Traffic Impact and Access Study

Riverside MBTA Station Redevelopment

Newton,
Massachusetts

Prepared for

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Executive Summary

Vanasse Hangen Brustlin, Inc. (VHB) has prepared a Traffic Impact and Access Study (TIAS) for the proposed Riverside Massachusetts Bay Transportation Authority (MBTA) Station Redevelopment (the "Project") in Newton, Massachusetts. The Project site is situated at the Riverside MBTA Station located on Grove Street and adjacent to the Route 128 northbound ramp frontage road in Newton, Massachusetts. The Project involves redevelopment and consolidation of the existing 960 surface parking spaces, and all vehicle transit services into a new parking structure to be located in close proximity to the existing MBTA rail platform. The consolidation of all existing surface parking and vehicle transit services to the proposed parking structure will allow for redevelopment on site. The development proposed includes: the construction of approximately 595,000 square feet (sf) of office space, 240 residential apartment units encompassing 260,000 sf of building area, and 14,800 sf of ancillary retail space. A total of approximately 2,720 parking spaces will be provided throughout the site to support the MBTA and Project parking demands primarily through structured parking facilities.

The proposed Project is a cooperative development proposal between the Proponent and the MBTA, under which the Proponent will lease the land to support the uses from the MBTA, thereby generating a yearly revenue stream to the public agency. Access to the site will be provided by two driveways: one full-access, signalized driveway along Grove Street at the location of the existing driveway to the site, and a second, new, unsignalized driveway to be located along a reconstructed frontage road (northwest portion of site) providing right-turn-in access and full egress (allowing both left and right turning vehicles to exit the site), adjacent to the Route 128 Northbound ramp to Route 30 and the Massachusetts Turnpike. The Project site provides convenient vehicular access to the major regional highways in the area such as Route 128/Interstate 95 and the Massachusetts Turnpike/Interstate 90. The proposed access plan, with new connection directly to the frontage road significantly enhances the site connection to the regional roadway system. The Project site also provides convenient access to public transportation opportunities including the D Line of the MBTA Green Line and MBTA Bus Routes 500, 555, and 558.

Based on a review of the anticipated trip generation and trip distribution for the Project, and thorough consultation with the City of Newton and MassDOT, a study area was established. Using this approach, the study area will include the following 18 intersections:

1. Washington Street (Route 16) at Concord Street – *signalized*
2. Washington Street (Route 16) at Grove Street - *unsignalized*
3. Concord Street at Hagar Road - *unsignalized*

4. Grove Street at Hagar Road and Colgate Road – *unsignalized*
5. Grove Street at Route 128 SB Ramps/Asheville Road – *unsignalized*
6. Grove Street at the Route 128 Northbound Ramps – *unsignalized*
7. Route 128 Exit 21B Collector-Distributor Road at the Route 128 Southbound Ramps – *unsignalized*
8. Washington Street (Route 16) at Quinobequin Road/Wales Road/ Route 128 Southbound Ramps – *signalized*
9. Washington Street (Route 16) at the Route 128 Northbound Ramps – *unsignalized*
10. Grove Street at the Riverside MBTA Parking Lot Driveway – *unsignalized*
11. Grove Street at the Riverside Office Building (South) and Apartment Driveways – *unsignalized*
12. Grove Street at the Riverside Office Building (Center) and Apartment Driveways – *signalized*
13. Grove Street at the Riverside Office Building Driveway (North) and Seminary Road – *unsignalized*
14. Grove Street at Hancock Street - *unsignalized*
15. Grove Street at Woodland Road – *unsignalized*
16. Grove Street at Central Street/Auburn Street – *signalized*
17. Hancock Street at Woodland Road – *unsignalized*
18. Woodland Road at Central Street – *unsignalized*

Manual turning movement counts (TMCs) were conducted at each of the 18 study-area intersections during the weekday morning peak period from 7:00 AM to 9:00 AM and the weekday evening peak period from 4:00 PM to 6:00 PM. The counts were primarily conducted in May 2009, with some preliminary TMCs conducted in April 2009. Concurrent with the TMCs, 48-hour automatic traffic recorder (ATR) counts were conducted along the following roadways:

- Grove Street, north of the Asheville Road
- Grove Street, south of Pine Grove Avenue
- Grove Street, south of the Riverside MBTA Driveway
- Grove Street, north of the Riverside MBTA Driveway
- Grove Street, south of Hancock Street
- Route 128 Southbound, south of Grove Street
- Route 128 Northbound, north of Route 16
- Route 128 Northbound Exits 23-24-25 Off-Ramp
- Route 128 Northbound Exit 25 Ramp to Route 30/Route 128/I-95 NB
- Route 128 Northbound Exit 24 Ramp to Massachusetts Turnpike
- Massachusetts Turnpike Ramp to Route 30/Route 128/I-95 NB
- Frontage road south of Recreation Road exit

A review of the vehicular crash history at the study area intersections for the latest three year review period (2005-2007) was undertaken to determine if there are any existing safety deficiencies within the study area. The Route 128 interchanges at Route 16 and Grove Street were shown to experience the most motor vehicle crashes over the three year review period. Other than these two locations, the remaining study area intersections were shown to experience fewer than four motor vehicle crashes per year, with no intersections exceeding the MassDOT District 4 (the MassDOT district that Newton is located in) average crash rate. Both the Route 16 and Grove Street interchanges experienced a significant number of accidents which are likely above the State average. But due to the lack of detail on the accidents reports, in terms of exact location of the incident, this could not be verified.

Existing public transportation services at and near the Project site were reviewed. The MBTA provides Green Line service between Riverside Station in Newton and Lechmere Station in Cambridge, with connections to other MBTA subway lines and many bus lines. There are also three MBTA bus routes that that travel to and from Riverside Station (MBTA bus routes 500, 555, and 558). Each of the three bus routes serves as a commuter bus between Riverside Station and downtown Boston, with all three offering express service along the Massachusetts Turnpike. In addition to the transit options available at the Riverside Station, MBTA commuter rail service is available within one mile of the site at the Auburndale stop of the Framingham/Worcester line.

The proposed Project is expected to generate approximately 6,948 (3,474 entering and 3,474 exiting) new vehicle trips during an average weekday, with 818 (654 entering and 164 exiting) new vehicle trips during the weekday morning peak hour and 876 (233 entering and 643 exiting) new vehicle trips during the weekday evening peak hour. While the project will result in traffic increases at study area intersections, the nature of the project, mixed use, and its location, immediately adjacent to a highly active rail and vehicle transit system make this a Transit Orientated Development (TOD). As such the overall traffic generation that is projected is likely very conservative, even with moderate traffic credits applied.

Capacity analyses were conducted for each of the study area intersections and weave sections under 2010 Existing conditions, 2015 No-Build conditions (without the proposed development), and 2015 Build conditions (with the proposed development).

Review of existing operations and safety along Grove Street in the vicinity of the site suggest that peak periods experience some operational constraints and clear safety concerns. Today, both Route 128/I-95 Ramps to Grove Street operate as unsignalized intersections with STOP control on the ramp approaches. Also under existing conditions, the Riverside Station has a single access driveway along Grove Street that consists of an unsignalized intersection with STOP control on the site approach to Grove Street. Speeds along Grove Street in this area were observed to be substantial with an 85th percentile speed of 38 mph. The poor peak operations and general safety concerns are further compounded when traffic congregates in this area for parking and train access to a Red Sox game (Game Day). Based on observations, and review of intersection operational analyses and safety records in this area, it is clear that improvements are necessary along Grove Street today, with or without the proposed project.

Based on the results of these analyses and the anticipated site-generated traffic, the Proponent is proposing to implement substantial improvements in this area that address existing concerns, address future traffic associated with the proposed project, and will provide additional capacity and safety enhancement to this area for the future. The initiatives planned include the following measures:

- Comprehensive Transportation Demand Management Program
- Intersection capacity/safety enhancements at:
  - Grove Street at Route 128 Northbound Ramps
  - Grove Street at Route 128 Southbound Ramps
  - Grove Street at Riverside Station Driveway
- Proposed right-turn in/full-egress out access off of Northbound Ramp access to the frontage road
- Roadway improvements along the Route 128 frontage road
- Pedestrian enhancements on-site and off-site
- Traffic calming improvements along Grove Street

Overall, VHB has concluded that the proposed Project, in concert with the comprehensive improvements proposed will accommodate future site-generated traffic associated with the Project, substantially improve the existing operational and safety concerns in this area, and provide some needed safety/capacity enhancements beyond those needed for the proposed project.

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Introduction

This traffic study documents the findings of the traffic evaluation conducted for the proposed Riverside Massachusetts Bay Transportation Authority (MBTA) Station Redevelopment (the "Project") to be undertaken by BH Normandy Riverside, LLC (the "Proponent") including an assessment of existing conditions, projection of future traffic volumes without and with the Project, analysis of impacts of the Project and recommendations for improving existing capacity and safety deficiencies as well as to offset Project-related traffic impacts.

Project Description

The Project site is situated at the Riverside MBTA Station located on Grove Street and adjacent to the Route 128 northbound ramp frontage road in Newton, Massachusetts. The Project site contains transit related uses, including the terminal light rail station, approximately 960 parking spaces, a maintenance facility, a storage yard, a bus terminal (servicing Peter Pan/Greyhound as well as MBTA buses), local shuttle buses, and associated facilities. These uses will remain although certain elements may be relocated as part of the Project.

The Project involves redevelopment and consolidation of the existing 960 surface parking spaces, and all vehicle transit services into a new parking structure to be located in close proximity to the existing MBTA rail platform. The consolidation of all existing surface parking and vehicle transit services to the proposed parking structure will allow for redevelopment on site. The development proposed includes the construction of approximately:

- 595,000 square feet (sf) of office space;
- 240 residential apartment units encompassing 260,000 sf of building area; and
- 14,800 sf of ancillary retail space.

A total of approximately 2,720 parking spaces will be provided throughout the site to support the MBTA and Project parking demands primarily through structured parking facilities. The site location is illustrated in Figure 1.

Source: MassGIS 2005 Aerial Photo Imagery

Vanasse Hangen Brustlin, Inc.

