORTH	11%	5%	10%	6%
King Street (Route 110/2A) to/from SOUTH	5%	0%	8%	14%
TOTAL	**100%**	**100%**	**100%**	**100%**

7.3.6 2034 Build Condition Traffic Volumes

The 2034 Build Condition traffic volume networks consist of 2034 No Build Condition peak hour traffic volumes with the addition of site generated traffic while removing those trips associated with the reoccupancy of the existing 550 King Street location as previously described. The resulting 2034 Build Condition weekday morning, weekday evening, and Saturday midday peak hour traffic volume network is presented in Figure 7-9.

Not to Scale

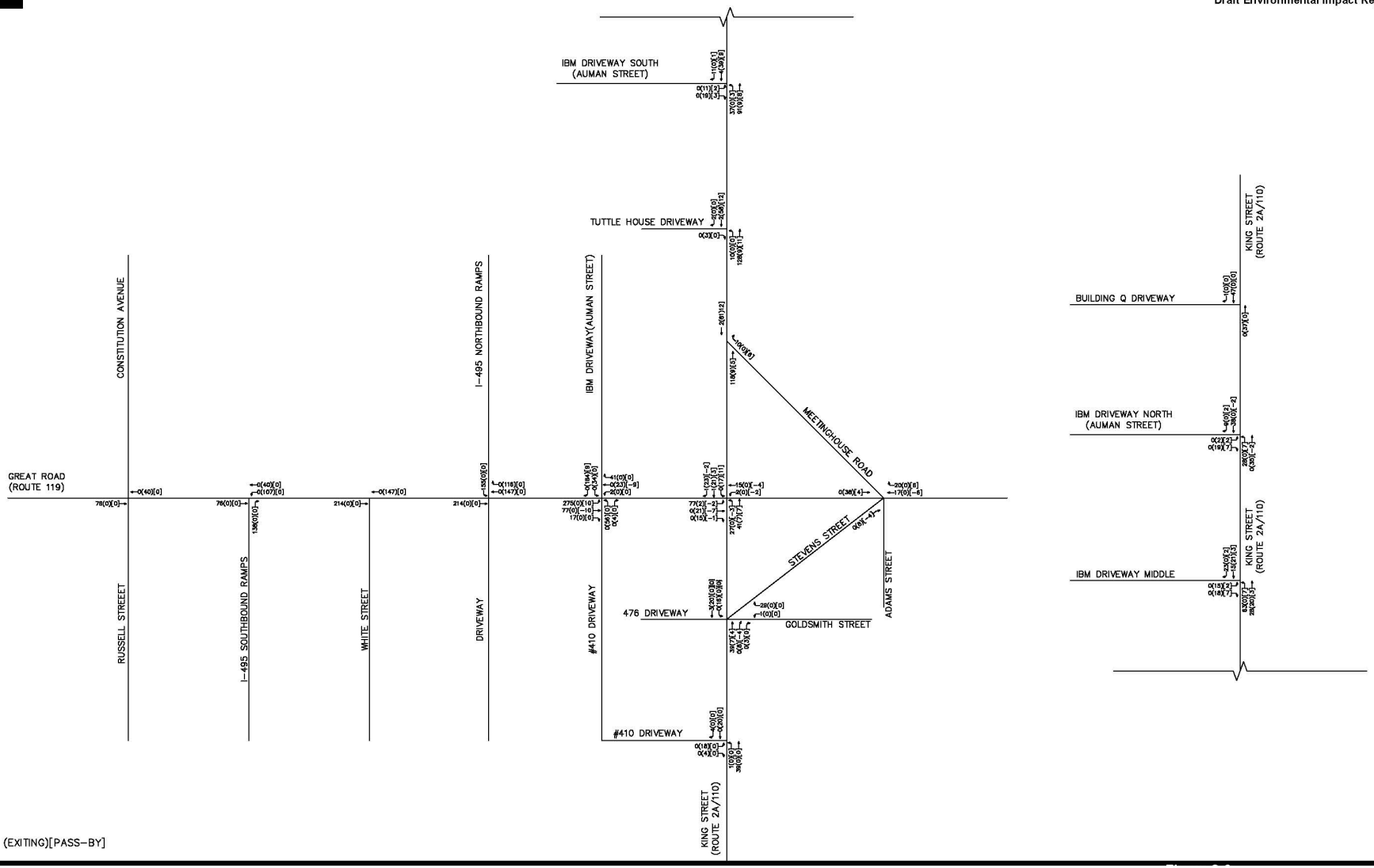


Figure 7-6

Site Generated Morning Weekday Peak Hour Traffic Volumes

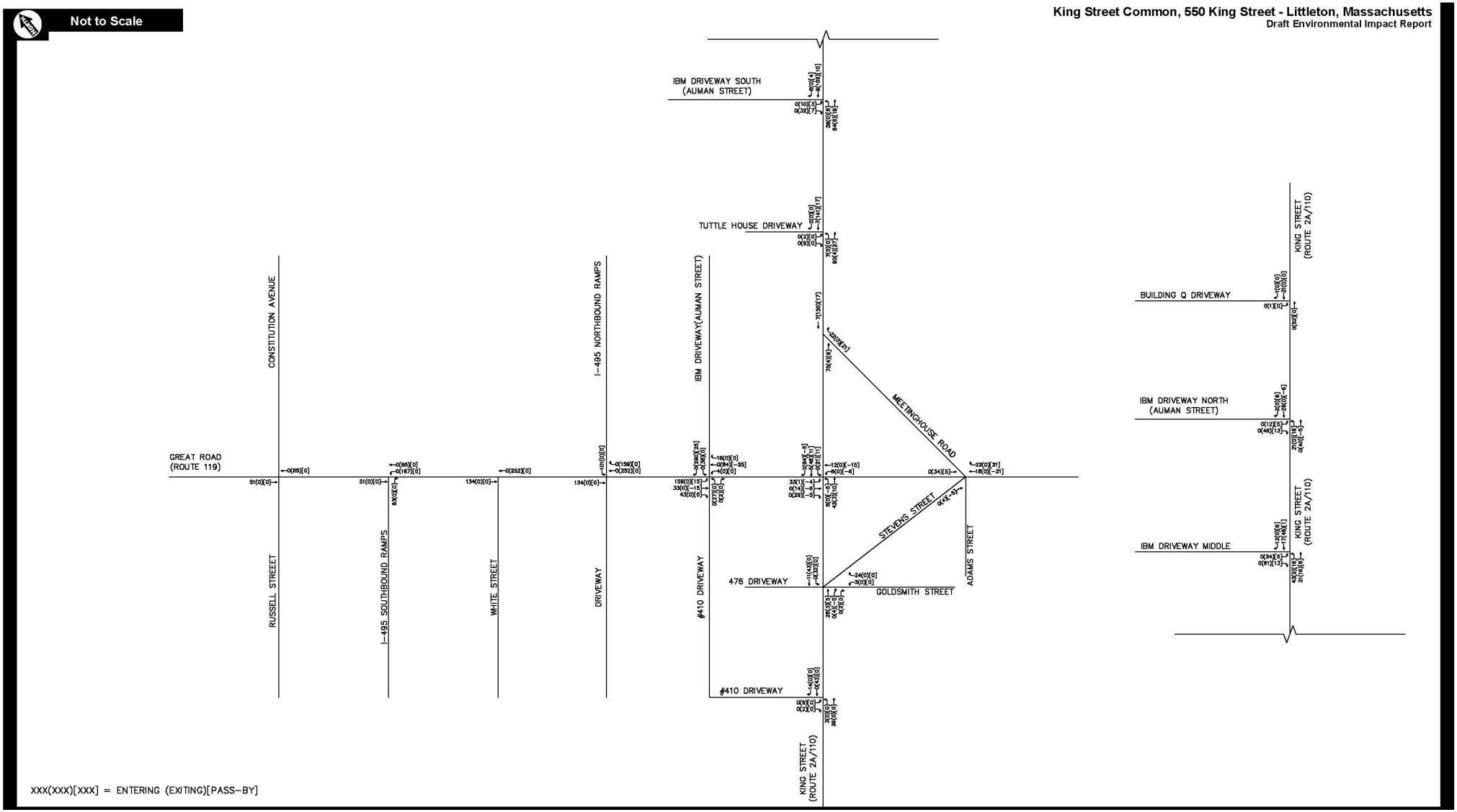
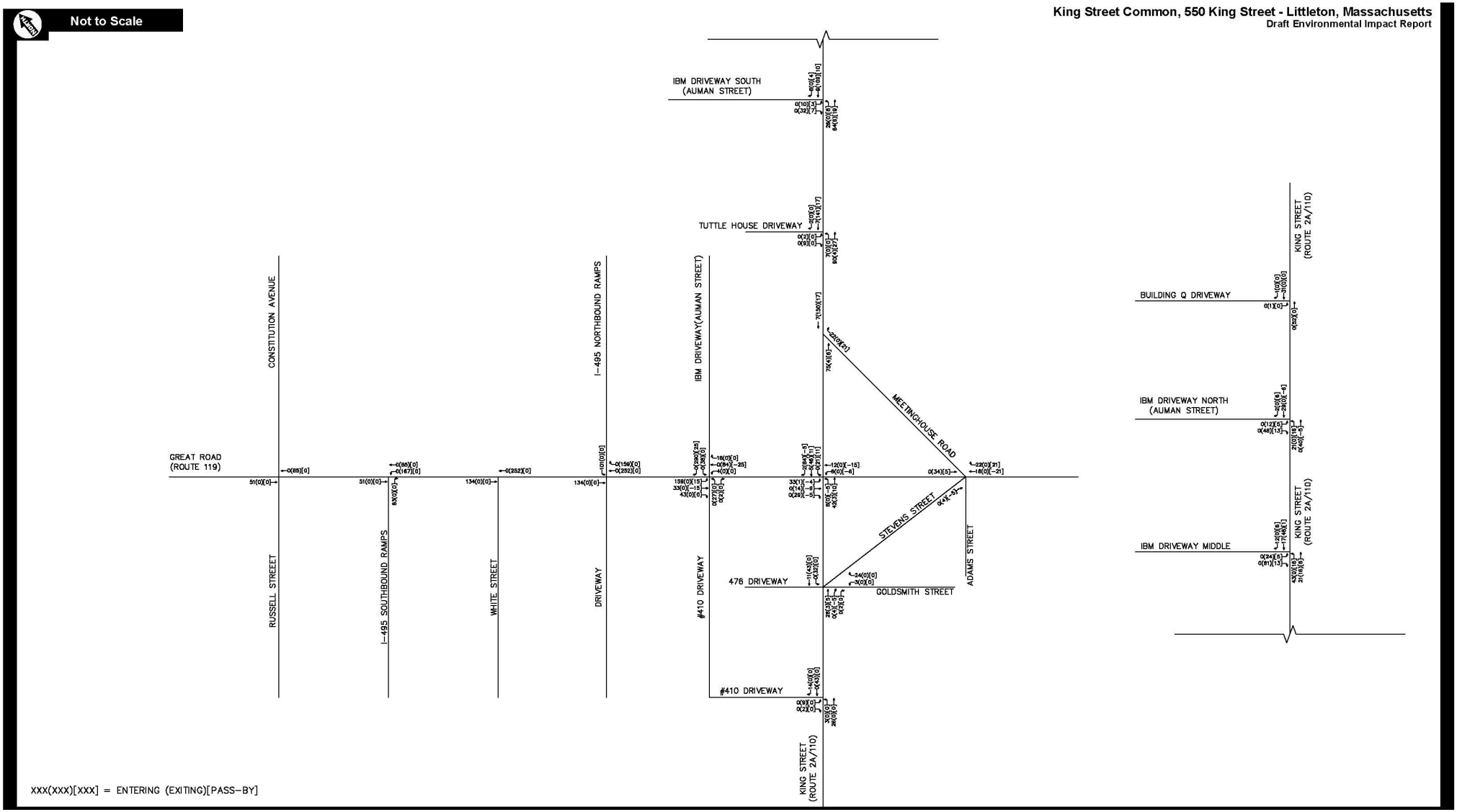