Study Area Map

Figure 1

Riverside MBTA Station Redevelopment
Newton, Massachusetts

The proposed Project is a cooperative development proposal between the Proponent and the MBTA, under which the Proponent will lease the land to support the uses from the MBTA, thereby generating a yearly revenue stream to the public agency. As part of the development proposal, the Proponent will build a new parking structure to primarily accommodate the MBTA commuter station parking demands. Additional structured parking will be provided for both the office and residential uses. A total of approximately 2,720 parking spaces will be provided to accommodate the Project and the needs of the MBTA station. Access to the site would be provided by two driveways: one full-access, signalized driveway along Grove Street, and a second unsignalized driveway providing right-turn in/full-egress out access off of the northbound ramp access to the frontage road, adjacent to the Route 128 Northbound ramp to Route 30 and the Massachusetts Turnpike. With the proposed site access plan, the Project site provides substantially enhanced vehicular access to the major regional highways in the area such as Route 128/Interstate 95 and the Massachusetts Turnpike/Interstate 90. With direct access off of the frontage road, the majority of the site generated traffic and MBTA traffic has the ability to enter and exit the site without traveling along Grove Street along the site frontage. The Project site also provides convenient access to public transportation opportunities such as the D Line of the MBTA Green Line and MBTA Bus Routes 500, 555, and 558.

Study Methodology

This traffic assessment has been conducted in three stages. The first stage involved an assessment of existing traffic conditions within the Project area including an inventory of existing roadway geometry; observations of traffic flow, including daily and peak period traffic counts; a review of vehicular crash data; and a review of existing public transportation characteristics at the site. In addition, traffic conditions in the vicinity of the site were also reviewed during special events (i.e. during a Red Sox game when parking at the Riverside station peaks) to assess operations in the vicinity of the Riverside MBTA station under increased traffic volume conditions

The second stage of the study established the framework for evaluating the transportation impacts of the proposed Project. Specific travel demand forecasts for the project were assessed along with future traffic demands on the study area roadways due to projected background traffic growth and other proposed area development that will occur, independent of the proposed development. The year 2015, a five-year time horizon, was selected as the design year for analysis for the preparation of this traffic impact and access assessment to satisfy the *Executive Office of Environmental Affairs/Executive Office of Transportation* [EOEA/EOT] guidelines.

The third and final stage involved conducting traffic analyses to identify both existing and projected future roadway capacities and demands. This analysis was used as the basis for determining potential project impacts and developing means and measures to address Project-related impacts.

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Existing Conditions

Evaluation of the transportation impacts associated with the proposed Project requires a thorough understanding of the existing transportation system in the Project study area. Existing transportation conditions in the study area include roadway geometry, traffic controls, daily and peak period traffic flow, and vehicular crash information data. Each of these elements is described in detail below.

Study Area

Based on a review of the anticipated trip generation and trip distribution for the proposed project, a reasonable study area was established. Using this approach, the Project study area will include the following intersections (shown previously in Figure 1):

1. Washington Street (Route 16) at Concord Street – *signalized*
2. Washington Street (Route 16) at Grove Street - *unsignalized*
3. Concord Street at Hagar Road - *unsignalized*
4. Grove Street at Hagar Road and Colgate Road – *unsignalized*
5. Grove Street at Route 128 SB Ramps/Asheville Road – *unsignalized*
6. Grove Street at the Route 128 Northbound Ramps – *unsignalized*
7. Route 128 Exit 21B Collector-Distributor (C-D) Road at the Route 128 Southbound Ramps – *unsignalized*
8. Washington Street (Route 16) at Quinobequin Road/Wales Road/ Route 128 Southbound Ramps – *signalized*
9. Washington Street (Route 16) at the Route 128 Northbound Ramps – *unsignalized*
10. Grove Street at the Riverside MBTA Parking Lot Driveway – *unsignalized*
11. Grove Street at the Riverside Office Building (South) and Apartment Driveways – *unsignalized*
12. Grove Street at the Riverside Office Building (Center) and Apartment Driveways – *signalized*
13. Grove Street at the Riverside Office Building Driveway (North) and Seminary Road – *unsignalized*
14. Grove Street at Hancock Street - *unsignalized*
15. Grove Street at Woodland Road – *unsignalized*
16. Grove Street at Central Street/Auburn Street – *signalized*
17. Hancock Street at Woodland Road – *unsignalized*
18. Woodland Road at Central Street – *unsignalized*

The existing conditions evaluation consisted of an inventory of the traffic control; roadway, driveway, and intersection geometry in the study area; an inventory of the existing pedestrian amenities throughout the study area; the collection of daily and peak period traffic volumes for normal everyday conditions along with Red Sox game day conditions; a review of public transportation routes within the study area; and a review of recent vehicular crash history.

Roadway Geometry

The major travel routes and intersections within the study area are described below. Figure 2 shows the observed existing geometry and traffic control at each study-area intersection.

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Roadways

Roadways within the study area are either under the jurisdiction of the City of Newton or under the jurisdiction of MassDOT. Within the Project study area, the following roadways are under MassDOT jurisdiction:

- Route 128 and the ramp interchanges with Route 16 and Grove Street;
- The Route 128 Exit 21B C-D Road between Grove Street and Route 16;
- Grove Street between the Riverside MBTA Driveway and the C-D Road; and
- Route 16 between the Route 128 northbound ramps and the C-D Road.

The remainder of the roadways within the study area are under the City of Newton's jurisdiction. Figure 3 illustrates the roadway jurisdiction designations within the study area.

Grove Street

Grove Street within the study area is a two-lane urban minor arterial roadway running generally in a northeast-southwest direction. Grove Street is primarily under local jurisdiction with the exception of the segment between the Riverside MBTA driveway and the Route 128 southbound ramps, which is under Massachusetts Department of Transportation (MassDOT) jurisdiction. Grove Street provides two travel lanes with variable shoulder widths. The posted speed limit along Grove Street varies between 25 mph and 30 mph within the study area. Land use along Grove Street consists of residential properties, commercial properties, the Woodland Golf Club, the Riverside MBTA Station, and the Project site.