Figure 7-7

Site Generated Evening Weekday Peak Hour Traffic Volumes



King Street Common **Littleton, Massachusetts**

Figure 7-8

Site Generated Saturday Midday Peak Hour Traffic Volumes

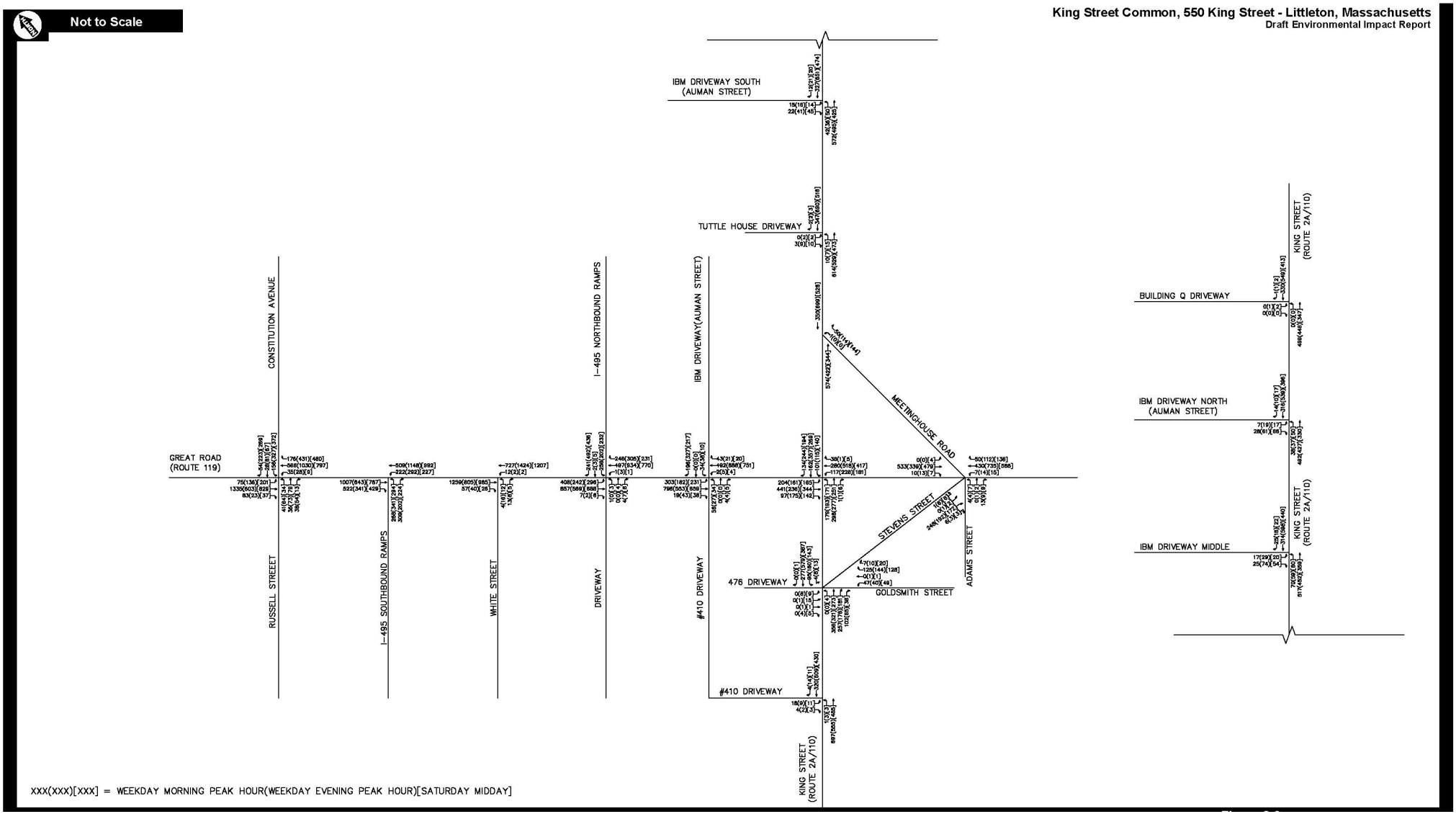


Figure 7-9

2034 Build Peak Hour Traffic Volumes

7.4 Traffic Warrants

7.4.1 Left Turn Lane Warrants

A left-turn lane warrant analysis was conducted for the intersection of Great Road / Auman Street (future Site Driveway West) using hourly traffic volumes based on TMCs conducted in December 2024. The potential left-turn lane along Great Road eastbound was analyzed under unsignalized intersection conditions.

The MassDOT *Project Development and Design Guide* (PDDG)[3] define left-turn lane volume warrants at unsignalized and signalized intersections based on the Transportation Research Board's (TRB) publication, the *Highway Capacity Manual* (HCM) *6th Edition*[4]. The criteria are based on the operating speed of the roadway (45 mph posted), the opposing volume, and the percentage of left-turning vehicles for the advancing vehicle volume. Based on the unsignalized operating conditions on Great Road, the traffic volumes do warrant the construction of a left-turn lane on the Great Road eastbound approach.

An excerpt from the MassDOT PDDG noting the criteria for the introduction of a left-turn lane by traffic volume is provided in Appendix E-12.

7.4.2 Traffic Signal Warrants

No specific traffic signal warrant analyses were completed for the study area intersection. Several of the intersections are already under traffic signal control in which off-site mitigation for the Project would not seek to remove traffic signal infrastructure. In addition, several of the site driveways along King Street are visible below thresholds for MUTCD Warrant 1 – 8 Hour Traffic Volumes which would be necessary for the installation of traffic signal infrastructure along SHLO. Whereas traffic volumes at the intersection of Great Road / Auman Street (future Site Driveway West) is anticipated to potentially warrant traffic signal control based on projected traffic volumes, the location of the intersection along the 6% grade and proximity to the adjacent Great Road / King Street signalized intersection (275-feet) would generally preclude the installation of a traffic signal without introducing a significant new traffic operational and safety challenge into the traffic network.

7.5 Traffic Operational Analysis

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build, Build, and Build with Mitigation traffic-volume conditions. Capacity analyses

3 MassDOT Project Development and Design Guide, MassDOT – Highway Division); Boston, Massachusetts, 2025

4 Highway Capacity Manual 6th Edition; Transportation Research Board; Washington, DC; 2017

provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

7.5.1 Methodology

7.5.1.1 Software Usage

Synchro Methodology for Signalized Intersections

The signalized intersection capacity and queue analysis was conducted using methodology from the *HCM 2000* methodology due to the restrictions posed on signalized intersection analysis using *HCM 6th Edition*. This includes the inability of *HCM 6th Edition* and Synchro software to correctly analyze non-standard-NEMA phasing, five-legged intersections, and exclusive pedestrian phases which are present at the project area signalized intersection. To remain consistent throughout the TIAPS, all signalized intersection capacity and queue analyses were therefore conducted using *HCM 2000* methodology.

MassDOT has recognized the significant errors and deficiencies in the *HCM 6th Edition* methodology and traffic impact software such as Synchro 11 when attempting to analyze traffic signals. Based on conversations with the MassDOT – Highway Division's Traffic Section, alternate methodologies to analyze capacity, delays, and queues can be conducted as long as the models are properly calibrated.

Sidra Intersection Usage for Atypical Traffic Control & Geometry

Various unsignalized intersection capacity and queue analyses were conducted using Sidra Intersection software and methodology due to the restrictions posed on unsignalized intersection analysis using present and former *HCM* editions. This includes the inability of *HCM* editions to correctly analyze five-legged intersections which are present at the project area unsignalized intersection. For locations and scenarios which are applicable to these conditions, Sidra Intersection 9.1 software was used. Sidra Intersection is an approved MassDOT analysis software program and bases its analysis equations on the *HCM*.

7.5.1.2 Methodology Parameters

Levels of Service

A primary result of capacity analyses is the assignment of level-of-service to traffic facilities under various traffic-flow conditions.[5] The concept of level-of-service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or

[5] The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual 6th Edition*; Transportation Research Board; Washington, DC; 2017

passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing the worst. Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

Queue Length Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the Synchro 11.0™ intersection capacity analysis software which is also based upon the methodology and procedures presented in the *HCM 6th Edition*. Synchro reports the 95th percentile queues for unsignalized intersections and both the 50th (average) and 95th percentile vehicle queues for signalized intersections, which are based on the number of vehicles that experience a delay of six (6) seconds or more at an intersection and is a function of the traffic signal timing; vehicle arrival patterns during the analysis period; and the saturation flow rate. The 50th percentile or average vehicle queue is the average number of vehicles that are projected to be delayed by six seconds or more at the intersection under study during the analysis period. The 95th percentile vehicle queue is the vehicle queue length that will be exceeded only five (5) percent of the time; or approximately three (3) minutes out of 60 minutes during the peak one hour of the day. During the remaining 57 minutes, the vehicle queue length will be less than the 95th percentile queue length.

7.5.1.3 Parameters for Traffic Impact Analysis

Unsignalized Intersections

The levels of service of two-way stop-controlled unsignalized intersections are determined by application of a procedure described in the *HCM 6th Edition*. The level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and stop signs. Control delay includes the effects of initial deceleration delay approaching a stop sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the *HCM 6th Edition*. Table 7-9 summarizes the relationship between level of service and average control delay.

Table 7-9 Level of Service Criteria for Unsignalized Intersections [(a)]

Level of Service (v/c ≤ 1.00)	Level of Service (v/c > 1.00)	Average Control Delay (sec / veh)	Measured Stopping Sight Distance
A	F	≤ 10.0	LOS A represents a condition with little or no control delay to minor street traffic.
B	F	10.1 to 15.0	LOS B represents a condition with short control delays to minor street traffic.
C	F	15.1 to 25.0	LOS C represents a condition with average control delays to minor street traffic.
D	F	25.1 to 35.0	LOS D represents a condition with long control delays to minor street traffic.
E	F	35.1 to 50.0	LOS E represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
F	F	> 50.0	LOS F represents a condition where minor street demand volume exceeds capacity of an approach lane, with excessive control delays resulting.

[a] Source: *Highway Capacity Manual 6th Edition*; Transportation Research Board; Washington D.C.; 2017

Signalized Intersections

Level of service for the signalized intersection is calculated using the operational analysis methodology of the *HCM 2000*. This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. Level of service designations are based on the criterion of control or signal delay per vehicle. Control or signal delay can be related to driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 7-10 summarizes the relationship between level of service and control delay. The tabulated control delay criterion may be applied in assigning level of service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table 7-10 Level of Service Criteria for Unsignalized Intersections [(a)]

Level of Service	Average Control Delay (sec / veh)	Measured Stopping Sight Distance
A	≤ 10.0	LOS A describes operations with very low control delay; most vehicles do not stop at all.
B	10.1 to 15.0	LOS B describes operations with relatively low control delay. However, more vehicles stop than LOS A.
C	15.1 to 25.0	LOS C describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Table 7-10 Level of Service Criteria for Unsignalized Intersections [(a)] (Continued)

Level of Service	Average Control Delay (sec / veh)	Measured Stopping Sight Distance
D	25.1 to 35.0	LOS D describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop and individual cycle failures are noticeable, whereby motorists are not able to get through the signal on one cycle.
E	35.1 to 50.0	LOS E describes operations with high control delay values. Individual cycle failures are frequent occurrences.
F	> 50.0	LOS F describes operations with high control delay values that often occur with over-saturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

[a] Source: *Highway Capacity Manual 2000*; Transportation Research Board; Washington D.C.; 2000

7.5.1.4 Traffic Impact Analysis Results

Level-of-service analyses were conducted for the 2024 Existing Condition, 2034 No-Build Condition, and 2034 Build Condition for the study area intersections. The results of the intersection capacity analysis are summarized in Table 7-11 and Table 7-12 for the signalized and unsignalized intersections, respectively. The capacity analysis worksheets are provided in Appendix E-13.

Great Road / Russell Street / Constitution Avenue

Several movements at the intersection of Great Road / Russell Street / Constitution Avenue are anticipated to operate at elevated levels of service (LOS E) during the weekday morning and weekday evening peak hours under both the 2034 No Build and 2034 Build Conditions. All movements at the intersection operate with a volume-to-capacity (V/C) ratio well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project. Queues on each intersection movement are not anticipated to increase by more than one (1) vehicle as a result of the Project. No project-specific mitigation is proposed at this location; however, the Proponent will fine-tune traffic signal and coordination timings / parameters as part of their Permit to Access State Highway process. See Section 8.7.1 for more detailed information.

Great Road / Interstate 495 SB Ramps

Several movements at the intersection of Great Road / I-495 SB Ramps are anticipated to operate at elevated levels of service (LOS E) during the weekday morning and weekday evening peak hours under both the 2034 No Build and 2034 Build Conditions. There is no change in LOS between the 2034 No Build and 2034 Build Conditions on any intersection movement. All movements at the intersection operate with a V/C ratio well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project. Queues along the Great Road westbound left-turn movement are anticipated to increase

by up to four (4) vehicles during the peak hour; however, the average delay on this movement is well below the intersection's cycle length which indicates that vehicles tend to still be processed through the intersection within one (1) cycle. No project-specific mitigation is proposed at this location; however, the Proponent will fine-tune traffic signal and coordination timings / parameters as part of their Permit to Access State Highway process. See Section 8.7.1 for more detailed information.

Great Road / Interstate 495 SB Ramps

Several movements at the intersection of Great Road / I-495 SB Ramps are anticipated to operate at elevated levels of service (LOS E) during the weekday morning and weekday evening peak hours under both the 2034 No Build and 2034 Build Conditions. All movements at the intersection operate with a V/C ratio well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project. Queues along the Great Road westbound left-turn movement are anticipated to increase by up to four (4) vehicles during the peak hour; however, the average delay on this movement is well below the intersection's cycle length which indicates that vehicles tend to still be processed through the intersection within one (1) cycle. No project-specific mitigation is proposed at this location; however, the Proponent will fine-tune traffic signal and coordination timings / parameters as part of their Permit to Access State Highway process. See Section 8.7.1 for more detailed information.

Great Street / White Street

The White Street northbound left-turn movement is anticipated to operate at an elevated level of service (LOS E) during the weekday morning, weekday evening, and Saturday midday peak hours. Although the LOS is elevated, the V/C ratios are well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

Great Road / Interstate 495 NB Ramps

The I-495 southbound left-turn movements at the intersection of Great Road / I-495 NB Ramps are anticipated to operate at elevated levels of service (LOS E) during the weekday morning peak hours under both the 2034 No Build and 2034 Build Conditions. All movements at the intersection operate with a V/C ratio well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project. Queues along the Great Road eastbound are anticipated to increase by up to seven (7) vehicles during the peak hour; however, the average delay on this movement is well below the intersection's cycle length which indicates that vehicles tend to still be processed through the intersection within one (1) cycle. No project-specific mitigation is proposed at this location; however, the Proponent will fine-tune traffic signal and coordination timings / parameters as part of their Permit to Access State Highway process. See Section 8.7.1 for more detailed information.

Great Road / Site Driveway West (Auman Street)

The Site Driveway West southbound left-turn movement is anticipated to operate at a degraded level of service (LOS F) during each analysis period with a V/C ratio above 1.00 during the weekday morning peak hour. The V/C ratio for the Site Driveway West southbound right-turn movement is also anticipated to be above 1.00 during the weekday evening peak hour. Vehicle delay experienced at the Site Driveway West approach is not atypical for a side street approach to a stopped-controlled intersection during peak hour. Gaps in the through movement traffic along Great Road from the upstream traffic signals in both directions will be frequent, allowing for more improved exiting movements from the site driveway than as reported from the software analysis. This level of delay is dedicated to the site driveway where operations along the Great Road mainline are generally expected to operate at acceptable levels of service; however, field observations do indicate that queue spillover from the signalized intersection east of the Site Driveway does meter the ability for the intersection to process vehicles along Great Road.

Great Road / King Street

The King Street northbound left-turn movement and the King Street southbound movement are anticipated to operate at elevated / degraded levels of service (LOS E or F) during the weekday evening and Saturday midday peak hour as part of the 2034 Build Condition. Each of these movements also exceed a V/C ratio of 1.00, which indicates that the intersection movements are above capacity. All other movements are anticipated to operate at acceptable levels or service (LOS D or better) during each analysis scenario. Project-specific mitigation is proposed at this location and is further described in Section 8.7.1.

Great Road / Stevens Street / Adams Street / Meetinghouse Road

All movements at the intersection of Great Road / Stevens Street / Adams Street / Meetinghouse Road are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / 410 Great Road Driveway

All movements at the intersection of King Street / 410 Great Road Driveway are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Goldsmith Street / Stevens Street / 476 King Street Driveway

The Goldsmith Street westbound approach is anticipated to operate at elevated levels of service (LOS E) during the weekday morning and weekday evening peak hours during the 2034 Build Condition. The movement previously operated at LOS D during 2034 No-Build Conditions; however, the change in LOS is directly related to only five (5) seconds of increased delay per vehicle where the level of service as part of the 2034 No-Build Conditions was at or slightly below the LOS D/E threshold. The 476 King Street Driveway also operates at an elevated level of service (LOS E) during the 2034 Build Condition as part of the weekday evening peak hour, similarly with less than a five (5) second increase in delay per vehicle. All other movements at the intersection are anticipated to operate at acceptable levels of service (LOS D or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios for all movements well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Meetinghouse Road

All movements at the intersection of King Street / Meetinghouse Road are anticipated to operate at acceptable levels of service (LOS B or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Tuttle House Driveway

All movements at the intersection of King Street / Tuttle House Driveway are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Site Driveway South

All movements at the intersection of King Street / Site Driveway South are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Site Driveway Middle

All movements at the intersection of King Street / Site Driveway Middle are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Site Driveway North

All movements at the intersection of King Street / Site Driveway North are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

King Street / Building Q Driveway

All movements at the intersection of King Street / Building Q Driveway are anticipated to operate at acceptable levels of service (LOS C or better) during the weekday morning, weekday evening, and Saturday midday peak hours with V/C ratios well below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project.

Table 7-11 Signalized Intersection Capacity and Queue Analysis Summary

Intersection / Lane Group	2024 Existing				2034 No-Build				2034 Build			
	V/C [a]	Delay [b]	LOS [c]	Queue [d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Russell Street / Constitution Avenue / Great Road												
Weekday Morning Peak Period												
Great Road EBL	0.17	11.7	B	<25/40	0.15	8.7	A	<25/38	0.16	8.8	A	<25/38
Great Road EBT	0.72	24.3	C	403/454	0.77	21.7	C	477/581	0.76	21.6	C	474/576
Great Road WBL	0.21	6.9	A	<25/<25	0.25	12.0	B	<25/<25	0.24	11.7	B	<25/<25
Great Road WBT	0.35	12.6	B	105/125	0.31	9.5	A	95/98	0.33	9.4	A	97/101
Russell Street NBT	0.65	53.9	D	114/150	0.73	67.1	E	82/185	0.73	67.1	E	82/185
Constitution Avenue SBL	0.69	61.1	E	86/140	0.68	61.7	E	78/140	0.68	61.7	E	78/140
Constitution Avenue SBT	0.66	59.2	E	85/138	0.67	61.3	E	80/142	0.67	61.3	E	80/142
Constitution Avenue SBR	0.04	48.2	D	<25/<25	0.04	49.1	D	<25/<25	0.04	49.1	D	<25/<25
Overall Intersection	**0.69**	**24.5**	**C**	-	**0.73**	**22.7**	**C**	-	**0.73**	**22.5**	**C**	-
Weekday Evening Peak Period												
Great Road EBL	0.59	21.2	C	62/106	0.68	25.6	C	58/109	0.69	26.3	C	59/111
Great Road EBT	0.38	23.1	C	166/217	0.41	21.6	C	187/224	0.43	21.9	C	202/240
Great Road WBL	0.07	18.1	B	<25/<25	0.08	15.9	B	<25/<25	0.09	15.7	B	<25/<25
Great Road WBT	0.65	31.4	C	342/404	0.73	30.7	C	424/470	0.73	29.8	C	431/471
Russell Street NBT	0.76	61.1	E	144/278	0.81	68.3	E	144/299	0.82	68.7	E	144/299
Constitution Avenue SBL	0.75	55.2	E	177/252	0.80	61.7	E	170/286	0.80	61.7	E	170/289
Constitution Avenue SBT	0.74	54.1	D	178/253	0.79	60.4	E	172/284	0.79	60.4	E	172/288
Constitution Avenue SBR	0.15	40.9	D	<25/60	0.18	42.9	D	<25/82	0.19	43.0	D	<25/83
Overall Intersection	**0.69**	**30.9**	**C**	-	**0.75**	**31.7**	**C**	-	**0.76**	**31.4**	**C**	-
Saturday Midday												
Great Road EBL	0.62	17.1	B	90/161	0.63	20.4	C	84/158	0.66	22.2	C	84/158
Great Road EBT	0.50	21.0	C	200/338	0.54	22.9	C	219/392	0.57	23.6	C	237/423
Great Road WBL	0.03	22.2	C	<25/<25	0.04	29.9	C	<25/<25	0.05	25.1	C	<25/<25
Great Road WBT	0.57	29.2	D	308/397	0.62	45.9	D	340/467	0.66	43.7	D	361/513
Russell Street NBT	0.60	50.4	D	98/163	0.60	53.1	D	99/164	0.60	53.1	D	99/164
Constitution Avenue SBL	0.76	46.0	D	185/254	0.76	55.0	D	185/254	0.76	55.0	D	185/254
Constitution Avenue SBT	0.75	45.9	D	184/253	0.75	54.0	D	184/253	0.75	54.0	D	184/253
Constitution Avenue SBR	0.16	40.7	D	<25/66	0.16	40.8	D	<25/<25	0.16	40.8	D	<25/66
Overall Intersection	**0.67**	**31.2**	**C**	-	**0.67**	**32.1**	**C**	-	**0.70**	**31.9**	**C**	-