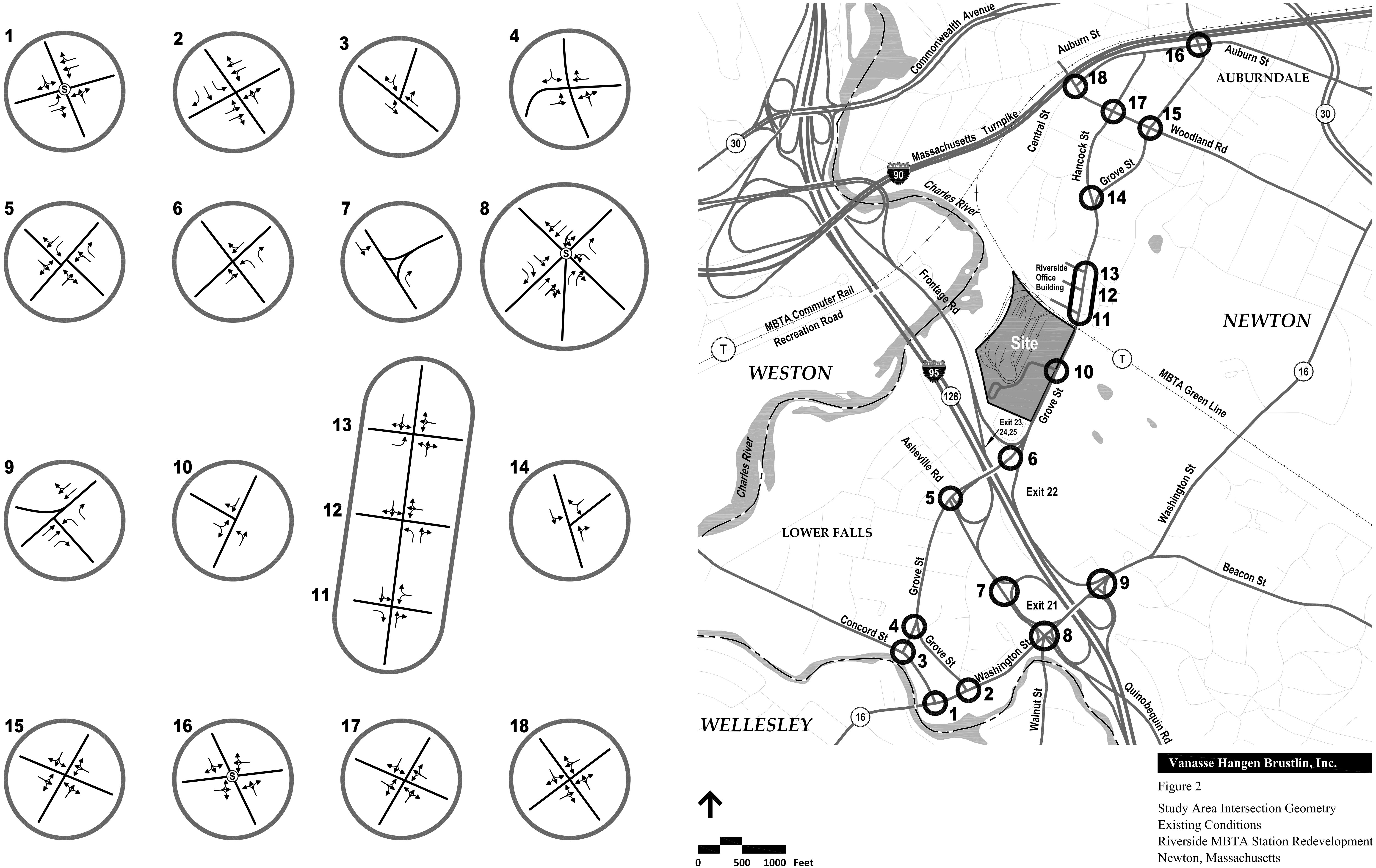

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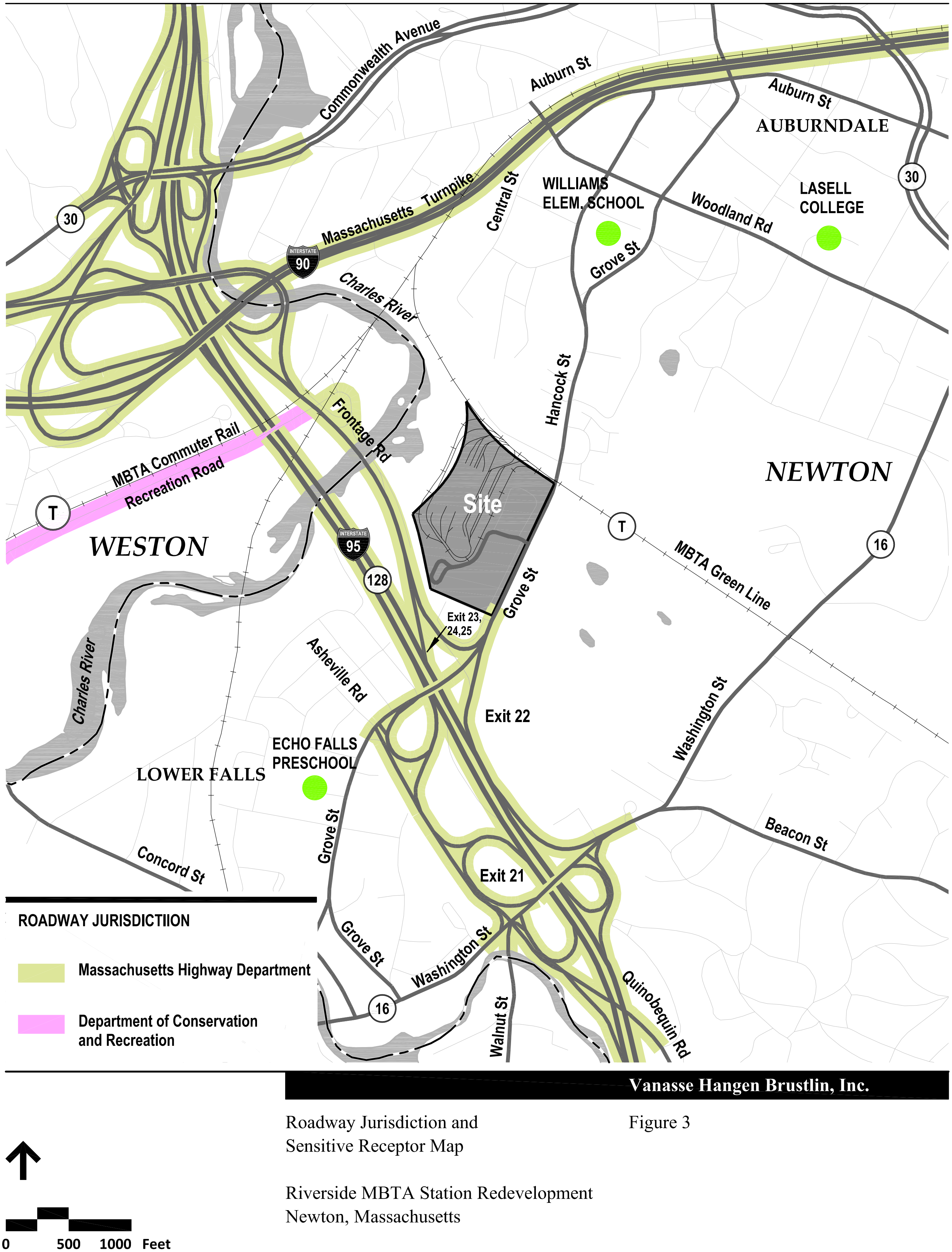
Figure 2

Study Area Intersection Geometry
Existing Conditions
Riverside MBTA Station Redevelopment
Newton, Massachusetts



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Roadway Jurisdiction and
Sensitive Receptor Map

Figure 3

Riverside MBTA Station Redevelopment
Newton, Massachusetts

Route 128/Interstate 95

Route 128, also designated as Interstate 95, is an eight-lane interstate highway (four lanes in each direction divided by a median, with additional acceleration and deceleration lanes at ramp junctions) running in a north-south direction through the study area. Route 128 is under MassDOT jurisdiction and provides access to both Grove Street and Route 16 via Interchanges 22 and 21, respectively. The posted speed limit along Route 128 through the study area is 55 mph.

Route 16

Route 16, also designated as Washington Street in the study area, is a four-lane urban major arterial roadway running generally in a northeast-southwest direction. Route 16 is under MassDOT jurisdiction between Neshobe Road (just east of the Route 128 Northbound off-ramp) and the Newton Executive Park Driveway (just west of Quinobequin Road) and under local jurisdiction at all other locations within the study area. Land use along Route 16 within the study area consists primarily of commercial properties. The posted speed limit along Route 16 is 25 mph.

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Intersections

The following sections describe the study-area intersections in detail.

Washington Street (Route 16) at Concord Street

- Four-legged signalized intersection
- Route 16 EB approach provides an exclusive left-turn lane and a shared through/right-turn lane
- Route 16 WB approach provides a shared left-turn/through lane and a shared right-turn/through lane
- Driveway northbound approach provides a single general purpose lane
- Concord Street southbound approach provides a single general purpose lane
- Sidewalks are provided along both sides of Route 16 and the east side of Concord Street
- Crosswalks are provided along the west and north legs of the intersection
- Land use in the area consists primarily of commercial properties

Washington Street (Route 16) at Grove Street

- Four-legged unsignalized intersection
- Route 16 EB approach provides a shared left-turn/through lane and a shared right-turn/through lane.
- Route 16 WB approach provides a shared left-turn/through lane and a shared right-turn/through lane.
- Driveway northbound approach provides a single general purpose lane and is under STOP control, although a STOP-sign is not provided
- Grove Street southbound approach provides a single general purpose lane and is under STOP control, although a STOP-sign is not provided
- Sidewalks are provided along both sides of Route 16
- Crosswalks are provided along the east, west and north legs of the intersection
- Land use in the area consists primarily of commercial properties
- On-street parking is allowed along Route 16 eastbound

Concord Street at Hagar Road

- Three-legged unsignalized intersection
- Concord Street northbound approach provides a single general purpose lane
- Concord Street southbound approach provides a single general purpose lane
- Hagar Road westbound approach provides a single general purpose lane and is under STOP-sign control
- Sidewalks are provided along both sides of Hagar Road and the east side of Concord Street
- A faded crosswalk is provided across the east leg of the intersection
- Land use in the area consists of St. Mary's cemetery, the Charles River, and residential properties

Grove Street at Hagar Road and Colgate Road

- Four-legged unsignalized intersection under all-way stop control
- Grove Street northbound approach provides a single general purpose lane under STOP-sign control
- Grove Street southbound approach provides a single general purpose lane under STOP-sign control
- Hagar Road eastbound approach provides a single general purpose lane and is under STOP-sign control
- Colgate Road westbound approach provides a single general purpose lane and is under STOP-sign control
- Grove Street south leg of the intersection accommodates one-way travel only in the northbound direction
- Sidewalks are provided along both sides of Grove Street and Hagar Road
- Crosswalks are provided across all legs of the intersection

- Land use in the area consists primarily of residential properties

Grove Street at the Route 128 Southbound Ramps and Asheville Road

- Four-legged, offset, unsignalized intersection
- Grove Street eastbound approach provides a shared left-turn/through lane and a right-turn slip ramp to the Route 128 southbound ramp
- Grove Street westbound approach provides a shared right-turn/through lane and an exclusive left-turn lane
- Route 128 southbound ramps approach provides a left-turn/through lane under STOP-sign control and an exclusive right-turn slip ramp under YIELD-sign control
- Asheville Road southbound approach provides a single general purpose lane under STOP control, although a STOP-sign is not provided
- A sidewalk is provided along the north side of Grove Street
- Crosswalks are not provided at the intersection
- Land use in the area consists primarily of residential properties

Grove Street at the Route 128 Northbound Ramps

- Four-legged unsignalized intersection
- Grove Street eastbound approach provides a single general purpose lane
- Grove Street westbound approach provides a through lane and a right-turn slip ramp
- The Route 128 Northbound Off-Ramp northbound approach provides a left-turn/through lane under STOP-sign control and an exclusive right-turn slip ramp under YIELD-sign control
- Direction of travel along the Route 128 Northbound -On Ramp north leg of the intersection is one-way in the northbound direction, away from the intersection
- Sidewalks are provided along both sides of Grove Street
- Crosswalks are not provided at the intersection
- Land use in the area consists primarily of commercial properties, with Hotel Indigo, the Riverside MBTA Station, and the project sitee located in the northeasterly corner of the intersection

Route 128 Exit 21B Collector-Distributor (C-D) Road at the Route 128 Southbound Ramps

- Three-legged unsignalized intersection
- C-D Road northbound approach provides a single exclusive right-turn slip ramp to Route 128 Southbound
- C-D Road southbound approach provides a single general purpose lane wide enough to accommodate to lanes of travel

- Direction of travel along the Route 128 Southbound Ramps east leg of the intersection is one-way in the eastbound direction away from the intersection
- Sidewalks are not provided at the intersection
- Crosswalks are not provided at the intersection
- Land use in the area consists of thee Route 128 Southbound interchange at exits 21 and 22

Washington Street (Route 16) at Quinobequin Road/ Wales Road/ Route 128 Southbound Ramps

- Five-legged signalized intersection
- Route 16 eastbound approach provides a through lane and a shared right-turn/through lane
- Route 16 westbound approach provides an exclusive left-turn lane, two through lanes, and a right-turn slip lane
- Quinobequin Road southbound approach provides an exclusive “hard” right-turn lane under YIELD-sign control, a “soft” right-turn lane to Wales Road, and a shared left-turn/through lane
- Quinobequin Road northbound approach provides an exclusive left-turn lane and an exclusive right-turn lane
- Wales Road northeastbound approach provides two general purpose lanes
- Sidewalks are provided along both sides of Route 16
- Crosswalks are provided across the west and north legs of the intersection
- Land use in the area consists primarily of commercial properties