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average) [c] Level of service, [d] 50th/95th Percentile Queue [95th Percentile Queue only for unsignalized intersections]

Table 7-11 Signalized Intersection Capacity and Queue Analysis Summary (Continued)

Intersection / Lane Group	2024 Existing				2034 No-Build				2034 Build			
	V/C [a]	Delay [b]	LOS [c]	Queue [d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Great Road / Interstate 495 SB Ramps												
Weekday Morning Peak Period												
Great Road EBT	0.44	21.5	C	267/332	0.53	18.6	B	284/317	0.59	22.8	C	288/294
Great Road EBR	0.29	78.4	E	102/148	0.31	56.5	E	81/129	0.31	61.5	E	79/116
Great Road WBL	0.70	63.0	E	105/142	0.76	65.4	E	118/184	0.81	64.8	E	194/277
Great Road WBT	0.22	4.2	A	55/57	0.20	3.9	A	44/76	0.21	3.9	A	52/82
I-495 SB Ramp NBL	0.71	54.1	D	123/141	0.70	54.9	D	112/155	0.70	54.9	D	112/155
I-495 SB Ramp NBR	0.23	35.6	D	37/61	0.66	43.8	D	168/235	0.53	34.4	C	150/204
Overall Intersection	**0.52**	**36.1**	**D**	-	**0.59**	**32.0**	**C**	-	**0.66**	**34.1**	**C**	-
Weekday Evening Peak Period												
Great Road EBT	0.28	12.6	B	101/140	0.37	19.2	B	115/296	0.40	20.9	C	117/323
Great Road EBR	0.20	36.0	D	50/86	0.21	41.8	D	57/84	0.21	40.9	D	52/79
Great Road WBL	0.64	58.8	E	78/119	0.81	58.2	E	163/217	0.82	61.7	E	189/260
Great Road WBT	0.39	2.2	A	44/61	0.46	2.1	A	45/62	0.46	2.2	A	43/68
I-495 SB Ramp NBL	0.73	54.9	D	131/175	0.74	54.6	D	140/186	0.74	54.6	D	140/186
I-495 SB Ramp NBR	0.06	35.7	D	<25/38	0.10	27.6	C	<25/38	0.22	27.6	C	45/80
Overall Intersection	**0.49**	**20.4**	**C**	-	**0.59**	**23.5**	**C**	-	**0.61**	**24.4**	**C**	-
Saturday Midday Peak Period												
Great Road EBT	0.35	10.5	B	144/168	0.38	11.4	B	148/170	0.45	13.4	B	150/144
Great Road EBR	0.26	26.9	C	68/73	0.26	26.1	C	62/71	0.26	26.4	C	55/64
Great Road WBL	0.66	52.1	D	92/146	0.72	52.5	D	118/183	0.77	46.9	D	182/253
Great Road WBT	0.37	6.9	A	192/264	0.39	7.2	A	208/292	0.40	6.0	A	228/316
I-495 SB Ramp NBL	0.69	54.8	D	111/152	0.70	54.8	D	118/159	0.70	54.8	D	118/159
I-495 SB Ramp NBR	0.07	36.9	D	<25/41	0.14	35.3	D	<25/57	0.27	31.6	C	57/103
Overall Intersection	**0.46**	**19.6**	**B**	-	**0.49**	**20.3**	**C**	-	**0.56**	**20.7**	**C**	-
Great Road / Interstate 495 NB Ramps												
Weekday Morning Peak Period												
Great Road EBL	0.78	50.2	D	169/214	0.79	55.0	E	179/231	0.79	50.6	D	179/229
Great Road EBT	0.47	6.2	A	52/264	0.72	10.8	B	240/391	0.72	14.5	B	346/536
Great Road WBT	0.21	11.3	B	73/90	0.23	13.9	B	82/133	0.30	14.7	B	112/177
Great Road WBR	0.09	10.4	B	<25/<25	0.10	12.8	B	<25/36	0.16	13.4	B	<25/45
I-495 NB Ramp SBL	0.37	52.3	D	39/65	0.71	55.5	E	107/148	0.71	55.4	E	109/150
I-495 NB Ramp SBR	0.15	0.2	A	<25/<25	0.16	0.2	A	<25/<25	0.17	0.2	A	<25/<25
Overall Intersection	**0.53**	**18.5**	**B**	-	**0.75**	**23.1**	**C**	-	**0.75**	**23.0**	**C**	-

Table 7-11 Signalized Intersection Capacity and Queue Analysis Summary (Continued)

Intersection / Lane Group	2024 Existing V/C [a]	2024 Existing Delay [b]	2024 Existing LOS [c]	2024 Existing Queue [d]	2034 No-Build V/C	2034 No-Build Delay	2034 No-Build LOS	2034 No-Build Queue	2034 Build V/C	2034 Build Delay	2034 Build LOS	2034 Build Queue
Weekday Evening Peak Period												
Great Road EBL	0.66	39.7	D	87/110	0.68	33.7	C	92/97	0.68	36.0	D	104/112
Great Road EBT	0.29	10.3	B	227/358	0.35	12.9	B	330/439	0.43	15.3	B	392/508
Great Road WBT	0.30	9.3	A	109/157	0.43	10.9	B	176/254	0.47	12.2	B	198/294
Great Road WBR	0.09	7.7	A	<25/<25	0.18	8.7	A	<25/34	0.19	9.7	A	<25/39
I-495 NB Ramp SBL	0.36	52.2	D	39/67	0.46	52.5	D	52/84	0.63	54.1	D	87/125
I-495 NB Ramp SBR	0.30	0.4	A	<25/<25	0.32	0.5	A	<25/<25	0.31	0.5	A	<25/<25
Overall Intersection	**0.38**	**12.7**	**B**	-	**0.47**	**13.2**	**B**	-	**0.51**	**15.7**	**B**	-
Saturday Midday Peak Period												
Great Road EBL	0.72	53.1	D	134/134	0.72	55.5	E	136/143	0.72	54.7	D	111/144
Great Road EBT	0.38	6.1	A	193/193	0.43	5.3	A	211/211	0.53	6.3	A	305/305
Great Road WBT	0.30	10.1	B	110/151	0.32	10.7	B	121/183	0.40	12.7	B	165/249
Great Road WBR	0.09	8.6	A	<25/<25	0.11	9.0	A	<25/31	0.14	10.4	B	<25/38
I-495 NB Ramp SBL	0.36	52.2	D	40/70	0.50	52.5	D	59/92	0.66	54.6	D	98/138
I-495 NB Ramp SBR	0.25	0.3	A	<25/<25	0.26	0.4	A	<25/<25	0.26	0.4	A	<25/<25
Overall Intersection	**0.44**	**15.2**	**B**	-	**0.49**	**15.7**	**B**	-	**0.59**	**17.2**	**B**	-
Great Road / King Street												
Weekday Morning Peak Period												
Great Road EBL	0.30	14.6	B	36/70	0.56	19.1	B	81/127	0.52	18.1	B	75/118
Great Road EBT	0.77	30.4	C	241/381	0.85	38.4	D	324/468	0.87	39.7	D	345/498
Great Road WBL	0.37	18.2	B	30/55	0.45	19.0	B	40/69	0.47	19.7	B	40/69
Great Road WBT	0.50	23.6	C	130/192	0.50	23.4	C	163/242	0.48	23.3	C	163/242
King Street NBL	0.47	21.9	C	63/133	0.69	31.8	C	95/218	0.72	36.7	D	92/169
King Street NBT	0.54	29.7	C	135/254	0.69	38.9	D	183/353	0.82	50.6	D	210/400
King Street SBL	0.17	25.3	C	<25/52	0.32	27.6	C	35/79	0.45	28.6	C	49/102
King Street SBT	0.63	36.5	D	113/237	0.76	46.3	D	156/322	0.85	56.3	E	189/384
Overall Intersection	**0.66**	**27.1**	**C**	-	**0.78**	**32.8**	**C**	-	**0.81**	**37.0**	**D**	-
Weekday Evening Peak Period												
Great Road EBL	0.45	23.1	C	47/93	0.61	28.4	C	68/111	0.76	41.1	D	79/159
Great Road EBT	0.63	33.4	C	190/318	0.74	38.1	D	292/422	0.75	41.9	D	292/412
Great Road WBL	0.52	22.1	C	79/144	0.70	29.0	C	108/165	0.75	35.8	D	112/165
Great Road WBT	0.80	40.3	D	297/468	0.84	43.8	D	396/548	0.87	50.6	D	402/543
King Street NBL	0.75	35.6	D	87/194	1.05	108.9	F	107/314	1.24	179.1	F	153/368
King Street NBT	0.39	28.1	C	129/220	0.44	32.7	C	149/265	0.48	32.4	C	186/324
King Street SBL	0.16	22.5	C	27/64	0.23	23.0	C	43/94	0.30	24.0	C	53/113
King Street SBT	0.79	41.6	D	260/443	0.64	47.8	D	327/594	1.03	86.7	F	513/883
Overall Intersection	**0.76**	**34.2**	**C**	-	**0.92**	**44.8**	**D**	-	**1.04**	**62.5**	**E**	-

Table 7-11 Signalized Intersection Capacity and Queue Analysis Summary (Continued)

	2024 Existing				2034 No-Build				2034 Build			
Intersection / Lane Group	**V/C [a]**	**Delay [b]**	**LOS [c]**	**Queue [d]**	**V/C**	**Delay**	**LOS**	**Queue**	**V/C**	**Delay**	**LOS**	**Queue**
Saturday Midday Peak Period												
Great Road EBL	0.35	19.4	B	49/73	0.42	20.5	C	55/89	0.49	21.0	C	65/103
Great Road EBT	0.84	42.8	D	318/401	0.85	44.1	D	343/486	0.85	44.0	D	334/475
Great Road WBL	0.50	22.1	C	56/90	0.61	24.9	C	71/110	0.60	24.5	C	71/110
Great Road WBT	0.61	30.7	C	226/332	0.67	32.5	C	271/388	0.68	33.5	C	269/382
King Street NBL	0.66	31.1	C	81/183	0.79	45.3	D	92/227	0.89	64.7	E	87/268
King Street NBT	0.35	30.5	C	105/196	0.40	34.0	C	117/225	0.56	36.5	D	172/314
King Street SBL	0.19	25.3	C	33/77	0.25	25.7	C	45/102	0.44	27.1	C	70/147
King Street SBT	0.78	44.7	D	231/435	0.85	53.4	D	267/554	1.04	91.7	F	376/718
Overall Intersection	**0.75**	**34.8**	**C**	**-**	**0.81**	**38.5**	**D**	**-**	**0.88**	**48.3**	**D**	**-**