Washington Street (Route 16) at the Route 128 Northbound Ramps

- Four-legged unsignalized intersection
- Route 16 eastbound approach provides two through lanes and an exclusive right-turn lane and slip ramp
- Route 16 westbound approach provides two through lanes and a right-turn slip ramp
- The Route 128 Northbound Off-Ramp provides an exclusive left-turn lane under STOP-sign control and an exclusive right-turn slip ramp under YIELD-sign control
- Sidewalks are provided along both sides of Route 16
- Crosswalks are not provided at the intersection
- Land use in the area consists of commercial and residential properties

Grove Street at the Riverside MBTA Parking Lot Driveway

- Three-legged unsignalized intersection
- Grove Street northbound approach provides a single general purpose lane
- Grove Street southbound approach provides a single general purpose lane

- Riverside MBTA Parking Lot Driveway eastbound approach provides one wide lane under STOP-sign control that can accommodate separate left-turning and right-turning movements
- Sidewalks are provided along the west side of Grove Street
- A crosswalk is provided across the Riverside MBTA Parking Lot Driveway
- Land use in the area consists of the Riverside MBTA Station, the Project site, and Woodland Golf Club

Grove Street at Riverside Office Building (South) and Apartment Building Driveways

- Four-legged unsignalized intersection
- Grove Street northbound approach provides a single general purpose lane
- Grove Street southbound approach provides a single general purpose lane
- Office Building Driveway eastbound approach provides a right-turn only lane under STOP-sign control
- Apartment Driveway westbound approach provides a single general purpose lane under STOP control, although a STOP-sign is not provided
- A crosswalk is provided across the Office Building Driveway
- Land use in the area consists the Riverside Office Building and residential properties

Grove Street at Riverside Office Building (Central) and Apartment Building Driveways

- Four-legged signalized intersection
- Grove Street northbound approach provides an exclusive left-turn lane and a shared right-turn/through lane
- Grove Street southbound approach provides a single general purpose lane
- Apartment Driveway westbound approach provides a single general purpose lane
- Direction of travel along the Office Building Driveway approach is one-way in the westbound direction, away from the intersection
- Crosswalks are provided across the Office Building Driveway and the north leg of the intersection
- Land use in the area consists the Riverside Office Building and residential properties

Grove Street at Riverside Office Building Driveway (North) and Seminary Avenue

- Four-legged unsignalized intersection
- Grove Street northbound approach provides a single general purpose lane
- Grove Street southbound approach provides a single general purpose lane
- Office Building Driveway eastbound approach provides a left-turn only lane under STOP-sign control

- Seminary Avenue westbound approach provides a single general purpose lane under STOP-sign control
- Crosswalks are not provided at the intersection
- Land use in the area consists the Riverside Office Building and residential properties

Grove Street at Hancock Street

- Three-legged unsignalized intersection
- Grove Street northbound approach provides a single general purpose lane
- Grove Street southwestbound approach provides a single general purpose lane
- Hancock Street southbound approach provides a single general purpose lane under STOP-sign control
- A crosswalk is provided across Hancock Street
- Land use in the area consists of the Walker Center and residential properties

Grove Street at Woodland Road

- Four-legged unsignalized intersection under all-way stop control
- Grove Street northbound approach provides a single general purpose lane under STOP-sign control
- Grove Street southbound approach provides a single general purpose lane under STOP-sign control
- Woodland Road eastbound approach provides a single general purpose lane under STOP-sign control
- Woodland Road westbound approach provides a single general purpose lane under STOP-sign control
- A flashing red-beacon is provided at the intersection to supplement the STOP-sign control along the four approaches
- Crosswalks are provided across all legs of the intersection
- Land use in the area consists of Lasell College, the United Parish of Auburndale, and residential properties

Grove Street at Central Street and Auburn Street

- Four-legged signalized intersection
- Grove Street northbound approach provides a single general purpose lane
- Auburn Street southbound approach provides a single general purpose lane wide enough to accommodate two lanes of traffic
- Central Street eastbound provides a single general purpose lane
- Auburn Street westbound approach provides a single general purpose lane
- Crosswalks are provided across all legs of the intersection
- Land use in the area consists of residential properties and the Massachusetts Turnpike

Hancock Street at Woodland Road

- Four-legged unsignalized intersection under all-way stop control
- Hancock Street northbound approach provides a single general purpose lane under STOP-sign control
- Hancock Street southbound approach provides a single general purpose lane under STOP-sign control
- Woodland Road eastbound approach provides a single general purpose lane under STOP-sign control
- Woodland Road westbound approach provides a single general purpose lane under STOP-sign control
- Crosswalks are provided across all legs of the intersection
- Land use in the area consists of the United Parish of Auburndale and residential properties

Woodland Road at Central Street

- Four-legged unsignalized intersection under all-way stop control
- Central Street northeastbound approach provides a single general purpose lane under STOP-sign control
- Central Street southwestbound approach provides a single general purpose lane under STOP-sign control
- Woodland Road northwestbound approach provides a single general purpose lane under STOP-sign control
- Woodland Road southeastbound approach provides a single general purpose lane under STOP-sign control
- Crosswalks are provided across the Central Street legs and the Woodland Road southeast leg of the intersection
- Land use in the area consists of residential properties and the Massachusetts Turnpike

Area Infrastructure and Existing Constraints

The Project site is the existing Riverside MBTA Station located on the north side of Grove Street in Newton, Massachusetts. Access to the site is currently provided via an unsignalized driveway on Grove Street approximately 1,100 feet to the east of the Route 128 Exit 22 northbound off-ramp. Grove Street is a two-lane roadway under MassDOT jurisdiction between the western site boundary and the intersection with the Route 128 southbound Off-Ramp. The site also abuts but does not currently provide vehicular access to the Route 128 frontage roRad (which serves Exists 23, 24 & 25 including access to the Massachusetts Turnpike).

Under existing conditions, the three intersections of Grove Street at the Route 128 southbound Off-Ramp, at the Route 128 northbound Off-Ramp/frontage road and at the Riverside MBTA Station (Site) Driveway are unsignalized. At the intersection with the Route 128 ramps, the off-ramp approach lanes are either under STOP (left-turn) or YIELD (right-turn) sign control. At the Riverside Station driveway a single, wide unstriped exit lane (which can accommodate separate left-turn and right-turn movements) operates under STOP control. Many of the movements under STOP control currently operate at poor levels of service (LOS) during normal peak conditions and during game day events. The Route 128 frontage road is a one-way roadway northbound which consolidates a number of movements to and from Route 128 including access from Grove Street, access to and from Recreation Road, access to and from the Massachusetts Turnpike (Route 90) and access to and from Commonwealth Avenue/South Avenue (Route 30). This roadway consists of a number of merge/diverge points and a variety of non-standard design elements. Under existing conditions Recreation Road was closed at the time of the traffic counts. When open, the exit from the Route 128 frontage road to Recreation Road introduces a short weave segment which would operate at a poor level of service during the weekday evening condition.

Within the vicinity of the Project site, a sidewalk is provided continuously along the west side of Grove Street. Sidewalks are also provided continuously along the east side of Grove Street, with the exception of along the Woodland Golf Club frontage, opposite the Project site. Crosswalks are provided at the intersection of Grove Street at the Route 128 Northbound Ramps across the north leg of the intersection and across the MBTA station driveway at its intersection with Grove Street. Crosswalks are not provided at the intersection of Grove Street at the Route 128 Southbound Ramps.

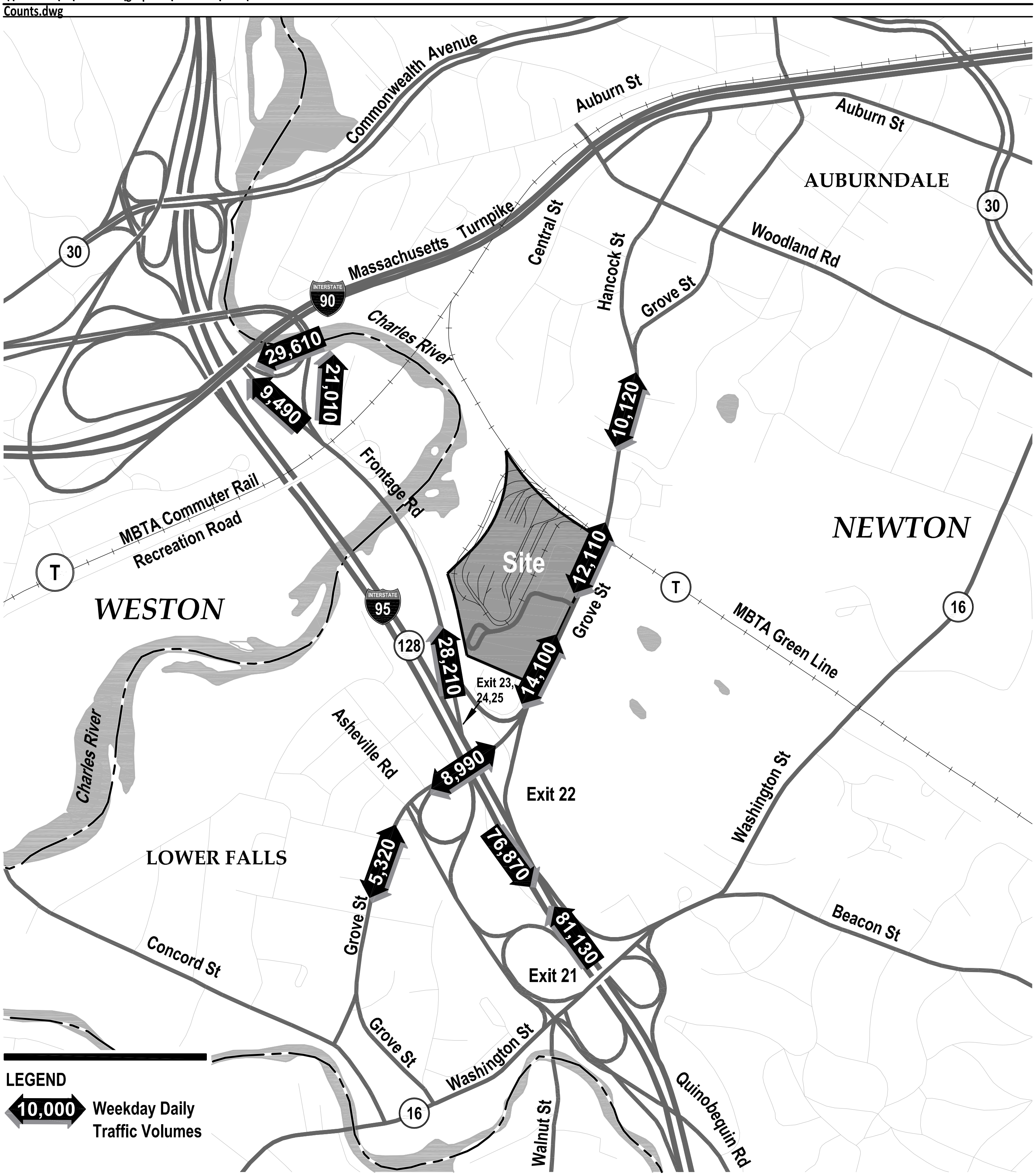
Traffic Volume Data

Manual turning movement counts (TMCs) were conducted at each of the 18 study-area intersections during the weekday morning peak period from 7:00 AM to 9:00 AM and the weekday evening peak period from 4:00 PM to 6:00 PM. These counts were primarily conducted in May 2009, with some preliminary TMCs conducted in April 2009. The weekday morning and evening peak periods are consistent with typical peak commuter traffic periods, and coincide with the expected peak periods for traffic entering and exiting the proposed site. In addition, weekday evening peak period (4:00 PM to 6:00 PM) TMCs were conducted at the intersections in immediate vicinity of the Riverside MBTA Station on a day which the Red Sox had a scheduled home game at 7:10 PM. These periods represent the most critical traffic volume conditions within the study area. The weekday morning peak period occurred from 8:00 to 9:00 AM and the weekday evening peak period occurred from 5:00 to 6:00 PM. Concurrent with the TMCs, 48-hour automatic traffic recorder (ATR) counts were conducted along the following roadways:

- Grove Street, north of the Asheville Road
- Grove Street, south of Pine Grove Avenue

- Grove Street, south of the Riverside MBTA Driveway
- Grove Street, north of the Riverside MBTA Driveway
- Grove Street, south of Hancock Street
- Route 128 Southbound, south of Grove Street
- Route 128 Northbound, north of Route 16
- Route 128 Northbound Exits 23-24-25 Off-Ramp
- Route 128 Northbound Exit 25 Ramp to Route 30/Route 128/I-95 NB
- Route 128 Northbound Exit 24 Ramp to Massachusetts Turnpike
- Massachusetts Turnpike Ramp to Route 30/Route 128/I-95 NB

A summary of the ATR traffic data is presented in Table 1 and is also shown on Figure 4. All traffic count data is contained in the Appendix.



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Automatic Traffic Recorder Counts Figure 4

Riverside MBTA Station Redevelopment
Newton, Massachusetts

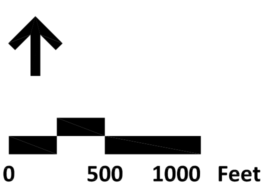


Table 1
Existing Traffic Volumes

	Weekday	Weekday AM Peak Period			Weekday PM Peak Period		
	ADT [b]	Volume [c]	K [d]	Dir. Dist [e]	Volume	K	Dir. Dist
Grove Street							
north of Asheville Road [a]	8,990	950	10.5%	59.3% NB	900	10.0%	71.7% SB
south of Pine Grove Ave. [a]	5,320	470	8.8%	67.3% EB	565	10.6%	56.0% WB
south of Riverside MBTA Driveway [a]	14,100	1,360	9.6%	71.0% NB	1,415	10.0%	60.0% SB
north of Riverside MBTA Driveway [a]	12,110	1,260	10.4%	68.0% NB	1,245	10.3%	59.4% SB
south of Hancock Street [a]	10,120	1,005	9.9%	55.8% NB	1,020	10.1%	55.5% NB
Route 128 Southbound							
south of Grove Street [a]	76,870	5,910	7.7%	--	5,725	7.4%	--
Route 128 Northbound							
north of Route 16 [a]	81,130	7,375 [f]	9.1%	--	6,040	7.4%	--
Exit 23-24-25 Off-Ramp [a]	28,210	2,005 [f]	7.1%	--	2,120	7.5%	--
Exit 25 Ramp to Route 30/Route 128/I-95 NB [a]	9,490	605 [f]	6.4%	--	590	6.2%	--
Exit 24 Ramp to MassPike [a]	21,010	1,440 [f]	6.9%	--	1,810	8.6%	--
MassPike Ramp to Route 30/ Route 128/ I-95 NB [a]	29,610	1,895	6.4%	--	2,135	7.2%	--
Frontage Road							
south of Recreation Rd Exit [a]	29,960	2,045 [f]	6.8%	--	2,340	7.8%	--

a traffic volumes are averages from counts conducted on May 13-14, 2009. ATRs on Grove Street north of Asheville Road and south of Pine Grove Avenue were conducted in March 2010.
b daily traffic expressed in vehicles per day,
c peak period volumes expressed in vehicles per hour
d percent of daily traffic that occurs during the peak period
e directional distribution of peak period traffic
f only the May 13 data was used due to a motor vehicle collision on Route 128 NB on May 13 during the weekday morning peak period.

As shown in Table 1, Grove Street, north of Asheville Road carries approximately 8,990 vehicles per day (vpd) on a weekday, with approximately 950 vehicles per hour (vph) during the weekday morning peak hour and 900 vph during the weekday evening peak hour.

Grove Street, south of Pine Grove Avenue carries approximately 5,320 vpd on a weekday, with approximately 470 vph during the weekday morning peak hour and 565 vph during the weekday evening peak hour.

Grove Street, south of the Riverside MBTA Driveway carries approximately 14,100 vpd on a weekday, with approximately 1,360 vehicles per hour (vph) during the weekday morning peak hour and 1,415 vph during the weekday evening peak hour.

Grove Street, north of the Riverside MBTA Driveway, carries approximately 12,110 vpd on a weekday, with approximately 1,260 vph during the weekday morning peak hour and 1,245 vph during the weekday evening peak hour.

Grove Street, south of Hancock Street, carries approximately 10,120 vpd on a weekday, with approximately 1,005 vph during the weekday morning peak hour and 1,020 vph during the weekday evening peak hour.

Route 128 southbound, south of Grove Street, carries approximately 76,870 vpd on a weekday, with approximately 5,910 vph during the weekday morning peak hour and 5,725 vph during the weekday evening peak hour.

Route 128 northbound, north of Route 16, carries approximately 81,130 vpd on a weekday, with approximately 7,375 vph during the weekday morning peak hour and 6,040 vph during the weekday evening peak hour.

The Route 128 Northbound Exits 23-24-25 Off-Ramp carries approximately 28,210 vpd on a weekday, with approximately 2,005 vph during the weekday morning peak hour and 2,120 vph during the weekday evening peak hour.

The Route 128 Northbound Exit 25 Ramp to Route 30/Route 128/I-95 Northbound carries approximately 9,490 vpd on a weekday, with approximately 605 vph during the weekday morning peak hour and 590 vph during the weekday evening peak hour.

The Route 128 Northbound Exit 24 Ramp to the Massachusetts Turnpike carries approximately 21,010 vpd on a weekday, with approximately 1,440 vph during the weekday morning peak hour and 1,810 vph during the weekday evening peak hour.

The Massachusetts Turnpike Ramp to Route 128/I-95 Northbound /Route 30 carries approximately 29,610 vpd on a weekday, with approximately 1,895 vph during the weekday morning peak hour and 2,135 vph during the weekday evening peak hour.

Event Traffic

In addition to being used heavily by commuters on a daily basis, the Riverside MBTA Station is also used as an alternative means of transportation to heavily attended sporting events like Boston Red Sox games and Boston College football and basketball games. Of the special events that attract spectators to use Riverside Station, Boston Red Sox games generate the most vehicle traffic. To gain an understanding of the traffic increases associated with Red Sox games, supplemental turning movement counts were conducted on May 7, 2009 (a weekday on which the Red Sox had a regularly scheduled home game with a 7:10 PM start time) during the weekday evening peak hour at the following four locations:

- Grove Street at Route 128 SB Ramps/Asheville Road

- Grove Street at the Route 128 Northbound Ramps
- Grove Street at the Riverside MBTA Station Driveway
- Grove Street at Hancock Street

A comparison of the turning movement counts shows that there are approximately 140 additional vehicles entering the Riverside MBTA Station during the weekday evening peak hour on a day that the Red Sox have a home game. Approximately 89 percent of the additional vehicles (125 vehicles) enter the Riverside MBTA Station from the south and travel through the Route 128 interchange area intersections. Table 2 shows the comparison of the total intersection volume from the weekday evening peak hour turning movement counts conducted at the four intersections listed above.

Table 2
Event Traffic Volume Comparison

	Total Intersection Traffic Volume		
Intersection	Non Game Day [a] Counts	Game Day [b] Counts	Difference
Grove Street at Route 128 SB Ramps/ Asheville Road	1,104	1,234	+11.8%
Grove Street at Route 128 NB Ramps	1,694	1,820	+7.4%
Grove Street at the Riverside MBTA Station Driveway	1,564	1,773	+13.3%
Grove Street at Hancock Street	1,045	1,112	+6.4%

a turning movement counts conducted May 14, 2009
b turning movement counts conducted May 7, 2009

As shown in Table 2, traffic volumes are between 6.4 percent and 11.8 percent higher during a Red Sox game, depending on location. While some of this increase could be attributable to normal daily fluctuation, it is clear that there are notable volume increases associated with Red Sox games. Based on observations conducted during the weekday evening peak hour on days which the Red Sox had regularly scheduled home games, the MBTA lot closest to the Riverside MBTA Station would typically reach its capacity by 5:30 PM. Due to the increased traffic volume along Grove Street and the higher demand to access the MBTA station parking lot, queues along Grove Street were observed to extend several additional vehicles on the eastbound approach, thus decreasing operational efficiency along Grove Street. Operational efficiency is most impacted in the eastbound direction as through traffic is impeded by vehicles turning left into the MBTA Driveway. Aside from the additional volume at the MBTA Driveway, additional delays are often caused by inefficient parking fee collection within the site. Discussion of future operations during Red Sox game days and measures proposed to improve operations in this area are provided in Chapter 5 - *Mitigation*.