Table 7-12 Unsignalized Intersection Capacity and Queue Analysis Summary

Intersection / Lane Group	2024 Existing				2034 No-Build				2034 Build			
	V/C [a]	Delay [b]	LOS [c]	Queue [d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Great Road / White Street												
Weekday Morning Peak Period												
Great Road WBL	0.03	12.6	B	<25	0.04	15.3	C	<25	0.04	15.2	C	<25
White Street NBL	0.16	28.8	D	<25	0.25	47.0	E	<25	0.26	49.0	E	<25
Weekday Evening Peak Period												
Great Road WBL	0.00	9.0	A	<25	0.00	9.3	A	<25	0.00	9.7	A	<25
White Street NBL	0.18	24.3	C	<25	0.25	34.1	D	<25	0.29	41.8	E	28
Saturday Midday												
Great Road WBL	0.00	9.7	A	<25	0.00	10.0	B	<25	0.00	10.6	B	<25
White Street NBL	0.12	29.1	D	<25	0.14	34.7	D	<25	0.19	46.2	E	<25
Great Road / Auman Street (Site Driveway West)												
Weekday Morning Peak Period												
Great Road EBL	0.02	8.8	A	<25	0.33	10.4	B	35	0.35	10.9	B	40
Auman Street SBL	0.00	0.0	A	<25	0.16	130.1	F	<25	1.09	358.9	F	98
Auman Street SBR	0.02	11.9	B	<25	0.08	12.4	B	<25	0.44	18.1	C	55
Weekday Evening Peak Period												
Great Road EBL	0.01	9.6	A	<25	0.08	10.6	B	<25	0.28	12.3	B	28
Auman Street SBL	0.00	0.0	A	<25	0.45	67.2	F	48	0.90	239.6	F	93
Auman Street SBR	0.06	51.5	C	<25	0.97	83.5	F	245	1.22	161.8	F	405
Saturday Midday Peak Period												
Great Road EBL	0.01	9.3	A	<25	0.08	10.0	A	<25	0.33	11.9	B	35
Auman Street SBL	0.00	0.0	A	<25	0.07	40.5	E	<25	0.29	138.6	F	25
Auman Street SBR	0.02	15.0	C	<25	0.15	16.6	C	<25	0.67	33.7	D	115
Great Road / 410 Great Road Driveway												
Weekday Morning Peak Period												
Great Road WBL	0.00	0.0	A	<25	0.00	0.0	A	<25	0.00	9.9	A	<25
Driveway NB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.50	57.8	F	58
Weekday Evening Peak Period												
Great Road WBL	0.00	8.4	A	<25	0.00	8.6	A	<25	0.01	8.9	A	<25
Driveway NB	0.01	9.8	A	<25	0.01	10.1	B	<25	0.30	51.0	F	30
Saturday Midday Peak Period												
Great Road WBL	0.00	0.0	A	<25	0.00	0.0	A	<25	0.01	9.3	A	<25
Driveway NB	0.01	10.4	B	<25	0.01	10.6	B	<25	0.36	51.1	F	35

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average), [c] Level of service, [d] 50th/95th Percentile Queue [95th Percentile Queue only for unsignalized intersections]

Table 7-12 Unsignalized Intersection Capacity and Queue Analysis Summary (Continued)

Intersection / Lane Group	2024 Existing V/C [a]	2024 Existing Delay [b]	2024 Existing LOS [c]	2024 Existing Queue [d]	2034 No-Build V/C	2034 No-Build Delay	2034 No-Build LOS	2034 No-Build Queue	2034 Build V/C	2034 Build Delay	2034 Build LOS	2034 Build Queue
Great Road / Adams Street / Stevens Street / Meetinghouse Road												
Weekday Morning Peak Period												
Great Road EB	0.29	2.3	A	<25	0.32	2.6	A	<25	0.34	2.8	A	<25
Great Road WB	0.25	2.1	A	<25	0.30	2.5	A	<25	0.31	2.6	A	<25
Adams Street NB	0.07	18.5	C	<25	0.09	20.1	C	<25	0.09	21.5	C	<25
Stevens Street NE	0.50	17.8	C	121	0.54	19.9	C	139	0.58	22.1	C	156
Weekday Evening Peak Period												
Great Road EB	0.18	1.4	A	<25	0.19	1.5	A	<25	0.21	1.6	A	<25
Great Road WB	0.41	3.6	A	<25	0.48	4.4	A	<25	0.51	4.7	A	<25
Adams Street NB	0.08	17.2	C	<25	0.09	19.2	C	<25	0.10	19.7	C	<25
Stevens Street SW	0.35	13.7	B	57	0.38	14.7	B	67	0.39	15.2	C	70
Saturday Midday Peak Period												
Great Road EB	0.23	1.8	A	<25	0.26	2.1	A	71	0.29	2.4	A	<25
Great Road WB	0.34	2.9	A	<25	0.41	3.6	A	<25	0.44	4.0	A	<25
Adams Street NB	0.06	17.9	C	<25	0.08	22.0	C	<25	0.09	23.3	C	<25
Stevens Street SW	0.32	14.2	B	46	0.40	16.7	C	71	0.43	18.0	C	76
King Street / 410 Great Road Driveway												
Weekday Morning Peak Period												
410 Driveway EB	-	-	-	-	-	-	-	-	0.09	19.8	C	<25
King Street NBL	-	-	-	-	-	-	-	-	0.00	8.0	A	<25
Weekday Evening Peak Period												
410 Driveway EB	-	-	-	-	-	-	-	-	0.06	23.7	C	<25
King Street NBL	-	-	-	-	-	-	-	-	0.00	8.9	A	<25
Saturday Midday Peak Period												
410 Driveway EB	-	-	-	-	-	-	-	-	0.05	17.6	C	<25
King Street NBL	-	-	-	-	-	-	-	-	0.00	8.3	A	<25

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average), [c] Level of service, [d] 50th/95th Percentile Queue [95th Percentile Queue only for unsignalized intersections]

Table 7-12 Unsignalized Intersection Capacity and Queue Analysis Summary (Continued)

Intersection / Lane Group	2024 Existing V/C [a]	2024 Existing Delay [b]	2024 Existing LOS [c]	2024 Existing Queue [d]	2034 No-Build V/C	2034 No-Build Delay	2034 No-Build LOS	2034 No-Build Queue	2034 Build V/C	2034 Build Delay	2034 Build LOS	2034 Build Queue
King Street / Stevens Street / Goldsmith Street / 476 King Street Driveway												
Weekday Morning Peak Period												
476 Driveway EB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.00	0.0	A	<25
Goldsmith Street WB	0.21	11.6	B	<25	0.29	13.0	B	30	0.30	13.3	B	33
King Street NBL	0.00	0.0	A	<25	0.00	0.0	A	<25	0.00	0.0	A	<25
King Street SBL	0.0	8.5	A	<25	0.01	8.8	A	<25	0.01	8.9	A	<25
Weekday Evening Peak Period												
476 Driveway EB	0.00	8.4	A	<25	0.00	8.4	A	<25	0.00	8.4	A	<25
Goldsmith Street WB	0.28	12.7	B	<25	0.26	12.2	B	25	0.31	13.0	B	33
King Street NBL	0.00	0.0	A	<25	0.00	0.0	A	<25	0.00	0.0	A	<25
King Street SBL	0.01	8.5	A	<25	0.01	8.4	A	<25	0.01	8.5	A	<25
Saturday Midday Peak Period												
476 Driveway EB	0.00	8.4	A	<25	0.00	8.4	A	<25	0.00	8.4	A	<25
Goldsmith Street WB	0.20	11.3	B	<25	0.23	11.6	B	<25	0.29	12.5	B	30
King Street NBL	0.00	8.3	A	<25	0.00	8.4	A	<25	0.00	8.6	A	<25
King Street SBL	0.01	8.2	A	<25	0.01	8.3	A	<25	0.01	8.4	A	<25
King Street / Meetinghouse Road												
Weekday Morning Peak Period												
Meetinghouse Road WB	0.00	0.0	A	<25	0.07	12.8	B	<25	0.11	13.3	B	<25
Weekday Evening Peak Period												
Meetinghouse Road WB	0.08	10.7	B	<25	0.12	11.1	B	<25	0.20	12.5	B	<25
Saturday Midday Peak Period												
Meetinghouse Road WB	0.09	10.1	B	<25	0.13	10.3	B	<25	0.23	11.9	B	<25
King Street Tuttle House Driveway												
Weekday Morning Peak Period												
Tuttle House Driveway EB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.01	10.4	B	<25
King Street NB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.01	8.1	A	<25
Weekday Evening Peak Period												
Tuttle House Driveway EB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.04	15.9	C	<25
King Street NB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.01	9.1	A	<25
Saturday Midday Peak Period												
Tuttle House Driveway EB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.03	13.6	B	<25
King Street NB	0.00	0.0	A	<25	0.00	0.0	A	<25	0.02	8.6	A	<25

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average), [c] Level of service, [d] 50th/95th Percentile Queue [95th Percentile Queue only for unsignalized intersections]

Table 7-12 Unsignalized Intersection Capacity and Queue Analysis Summary (Continued)