Seasonality of Count Data

Based on two continuous count stations located along Route 128 in Newton[1] and on the MassDOT Weekday Seasonal Factors, both the April and May traffic counts were shown to be above average month conditions, therefore no seasonal adjustment factor is necessary. Based on the continuous traffic count station data, April traffic volumes are approximately 1.3 percent above average month conditions and May traffic volumes are approximately 3.6 percent above average month conditions. Based on the data presented in the MassDOT Weekday Seasonal Factors report, April traffic volumes are 8 percent above average month conditions and May traffic volumes are 9 percent above average month conditions for roadways similar to the study area roadways. In order to develop 2010 Existing traffic volumes, a 0.5 percent per year average annual growth rate was applied to the 2009 traffic volumes. A discussion of the average annual growth rate is provided in the Future Conditions section of this study. Figures 5 and 6 illustrate the 2010 Existing weekday morning and weekday evening peak hour traffic volumes, respectively.

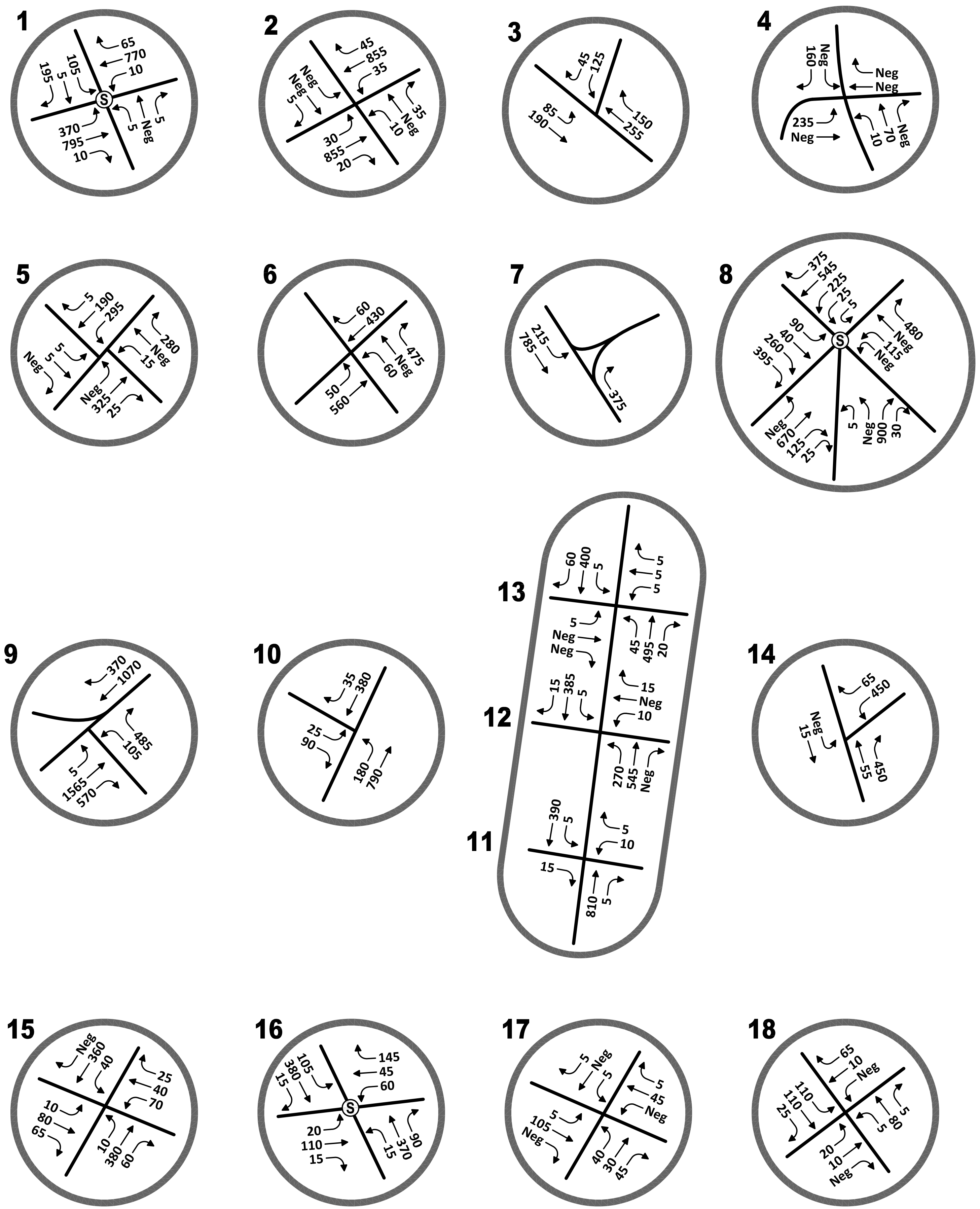
Vehicular Crash History

To help identify intersections with a higher than average vehicle crash history in the study area, reported vehicular crash data for the study-area intersections was obtained from MassDOT Highway Division for the years 2005 through 2007, the most recent three-year history available. A summary of the MassDOT vehicle crash history and crash rates is presented in Table 3. This data is contained in the Appendix.

The 2007 MassDOT average crash rates for signalized and unsignalized intersections for District 4 (the MassDOT district designation for Newton) are 0.78 and 0.58, respectively. Intersections with a crash rate higher than these rates are exhibiting higher than average crash tendencies as compared to the regional average and should be investigated further. As shown in Table 3, the Route 128 interchanges at Route 16 and Grove Street were shown to experience the most motor vehicle crashes over the three year review period, with 106 and 82 crashes, respectively. However, the majority of the crashes that were reported did not include the specific location within the interchange or at the intersections, so a meaningful motor vehicle crash rate could not be calculated for these locations. For this reason, as this report was developed, careful consideration was given to these locations when assessing the Project impacts. Other than these two locations, the remaining study area intersections were shown to experience fewer than four motor vehicle crashes per year, with no intersections exceeding the MassDOT District 4 crash rate for signalized or unsignalized intersections.

▼

[1] Continuous Count Station 415 – Route 128, South of I-90; and Continuous Count Station 4165 – Route 128, North of Route 16; both located in Newton, Massachusetts.



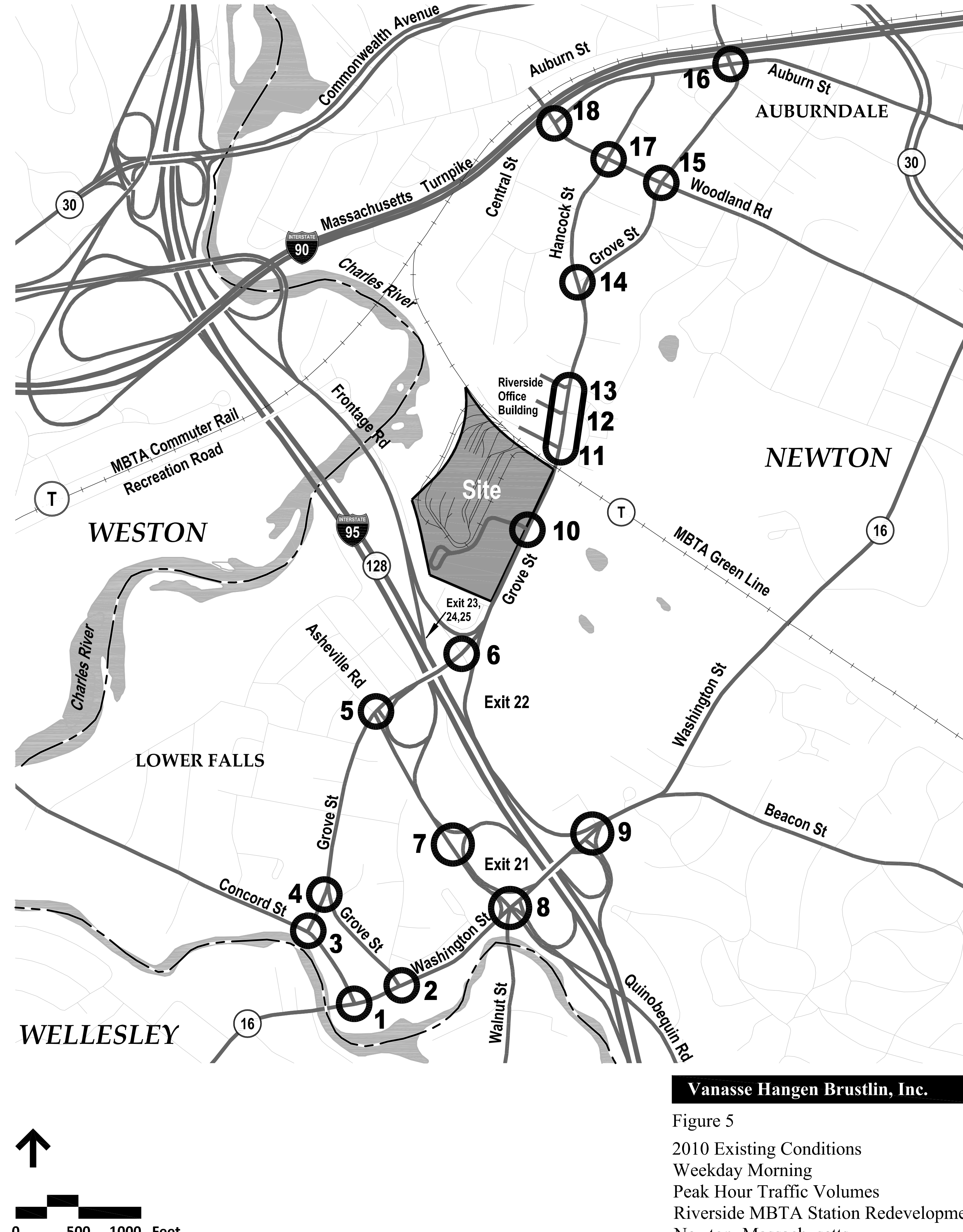


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Figure 5

2010 Existing Conditions
Weekday Morning
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts

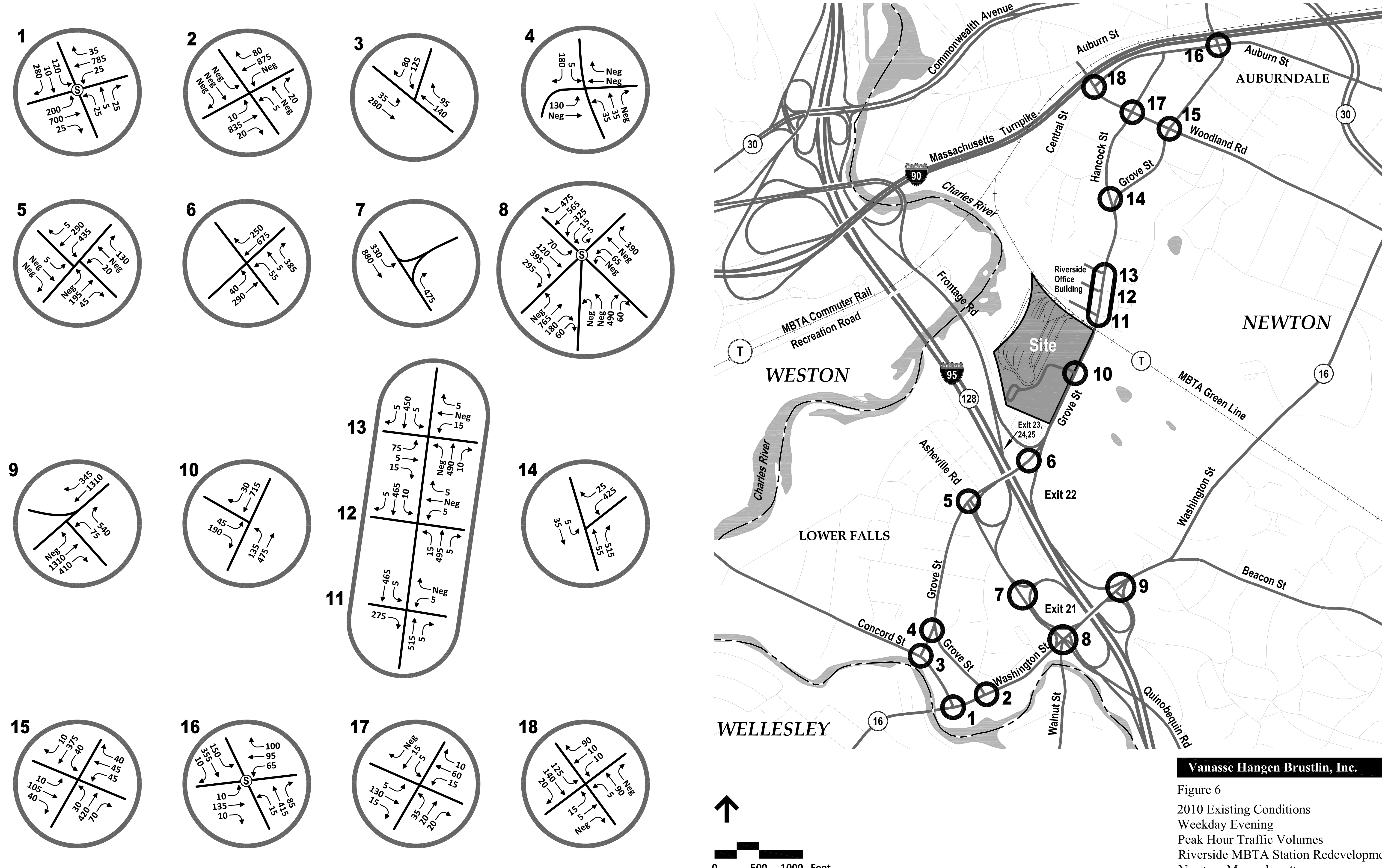

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Figure 6

2010 Existing Conditions
Weekday Evening
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts

Table 3
Vehicular Crash Summary [2005 – 2007]

	Route 16 at Concord Street	Route 16 at Grove Street	Concord Street at Hagar Road	Grove Street at Hagar Road and Colgate Road	Grove Street at Route 128 Interchange[a]	Route 16 at Route 128 Interchange[b]	Grove Street at the Riverside MBTA Parking Lot Driveway[c]	Grove Street at Riverside Office Building	Grove Street at Hancock Street	Grove Street at Woodland Road	Grove Street at Central Street/ Auburn Street	Hancock Street at Woodland Road	Woodland Road at Central Street
Currently Signalized?	Yes	No	No	No	--	--	No	--	No	No	Yes	No	No
MassDOT ACR	0.78	0.58	0.58	0.58	--	--	0.58	--	0.58	0.58	0.78	0.58	0.58
MassDOT CCR	0.44	0.53	0.33	0.00	--	--	0.21	--	0.16	0.53	0.63	0.25	0.48
Exceeds?	No	No	No	No	--	--	No	--	No	No	No	No	No
Year													
2005	6	4	1	0	28	35	0	3	0	2	5	1	0
2006	2	3	1	0	23	38	1	1	0	1	4	0	1
2007	4	5	1	0	31	33	3	1	2	5	2	0	2
Total	12	12	3	0	82	106	4	5	2	8	11	1	3
Average	4.0	4.0	1.0	0.0	27.3	35.3	1.3	1.7	0.7	2.7	3.7	0.3	1.0
Collision Type													
Angle	4	4	0	0	10	16	1	2	0	5	2	0	0
Head-on	0	0	1	0	3	3	0	0	0	0	0	0	0
Rear-end	4	5	1	0	41	55	1	3	1	1	3	0	1
Sideswipe	2	1	0	0	9	10	1	0	1	2	1	1	1
Single-vehicle crash	1	2	1	0	11	10	1	0	0	0	4	0	1
Unknown	1	0	0	0	8	12	0	0	0	0	1	0	0
Total	12	12	3	0	82	106	4	5	2	8	11	1	3
Severity													
Fatal	0	0	0	0	0	0	0	0	0	0	0	0	0
Injury	2	3	2	0	21	27	1	1	0	0	2	1	0
Property-related	8	8	1	0	54	72	3	4	1	8	6	0	2
Unknown	2	1	0	0	7	7	0	0	1	0	3	0	1
Total	12	12	3	0	82	106	4	5	2	8	11	1	3
Time of day													
Weekday, 7:00 AM - 9:00 AM	2	4	2	0	16	12	0	4	1	1	1	1	0
Weekday, 4:00 PM – 6:00 PM	1	2	0	0	12	10	1	0	0	1	2	0	1
Saturday, 11:00 AM - 2:00 PM	1	0	0	0	1	3	1	0	0	0	0	0	0
Weekday, other time	5	0	1	0	41	69	2	1	1	5	6	0	2
Weekend, other time	3	6	0	0	12	12	0	0	0	1	2	0	0
Total	12	12	3	0	82	106	4	5	2	8	11	1	3
Pavement Conditions													
Dry	9	9	1	0	55	83	2	2	1	4	7	1	2
Wet	2	3	0	0	19	18	1	2	1	2	1	0	0
Snow	0	0	1	0	4	1	0	0	0	2	3	0	0
Ice/Slush	1	0	1	0	1	2	1	1	0	0	0	0	0
Other	0	0	0	0	1	0	0	0	0	0	0	0	1
Unknown	0	0	0	0	2	2	0	0	0	0	0	0	0
Total	12	12	3	0	82	106	4	5	2	8	11	1	3

ACR average crash rate
CCR calculated crash rate
Source: MassDOT vehicle crash data
a The data did not differentiate between crashes along Route 128, along the ramp system, or at the Route 128 NB and SB ramp intersections with Grove Street, therefore a meaningful crash rate could not be calculated.
b The data did not differentiate between crashes along Route 128, along the ramp system, or at the Route 128 NB and SB ramp intersections with Route 16, therefore a meaningful crash rate could not be calculated.
c The data did not differentiate between the three Riverside Office Building driveway intersections along Grove Street.

Public Transportation

The Riverside MBTA Station is an integral component of the region's MBTA transit service. Not only is it the terminus point of the trolley service's Green (D) Line, but it also provides connections to multiple MBTA bus lines, inter-city bus service provided by Peter Pan and Greyhound bus lines, and multiple privately-operated shuttle bus services. The station is located within easy access from Route 128/I-95 and provides parking for 960 vehicles, making it attractive to regional commuters. The accessibility of these existing transit services will be integral to the project by promoting equitable share mode and thereby reducing the impacts of passenger vehicles on the local roadway system. The following sections describe each of these existing local services.

One of the Proponent's goals is to maximize alternative forms of transportation and reduce the number of single occupant vehicle trips to the site. Accordingly, Chapter 5 – *Mitigation*, contains discussion of a substantial Transportation Demand Management (TDM) program proposed as part of the Project. It also summarizes the efforts the Proponent is making to connect to the existing public transportation opportunities described in this section including pedestrian/bicycle amenities. In addition, a detailed review and analysis of existing and future transit operations is provided in Chapter 4 – *Traffic Operations Analysis*.

MBTA Green Line Service

The MBTA provides Green Line service between Riverside station in Newton and Lechmere station in Boston. Connections can be made along the line to many of the other MBTA transit services which provide access to the areas northwest, west and southwest of Boston. These include connections to all of the other MBTA subway lines (Red, Blue, Orange and Silver) in addition to connections to the MBTA commuter rail at North Station and numerous MBTA bus lines at interim stops. The connectivity that already exists between local and regional transit opportunities should be attractive, particularly to potential employees of the office uses of the proposed Riverside Redevelopment. Table 4 summarizes the headways of Riverside Green Line service within the vicinity of the site. Supporting data is included in Appendix.