Intersection / Lane Group	2024 Existing V/C [a]	2024 Existing Delay [b]	2024 Existing LOS [c]	2024 Existing Queue [d]	2034 No-Build V/C	2034 No-Build Delay	2034 No-Build LOS	2034 No-Build Queue	2034 Build V/C	2034 Build Delay	2034 Build LOS	2034 Build Queue
King Street / IBM South Driveway (Site Driveway South)												
Weekday Morning Peak Period												
Site Driveway EB	0.02	14.3	B	<25	0.04	14.7	B	<25	0.10	15.4	C	<25
King Street NBL	0.00	7.7	A	<25	0.06	8.1	A	<25	0.04	8.1	A	<25
Weekday Evening Peak Period												
Site Driveway EB	0.02	15.7	C	<25	0.26	17.8	C	25	0.20	19.6	C	<25
King Street NBL	0.00	8.3	A	<25	0.01	8.8	A	<25	0.04	9.2	A	<25
Saturday Midday Peak Period												
Site Driveway EB	0.05	12.2	B	<25	0.06	12.5	B	<25	0.16	15.6	C	<26
King Street NBL	0.01	8.1	A	<25	0.02	8.3	A	<25	0.05	8.7	A	<25
King Street / Site Driveway Middle												
Weekday Morning Peak Period												
Site Driveway EB	-	-	-	-	-	-	-	-	0.12	15.9	C	<25
King Street NBL	-	-	-	-	-	-	-	-	0.06	8.2	A	<25
Weekday Evening Peak Period												
Site Driveway EB	-	-	-	-	-	-	-	-	0.34	21.7	C	38
King Street NBL	-	-	-	-	-	-	-	-	0.07	9.0	A	<25
Saturday Midday Peak Period												
Site Driveway EB	-	-	-	-	-	-	-	-	0.20	16.1	C	<25
King Street NBL	-	-	-	-	-	-	-	-	0.08	8.7	A	<25
King Street / IBM Nouth Driveway (Site Driveway Nouth)												
Weekday Morning Peak Period												
Site Driveway EB	0.01	14.0	B	<25	0.04	14.0	B	<25	0.07	12.3	B	<25
King Street NBL	0.00	8.1	A	<25	0.06	8.2	A	<25	0.03	8.1	A	<25
Weekday Evening Peak Period												
Site Driveway EB	0.01	16.1	C	<25	0.22	16.2	C	<25	0.22	16.6	C	<25
King Street NBL	0.00	0.0	A	<25	0.01	8.5	A	<25	0.04	8.7	A	<25
Saturday Midday Peak Period												
Site Driveway EB	0.03	14.5	B	<25	0.05	13.4	B	<25	0.18	13.8	B	<25
King Street NBL	0.00	8.1	A	<25	0.01	8.2	A	<25	0.05	8.4	A	<25
King Street / Building Q Driveway												
Weekday Morning Peak Period												
Site Driveway EB	-	-	-	-	-	-	-	-	0.00	0.0	A	<25
Weekday Evening Peak Period												
Site Driveway EB	-	-	-	-	-	-	-	-	0.00	19.3	C	<25
Saturday Midday Peak Period												
Site Driveway EB	-	-	-	-	-	-	-	-	0.01	15.6	C	<25

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average), [c] Level of service, [d] 50th/95th Percentile Queue [95th Percentile Queue only for unsignalized intersections]

7.6 Parking Demand

The existing site currently includes 1,950 off-street surface parking spaces to service the existing uses in both site locations. The Project looks to significantly increase the parking at the site and will provide 3,010 parking spaces to service the redevelopment area (358 parking spaces at the 410 Great Road location and 2,652 parking spaces at the 550 King Street location).

7.6.1 Town of Littleton Zoning By-Laws

The Town of Littleton Zoning By-Laws contains minimal off-street parking supply requirements for various land uses within the Village Common (VC) Zoning District. of the Town of Littleton Zoning Bylaw, as amended. Based on zoning regulations for the VC district, a total off-street parking space level in excess of 2,869 parking spaces are required to serve the Project (Per Section §173-224.A.) as noted in Table 7-13.

Table 7-13 Town of Littleton Zoning Parking Requirements [(a)]

Land Use	Zoning Requirements	Size	Spaces Required
Residential [410 Great Road]	1.25 spaces / unit	285 Units	357
Residential [550 King Street]	1.25 spaces / unit	804 Units	1,005
Hotel	1.25 spaces / room	150 Keys	188
Office	3 spaces / 1,000 SF	19,000 SF	57
Research & Development	1.5 spaces / 1,000 SF	545,520	818
Retail	4 spaces / 1,000 SF	90,800 SF	364
Restaurant	4 spaces / 1,000 SF	20,000 SF	80
		TOTAL	**2,869**

[a] Zoning By-Law Section 173-224.A. for Village Common Zoning District

Based on a parking supply of 3,010 spaces throughout the site, the proposed parking supply on-site is in general conformance with Town of Littleton Zoning requirements.

7.6.2 Institute of Transportation Engineers Parking Demand Estimates

The size and configuration of the Project site provides an opportunity for shared parking between the several land uses except for the residential uses located at 410 Great Road. The peak parking demand generated by the proposed land uses was estimated based on the '85th percentile' peak parking demand generation rates obtained from the ITE publication *Parking Generation, 6th Edition* for LUC 221 – Multifamily Housing (Mid-Rise) 2+ Bedrooms, LUC 310 – Hotel, LUC 710 – General Office Building, LUC 760 – Research & Development Center, LUC 821 – Shopping Center (40-120K), and LUC 932 – High-Turnover Sit-Down Restaurant. Detailed parking demand and shared parking demand comparison rate worksheets are included in Appendix E-14.

7.6.2.1 Multifamily Housing Parking at 410 Great Road Location

Based on the ITE publication *Parking Generation, 6th Edition*, the 85th percentile peak parking demand for 285 dwelling units of multifamily housing is 413 parked vehicles. The proposed project is proposed to include 358 vehicular parking spaces at the 410 Great Road location. Based on the empirical data, the site will provide approximately 87% of the anticipated parking demand. Although there is slightly less supply at the 410 Great Street location than the estimated demand, the proposed parking is generally in line with the Town of Lancaster Zoning By-Laws for this site where the opportunity to share parking is limited.

7.6.2.2 Shared Parking at 550 King Street

Based on ITE shared parking demand calculations, the 550 King Street location would demand 2,693 parking spaces, approximately 7% above the Town of Littleton zoning requirements for this location. Although slightly above zoning requirements, the proposed shared parking demand is only 1.5% above the parking supply proposed at the 550 King Street location. Whereas the location will offer the ability for shared parking, the Proponent has sought to provide a parking supply in line with shared parking rates as opposed to the much larger demand rates land use by land use while still supporting the potential for diverse tenant applicability.

7.7 Transportation Mitigation

After evaluating the operations and safety of the study area roadways and intersections, the next step is to identify measures to improve the roadways and intersections based on existing and future deficiencies. The Project has impacts in the area immediately adjacent to the site and requires mitigation. The following section provides a summary of measures that are recommended to improve the existing and future operations and safety of the study area intersections. The Proponent has proposed a comprehensive transportation mitigation program in the vicinity of the site to improve vehicular, bicycle, and pedestrian operations and safety.

7.7.1 Off-Site Commitments

7.7.1.1 Intersection Improvements

A graphic depiction of conceptual off-site mitigation improvements is provided in Appendix E-15. Note that these conceptual depictions are a high-level programming conceptual layout and will be further detailed for the project's FEIR.

Field Traffic Signal Timing Fine-Tuning

The Proponent has committed to the field fine-tune traffic signal timings, coordination, and phasing parameters, in the presence of MassDOT, post-occupancy to accommodate the additional traffic flow from the Project site for the following locations:

- Great Road / Russell Street / Constitution Avenue

- Great Road / Interstate 495 SB Ramps
- Great Road / Interstate 495 NB Ramps

The implementation of these improvements will be reviewed and coordinated with MassDOT, who holds jurisdiction of the traffic signal, at agreed upon occupancy thresholds that will be identified in the MassDOT Permit to Access State Highway. No specific modified traffic signal timings have been presented as off-site mitigation within this DEIR as the Project's site generated traffic does not result in significant change to traffic operations between the 2034 No-Build and 2034 Build conditions. In conjunction with field fine-tuning of the traffic signal timings, coordination, and phasing parameters, the Proponent will generate an as-built traffic signal regulation and plan at each intersection location following any updates to traffic signal timings, coordination, and phasing parameters.

Great Road / Site Driveway West

The Proponent has committed to the following improvements at the intersection of Great Road / Site Driveway West:

- Reconstruct the Site Driveway West southbound approach to the intersection to include formalized exclusive left-turn lane and exclusive right-turn lane with a single northbound receiving lane and sidewalks along each side of the approach.
- Reset the curb line along the northerly side of Great Road to open Great Road westbound to two (2) lanes in conjunction with the driveway, as opposed to west of the driveway.
- Restripe the inside travel lane along Great Road eastbound to be an exclusive left-turn lane directly in line with the downstream exclusive left-turn lane at King Street. The traffic volumes along the approach had formerly used this lane, while IBM was actively operating adjacent to the intersection, as a de facto exclusive left-turn lane during peak periods. The de facto nature of the lane is represented in both the 2034 Build and 2034 Build with Mitigation analysis scenarios.
- Install a crosswalk across Great Road to the west of the Site Driveway West including the (re)construction of accessible pedestrian curb ramps to connect the site to the existing sidewalk along the southerly side of Great Road with appropriate warning signage.

Great Road / King Street

The Proponent has committed to the following improvements at the intersection of Great Road / King Street:

- At the recommendation of MassDOT, complete a 'partial' reconstruction of the traffic signal infrastructure at the intersection including new overhead mast arm assemblies to mount signal housings as needed, a new Advanced Transportation Control (ATC) cabinet and controller system with Field Monitoring Unit (FMU) to support transit signal priority (TSP) and future coordinator connections, new demand-based vehicle and bicycle

detection as needed, accommodations for emergency-vehicle pre-emption, Accessible Pedestrian Signal (APS) push buttons, and pedestrian countdown indications. Note that MassDOT has noted that the Proponent may only need to upgrade those infrastructure parts and pieces that are in need of upgrade as opposed to a full traffic signal reconstruction.

- Optimize traffic signal timings at the intersection.
- Reconstruct, as necessary, all sidewalk and pedestrian curb ramps at the intersection to support the new traffic signal infrastructure and provide ADA / AAB / PROWAG compliance. Where possible, as a result of the difficult grading along Great Road eastbound, provide two (2) accessible ramps per intersection corner and realign the crosswalks to be as perpendicular as possible to the four (4) approaches.
- Complete a full pavement resurfacing for a minimum of 50 feet along each intersection approach to match new accessibility accommodations. The distance of resurfacing may extend to a point where the overall queueing on the approach is unaffected. This will be determined at the 25% Design stage of the Permit to Access State Highway process. Reapply high-visibility pavement markings along each approach while maintaining the existing cross-sectional nature of each approach.
- Implement traffic sign and pavement marking upgrades in the vicinity of the intersection to eliminate clutter and comply with the current version of the MUTCD.
- Retain the existing bicycle lanes along each side of King Street through the intersection.
- In conjunction with the reconstruction, the Proponent will generate an as-built traffic signal regulation and plan for the intersection.

The improvements at this intersection are anticipated to improve operations at the intersection. Although some movements will continue to operate with elevated levels of service (LOS E), no movements will operate at LOS F and all movements will operate with V/C ratios below 1.00, which indicates that the intersection movements have adequate capacity to accommodate the additional demand created by the project. There is no feasible means at this location to further expand capacity through roadway expansion due to the proximity of buildings and public open space. Table 7-14 summarizes the operations being 2034 Build and 2034 Build with Mitigation Conditions.

Table 7-14 Mitigation Intersection capacity and Queue Analysis

Intersection / Lane Group	2034 Build				2034 Build with Mitigation			
	V/C [a]	Delay [b]	LOS [c]	Queue [d]	V/C	Delay	LOS	Queue
Weekday Morning Peak Period								
Great Road EBL	0.52	18.1	B	75/118	0.51	15.1	B	69/127
Great Road EBT	0.87	39.7	D	345/498	0.85	35.4	D	319/526
Great Road WBL	0.47	19.7	B	40/69	0.46	17.1	B	37/74
Great Road WBT	0.48	23.3	C	163/242	0.49	22.1	C	153/253
King Street NBL	0.72	36.7	D	92/169	0.67	27.9	C	86/175
King Street NBT	0.82	50.6	D	210/400	0.70	35.8	D	196/330
King Street SBL	0.45	28.6	C	49/102	0.43	25.1	C	46/94
King Street SBT	0.85	56.3	E	189/384	0.78	43.4	D	176/307
Overall Intersection	**0.81**	**37.0**	**D**	**-**	**0.79**	**30.4**	**D**	**-**
Weekday Evening Peak Period								
Great Road EBL	0.76	41.1	D	79/159	0.88	62.0	E	82/213
Great Road EBT	0.75	41.9	D	292/412	0.83	49.8	D	302/432
Great Road WBL	0.75	35.8	D	112/165	0.81	41.1	D	116/185
Great Road WBT	0.87	50.6	D	402/543	0.90	54.6	D	399/545
King Street NBL	1.24	179.1	F	153/368	0.91	69.0	E	112/299
King Street NBT	0.48	32.4	C	186/324	0.43	27.2	C	172/295
King Street SBL	0.30	24.0	C	53/113	0.26	20.9	C	48/96
King Street SBT	1.03	86.7	F	513/883	0.99	70.4	E	461/796
Overall Intersection	**1.04**	**62.5**	**E**	**-**	**0.95**	**53.3**	**D**	**-**
Saturday Midday Peak Period								
Great Road EBL	0.49	21.0	C	65/103	0.55	21.6	C	71/120
Great Road EBT	0.85	44.0	D	334/475	0.89	48.1	D	338/560
Great Road WBL	0.60	24.5	C	71/110	0.72	29.3	C	77/163
Great Road WBT	0.68	33.5	C	269/382	0.76	36.3	D	282/441
King Street NBL	0.89	64.7	E	87/268	0.73	31.8	C	74/150
King Street NBT	0.56	36.5	D	172/314	0.53	30.1	C	156/247
King Street SBL	0.44	27.1	C	70/147	0.39	19.8	B	61/103
King Street SBT	1.04	91.7	F	376/718	0.89	49.6	D	306/488
Overall Intersection	**0.88**	**48.3**	**D**	**-**	**0.88**	**37.9**	**D**	**-**

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average)

[c] Level of service, [d] 50th/95th Percentile Queue [95th Percentile Queue only for unsignalized intersections]

Great Road / Stevens Street / Adams Street / Meetinghouse Road

The Proponent has committed to the following improvements at the intersection of Great Road / Stevens Street / Adams Street / Meetinghouse Road:

- Reconstruct, as necessary, all pedestrian curb ramps at the intersection to provide ADA / AAB / PROWAG compliance. Reapply high-visibility crosswalk markings between each ramp pair.
- Replace out-of-date pedestrian crossing traffic signs along Great Road for each crosswalk with new florescent yellow-green pedestrian crossing signage (W11-2 & W16-7pL) signs and advance pedestrian crossing (W11-2 & W16-9p) traffic signs upstream.

King Street / Goldsmith Street / Stevens Street / 476 King Street Driveway:

The Proponent has committed to the following improvements at the intersection of King Street / Goldsmith Street / Stevens Street / 476 King Street Driveway:

- Reconstruct the intersection's southwest corner between King Street and Goldsmith Street to provide a new curb line in conjunction with a curb extension to shorten pedestrian crossing distance and remove excess pavement area.
- Construct a curb extension along the easterly side of Stevens Street, north of Goldsmith Street, to shorten pedestrian crossing distance and remove excess pavement area. Relocate the Goldsmith Street stop sign (R1-1) and stop line, as necessary. Retain the existing bicycle lane along Steven Street.
- Reconstruct, as necessary, all pedestrian curb ramps at the intersection to provide ADA / AAB / PROWAG compliance. Reapply high-visibility crosswalk markings between each ramp pair.
- Replace out-of-date pedestrian crossing traffic signs along Great Road with new florescent yellow-green pedestrian crossing signage (W11-2 & W16-7pL) signs and advance pedestrian crossing (W11-2 & W16-9p) traffic signs upstream.

Other Pedestrian Infrastructure Upgrades

The Proponent will reconstruct accessible pedestrian ramps and crosswalks with appropriate pedestrian crossing signage (W11-2 & W16-7pL) signs and advance pedestrian crossing (W11-2 & W16-9p) traffic signs upstream at the following locations:

- King Street / 410 Great Road Driveway
- King Street / Meetinghouse Road
- King Street / Site Driveway South
- King Street / Site Driveway Middle
- King Street / Site Driveway North
- King Street / Building Q Driveway

7.7.1.2 Corridor Improvements

Great Road

The Proponent will reconstruct the existing sidewalk along the southerly side of Great Road along the site frontage of 410 Great Road (400-feet) with 6-inch vertical granite curbing to provide separation between vehicle and pedestrian traffic.

King Street

The Proponent will reconstruct the existing sidewalk along the westerly side of King Street along the site frontage between the Tuttle House Driveway and the Building Q Driveway (1,650-feet) with 6-inch vertical granite curbing to provide separation between vehicle and pedestrian traffic. The sidewalk will provide site connectivity on each driveway into the site. The Proponent will reset the curb line along the westerly side of King Street to accommodate on-street parking stalls between the open space common area and the Building Q Driveway (1,350-feet) including up to 43 on-street parking spaces. On-street parking along SHLO will be further discussed with MassDOT during the design process. The new curbline and sidewalk area will be lined with opportunities for street trees to change the characteristics of the corridor to a pedestrian and bicycle-friendly environment and lower travel speeds. The bicycle lanes along King Street northbound and southbound will be maintained.

7.7.2 Transportation Demand Management Measures

The Proponent has commitment to research and provide a dynamic TDM program in order to reduce vehicular trips to/from the site. The Proponent is committed to providing the following TDM measures:

7.7.2.1 Parking Measures

Preferential Parking - Provide preferential parking for rideshare, carpool, and hybrid vehicles at locations throughout the site's parking areas in close proximity to major entranceways. The designated spaces will be monitored to ensure that the license plates of those employees parking in the spots each day match the registrations of participants. Employees will only be allowed to use these spaces on the days that they are carpooling. Locations for preferential parking will be identified in future filings.

Electric Vehicle Stations – Electric vehicle (EV) charging stations will be provided at locations throughout the site's parking areas in close proximity to major entranceways. Locations for the EV charging stations will be identified in future filings.

Reduced Parking Supply – The Proponent is committed to reducing the parking supply by providing minimal number of parking spaces to a level of the demand need only.

7.7.2.2 Bicycle and Pedestrian Measures

Sidewalk Connectivity – The site will provide connectivity of sidewalk infrastructure along King Street and Great Road and internal to the site to each building within the construction limits for both the 410 Great Road and 550 King Street locations.

Bicycle Accommodations – The site will include bicycle accommodation through the main drive aisle of the site with connectivity to bicycle infrastructure along King Street. Internal bicycle accommodation may include bicycle lanes and/or shared use paths.

Bicycle Racks – The Proponent will provide secure, weather protected, long-term bicycle parking for employees and residents at designated locations within the site. The site plan will also provide bicycle racks for short-term users at several locations on-site.

Public Bicycle Vendor – The Proponent is exploring opportunities to implement a public bicycle vendor, such as Blue Bikes, on-site. If deemed feasible, a vendor station will be strategically located within the site.

Employee Shower Facilities - Coordinate with commercial tenants to provide showers for employees who commute by walking or biking.

Pedestrian Signal Equipment – See Off-Site Mitigation Commitments

Accessibility Compliance in Vicinity of Site – See Off-Site Mitigation Commitments

7.7.2.3 Public Transportation Measures

LRTA Bus Service – The Proponent seeks to continue LRTA bus service to the site along LRTA Bus Route 15. The Proponent will relocate the existing bus stop location to a new location within the site and provide a second bus stop location; each along the main drive aisle in the southbound direction. Each bus stop location will contain a pavement turn-out, bus shelter, trash receptacle, bike rack, and sufficient hardscape area to accommodate full accessibility and bus ramp access.

Public Transportation Shuttle Service – The Proponent is committed to provide access to the Littleton / I-495 Commuter Rail Station located 2.5 miles south of the Project site along Foster Street. The shuttle will be funded by the Proponent and be scheduled to coincide with train boarding / alighting schedules for the MBTA Fitchburg Line. The shuttle stop will be combined with one (1) of the two (2) LRTA bus stops on-site.

Maps / Schedules - Public transportation schedules with transit maps for LRTA Bus Route 15 and the MBTA Commuter Rail, as well as for all nearby connecting routes will be provided to each resident upon move-in and employees upon employment. Maps and schedules will also be posted on each floor of the residential buildings. Schedules and maps will also be provided in the lobby and near doorways in all other on-site buildings.

7.7.2.4 Standard TDM Measures

Employee Transportation Coordinator (ETC) – An ETC will be provided on-site to oversee, implement, monitor, and evaluate TDM measures, employed or funded by the Proponent. The ETC will be responsible for managing rideshare and carpool programs, as well as distributing information to residents and employees to encourage alternative means of transportation. The ETC will be responsible for posting and distributing announcements, holding promotional events to encourage rideshare, bicycling, and walking.

Transportation Management Association (TMA) – The Applicant will seek membership in the Middlesex 3 Transportation Management Association (TMA) which is utilized in neighboring Westford and communities to the northeast of Littleton. The TMA will assist the Proponent and the ETC in support of employees' commuting choices by providing flexible and sustainable transportation solutions.

Marketing of Transportation Options and Benefits - A welcome packet for all tenants and employees will be distributed at move-in or employment which includes information for all transportation related benefits, promotions, and local transportation options; including location of LRTA / MBTA stops, transit schedules, EV and carpool parking locations, and any other emerging new mobility locations.

Vanpool and Carpool – The Proponent, and the ETC, will encourage vanpool and carpooling participation through marketing, events, and vanpool formation meetings. The ETC will implement a ride-matching program to assist employees and residents in finding appropriate carpool matches. The ETC will contact employees and residents to determine if they receive their match-lists, review the lists with them and see if they have contacted anyone on the list or would like assistance in contacting people.

Guaranteed Ride Home Program – The ETC will be responsible for providing all employees who carpool, bicycle, or walk to work with an emergency ride home. This program eliminates the fear of being stranded on days that the employees are ridesharing or having to walk or bicycle in inclement weather conditions.

On-Site Laundry Services - The Proponent will provide laundry services on-site to allow for the reduction of trips to/from the site of nearby laundromats.

Flex Hours – The Proponent will encourage tenants within the mixed-use development to provide flexible hours to employees.

Direct Deposit for Employees - The Proponent will encourage tenants within the mixed-use development to provide direct deposit to reduce employee trips to/from the site.

Site Amenities – As a mixed-use development, the site includes several on-site amenities, such as restaurants, retail, open space, and resident-specific amenities within the residential component of the site. This location will assist in reducing vehicular demand and increase multi-use trips, which include parking capacity sized to meet minimum local requirements without providing excessive parking.

Promotional Events and Activities – The ETC will be responsible for organizing promotional events and activities to encourage rideshare and alternative transportation means. In addition, the ETC will distribute brochures to all new employees and residents during, and post posters and bulletins on various subjects from carpooling to the Guaranteed Ride Home program throughout the site.

7.7.3 Transportation Monitoring Program

The Proponent is committed to implementing a Transportation Monitoring Program (TMP), which is intended to monitor traffic operations, parking occupancy, public transportation utilization, and pedestrian / bicycle use for a period following completion of the Project. The TMP will include providing traffic count information to the MassDOT District 3 office and the Town of Littleton for use of tracking site-generated trips. The intent of the monitoring program is to ensure that the Project impacts are consistent with those predicted in the Project's permitting process, evaluate the effectiveness of the TDM measures in meeting the mode share targets, and assess the need for additional off-site improvements or TDM measures.

The MassDOT / Town of Littleton monitoring program will include an evaluation of the following:

- Traffic operations at the intersections of:
  - Great Road / Interstate 495 SB Ramps
  - Great Road / Interstate 495 NB Ramps
  - Great Road / Site Driveway West
  - Great Road / 410 Great Road Driveway
  - Great Road / King Street
  - King Street / 410 Great Road Driveway
  - King Street / Tuttle House Driveway
  - King Street / Site Driveway South
  - King Street / Site Driveway Middle
  - King Street / Site Driveway North
  - King Street / Building Q Driveway
- Adequacy of the constructed parking supply.
- Safety evaluations based on available crash data.
- Effectiveness of TDM measures.

As part of the monitoring program, the Proponent will complete the following tasks annually for five (5) years following occupancy of the proposed mixed-use development:

- Collect manual Turning Movement Counts (TMCs) during the weekday morning (7:00 AM to 9:00 AM), weekday evening (4:00 to 6:00 PM), and Saturday midday (11:00 AM to 2:00 PM) peak periods at the following intersections:
  - Great Road / Interstate 495 SB Ramps
  - Great Road / Interstate 495 NB Ramps

- Great Road / Site Driveway West
- Great Road / 410 Great Road Driveway
- Great Road / King Street
- King Street / 410 Great Road Driveway
- King Street / Tuttle House Driveway
- King Street / Site Driveway South
- King Street / Site Driveway Middle
- King Street / Site Driveway North
- King Street / Building Q Driveway

- Collect ATR data for a continuous 7-day week-long period along Great Road, King Street, and each of the Site Driveway locations.
- Collect parking demand counts during the peak parking demand periods for the specific land use areas, including:
  - Residential and Hotel - 5:00 AM to 9:00 AM
  - Retail, Restaurants, R&D, Office, and Industrial - 10:00 AM to 5:00 PM
- Collect motor vehicle crash reports from the Town of Littleton Police Department and MassDOT for the most recent one-year period to ascertain changes in crash frequency, crash trends, and severity at the monitored locations.
- Complete an employee and resident travel survey to gage employee and resident travel patterns and mode share.
- Compare the TMCs collected above with those projected within the TIAPS for the Project to determine whether the total vehicles entering each intersection exceeds the volumes projected.
- Perform a capacity and queuing analysis using Synchro / Sidra analysis software to evaluate the traffic operations at each of the intersections listed above and compare to the operations projected in the TIAPS prepared for the Project.
- Assess whether additional mitigation is necessary at any of the study intersections and identify measures to improve operations and/or reduce vehicular traffic volumes. The need or evaluation for further mitigation will be conditioned upon:
  - The measured site generated traffic volumes for the Project exceeded the projected site generated traffic volumes established in this TIAPS, or subsequent revisions as presented to the Town of Littleton, by more than 10 percent (i.e., 110 percent of the projected site generated traffic volumes.

- One or more of the movements at the monitored intersections is identified to be operating at or over capacity (defined as a V/C ratio equal to or exceeds 1.00) in consultation with MassDOT or the Town of Littleton.
- There is a pronounced increase in the frequency of occurrence of motor vehicle crashes at a monitored location and the calculated motor vehicle crash rate excess the MassDOT average crash rate for similar locations.

- Corrective actions to reduce the unmitigated impact of the Project should be proposed and implemented based on the thresholds listed above. The corrective actions should be documented in the TMP, approved and coordinated with the Town and/or MassDOT if desired by the agencies, and be undertaken by the Proponent subject to receipt of all necessary rights, permits, and approvals.
- Assess whether the constructed parking supply is adequate for the parking demand as observed.
- Prepare a memorandum summarizing the results of the TMCs, ATRs, parking demand counts, traffic impact analysis for submission to MassDOT District 3 and the Town of Littleton.

The monitoring program will occur on an annual basis beginning six (6) months after issuance of the first occupancy permit and continuing for five (5) years following full occupancy of the project. The monitoring program may be suspended at any time upon agreement with MassDOT and the Town of Littleton that the Project has sufficiently provided evidence that the upper limits of vehicle delay and trip projection would not be feasibly satisfied. The annual nature of the monitoring program may be postponed in consultation with the Town and MassDOT based on lack of need circumstances if no new development has occurred during full build-out. The monitoring program may also be suspended if five (5) years have passed since the issuance of an occupancy permit for the project and will be recommended should an additional occupancy permit be issued.

7.8 Transportation Summary & Conclusions

TEC has examined the potential traffic impacts associated with the proposed King Street Common location in Littleton, Massachusetts on the study area roadways and intersections. The following is a summary of the results and conclusions of this effort:

- The Project Site is located across two (2) distinct areas at 550 King Street and 410 Great Road as part of 47.4 acres.
- At the time of DEIR submittal, the existing 550 King Street location includes 72,500 SF of occupied commercial space within the former IBM buildings and an additional 20,000 SF of commercial space under lease and undergoing tenant specific fitting. The existing 410 Great Road location is generally occupied in full.

- The Project consists of redeveloping the two (2) existing development locations including repurposing the two (2) former IBM office buildings, demolishing the various mill structures at 410 Great Road, and constructing several other buildings throughout the site with associated surface and structured parking. The proposed mixed-use development program includes ±545,520 SF of research & development space (former IBM buildings), ±19,000 of general office space, ±90,800 SF of retail space, ±20,000 SF of restaurant space, a 150-room hotel, and 1,089 units of multifamily housing. For the multifamily housing component, 804 units will be located within the 550 King Street location and 285 units will be located within the 410 Great Road location. The 410 Great Road location will be solely for residential use.
- The 550 King Street location proposes to retain access/egress to the site via Auman Street along the northerly side of Great Road. In addition, the Project proposes to retain the two (2) driveway locations along the westerly side of King Street and construct an additional two (2) full access/egress driveways along the westerly side of King Street. The project will also maintain the existing driveway to the Tuttle House historical property parking lot which will be inclusive of the project area.
- The 410 Great Road location will terminate access/egress from all of its existing driveway locations along the southerly side of Great Road and provide full access/egress via a single driveway along the southerly side of Great Road slightly offset from the opposing Auman Street driveway to the 550 King Street location. A second full access/egress driveway will be constructed along the westerly side of King Street within the existing vacant 450 King Street property just south of Dunkin Donuts.
- The SSD at each of the Project driveway locations exceeds AASHTO minimum recommendations except for Great Road westbound approaching Auman Street as the sight distance is metered by the upstream intersection with King Street 275 feet to the east. Whereas the intersection provides a flatter pavement surface and serves as a crest in the vertical curvature of Great Road, the sight line does not extend any substantial distance past the signalized intersection.
- The ISD along Auman Street at Great Road looking east is obstructed by a large tree and grading of the embankment along the northerly side of Great Road. Some of this aera is on the adjacent private parcel. Upon removal of the trees and regrading, the ISD would still be less than the AASHTO minimum recommendation as the crest in the vertical curvature of Great Road further limits the sight line past the signalized intersection with King Street.
- The ISD along the future location of the 410 Great Road Driveway looking east along Great Road is obstructed by the crest in the vertical curvature of Great Road which limits the sight line past the signalized intersection with King Street.

- The ISD along the future location of the 410 Great Road Driveway looking north along King Street is obstructed by landscaped plantings along neighboring properties on the westerly side of King Street. Relocation of these plantings would generally result in a sight line that meets AASHTO minimum recommendation.
- There are currently no intersections within the study area that are designated as HSIP-eligible intersections.
- The project is anticipated to generate approximately 13,388 new vehicle trips during the average weekday, with 949 vehicle trips (552 entering and 397 exiting) during the weekday morning peak hour and 977 vehicle trips (387 entering and 590 exiting) during the weekday evening peak hour. Approximately 9,308 new vehicle trips are anticipated during the average Saturday with 887 new vehicle trips (468 entering and 419 exiting) during the Saturday midday peak hour.
- Compared to the potential full reoccupancy of the existing IBM Corporation buildings, the project is anticipated to NET 9,098 new vehicle trips during the average weekday, with 340 new vehicle trips (16 entering and 324 exiting) during the weekday morning peak hour and 401 vehicle trips (289 entering and 112 exiting) during the weekday evening peak hour. Approximately 8,304 NET new vehicle trips are anticipated during the average Saturday with 647 new vehicle trips (338 entering and 309 exiting) during the Saturday midday peak hour.
- Based on the unsignalized operating conditions on Great Road at the Site Driveway West, the traffic volumes do warrant the construction of a left-turn lane on the Great Road eastbound approach. Based on the traffic operation analysis, no left-turn lane is specifically proposed at this location; however, the Proponent proposes to reassign the inside travel lane to an exclusive left-turn lane where it operates as a de facto left-turn lane.
- The existing site currently includes 1,950 off-street surface parking spaces to service the existing uses in both site locations. The Project looks to significantly increase the parking at the site and will provide 3,010 parking spaces to service the redevelopment area (358 parking spaces at the 410 Great Road location and 2,652 parking spaces at the 550 King Street location). The parking supply is consistent with ITE parking demand estimates as opposed to a direct alignment with Town of Littleton zoning requirements.
- The Proponent has proposed a comprehensive transportation mitigation program in the vicinity of the site to improve vehicle, bicycle, and pedestrian operations and safety with includes a mix of improvement for vehicle, pedestrian, and bicycle traffic. Following improvements, the various study area intersections will generally operate comparable to traffic operations in the No-Build conditions.
- The Proponent is currently working with the Town of LRTA to retain the bus service to the site and expand the amenities for the bus service with two (2) bus stop locations internal to the site. The Proponent will also provide a shuttle service to the nearby Littleton / I-495 MBTA Commuter Rail Station.

- The Proponent has commitment to research and provide a dynamic and extensive TDM program in order to reduce automobile trips to/from the site and promote multi-modal travel. A full compilation of TDM measures have been identified and include provisions to reduce on-site parking, increase pedestrian and bicycle travel, promote transit use to/from the site, and decrease the impacts of vehicle emissions.

In conclusion, with implementation of the proposed improvements and TDM measures, the anticipated traffic generated by the King Street Common Project can be safely and efficiently accommodated within the study area corridors and intersections upon implementation of off-site mitigation. The Proponent has committed to working cooperatively with the Town of Littleton and MassDOT to implement the robust transportation mitigation program.