Table 4
Green (D) Line Headways at Riverside Station

Direction/Service	Peak Period[a]	Other Periods
Weekday Service	5 Mins	10-15 Mins
Weekend Service	n/a	8-10 Mins

Source: MBTA (2009 Schedules)
a Peak – Inbound: 5:45 a.m. - 9:30 a.m. and Outbound: 4:00 p.m. – 7:45 p.m.

MBTA Bus Service

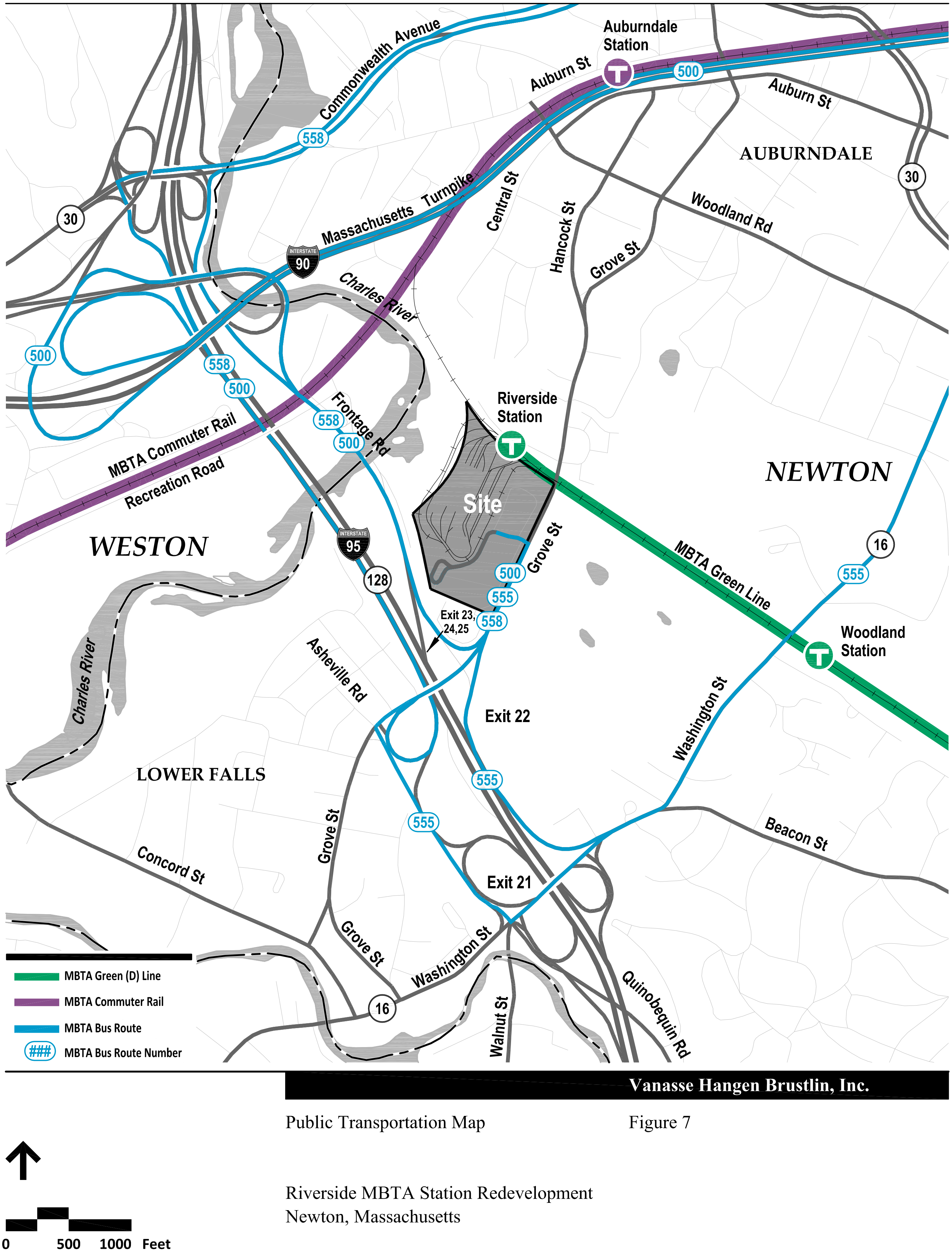
There are currently three MBTA bus routes (500, 555 and 558) that travel to Riverside station. A summary of those routes is as follows:

- Route 500 - Outer Express Bus, Riverside to Downtown Boston – Express service is provided on Route 500 between the Riverside station and downtown Boston via the Massachusetts Turnpike. This bus service operates from roughly 6:15 AM to 9:00 AM and 3:00 PM to 7:30 PM on weekdays with peak headways approximately 60-70 minutes. The one-way trip time for the Route 500 bus is approximately 30 minutes.

- Route 555 - Inner Express Bus, Riverside to Downtown Boston – Express service is provided on Route 555 between the Riverside station and downtown Boston via Newton, the Massachusetts Turnpike and Copley Square. This bus service operates from roughly 7:00 PM to 11:00 PM on weekdays with headways between 20-80 minutes. The one-way trip time for the Route 555 bus is approximately 35 minutes.

- Route 558 - Riverside to Downtown Boston via Newton Corner – Service is provided on Route 558 between the Riverside station and downtown Boston via Waltham Highlands, Central Square Waltham, Newton Corner and the Massachusetts Turnpike. This bus service operates from roughly 6:30 AM to 8:00 PM on weekdays with headways between 25-60 minutes. The one-way trip time for the Route 558 bus is approximately 50 minutes.

Table 5 summarizes the headways of the bus services within the vicinity of the site. Supporting data including schedules is included in the Appendix. Figure 7 illustrates the MBTA bus routes in the area.



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Public Transportation Map

Figure 7

Riverside MBTA Station Redevelopment
Newton, Massachusetts

Table 5
Bus Service Headways Within Study Area

Bus Route	Headway
Weekday Service	
500	60-70 Mins
555	20-80 Mins
558	25-60 Mins

Source: MBTA
All Routes provide weekday service only

Peter Pan / Greyhound Bus Lines

Inter-city bus services are provided at the Riverside Station by Peter Pan / Greyhound bus lines (in 1999, an alliance was formed between Peter Pan and Greyhound bus lines coordinating schedules, marketing, and ticket sales). Multiple routes stop at the Riverside Station on a daily basis. These routes are summarized below (each of the routes listed below also operate in reverse from that shown):

- Boston -- New York Express Service (some buses stop at the Riverside Station and Shopper's World in Framingham)
- Logan Airport – Boston – Worcester – Hartford – New Haven – New York
- Logan Airport – Boston – Springfield – Pittsfield – Albany – Toronto – Montreal
- Logan Airport – Boston – Worcester – Springfield – Northampton – Amherst – Greenfield
- Boston – Newton – Framingham – Worcester
- Boston – Amherst – Northampton
- Boston – Foxwoods Casino

The number of buses accessing the Riverside Station varies from day-to-day. On a typical weekday approximately 50 buses will enter the site with the first bus arriving at 7:10 AM and the last bus leaving the site at 11:15 PM. All buses enter the site via a left-turn from Grove Street and then turn right into the existing circulation area adjacent to the Peter Pan/Greyhound terminal and the MBTA service yard. Buses then typically travel through this circulation area, reversing direction and stop adjacent to the Peter Pan/Greyhound terminal to drop-off/pick-up passengers.

Shuttle Bus & Taxi Activity

A number of privately operated shuttle bus services currently operate at Riverside Station. These shuttle services pick-up and drop-off passengers within the existing bus circulation area between the stairs to the MBTA platform and the PeterPan/Greyhound bus terminal. A number of MBTA Green line passengers were observed exiting the MBTA platform and boarding these shuttles during the morning peak hour. A number of passengers were also observed exiting these shuttles and boarding the Green Line during the afternoon peak hour. Shuttles often idle within the circulation area as they wait for passengers. The most frequently observed shuttles are associated with MassBay Community College in Wellesley and Regis College in Weston. Both of these shuttles offer numerous arrivals and departures throughout the day and operate at headways between 15 minutes to an hour. Shuttle schedules for these services can be found in the Appendix. Other observed shuttle services were associated with Lasell College in Newton and area hotels. Taxis also frequent the station and were observed picking up and dropping off passengers within the circulation area between the MBTA platform and the PeterPan/Greyhound bus terminal. It should be noted that multiple local colleges state as a recommended travel option on their websites that visitors take the Green Line to the Riverside Station and then hail a taxi to their respective campuses.

Existing Condition Conclusions

Without improvements, the existing infrastructure is at or near capacity during peak traffic periods and future development that can occur on site is or in the area in general is substantially limited. Intersection improvements that add capacity and address general safety concerns are needed today at the intersections of Grove Street at Route 128 SB Ramps/Asheville Road, Grove Street at the Route 128 Northbound Ramps, and Grove Street at the Riverside MBTA Station Driveway in order to minimize delay, to ensure that vehicle queues do not impact upstream locations, including the Route 128 mainline, and to enhance safety of flow. Improvements will also be needed on the Route 128 frontage road to avoid a less than desirable weave section between the Grove Street on-ramp and the Recreation Road off-ramp. Additionally maintaining only a single access point to the site provides is not only a disadvantage from a traffic perspective (as will be shown in the capacity analysis), but also from an emergency vehicle perspective as well. At a minimum, a second point of access would be appropriate today, even without the proposed project. Details of the improvements proposed as part of this Project are provided in Chapter 5 - *Mitigation*.

3

Future Conditions

Traffic volumes in the study area were projected to the year 2015, reflecting a typical five-year traffic-planning horizon from the existing conditions that were analyzed. Independent of the project, volumes on the roadway network under year 2015 No Build conditions were assumed to include existing traffic and new traffic resulting from background traffic growth. Anticipated site-generated traffic volumes were added to the year 2015 No Build traffic volumes to reflect the year 2015 Build conditions in the study area.

Background Traffic Growth

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. A frequently used procedure is to estimate an annual percentage increase (based on historical trends) and apply that increase to future study-area traffic volumes. An alternative procedure is to identify specific planned major developments and estimate the amount of their traffic that would be expected to affect the project study area roadways. For the purpose of this assessment, *both* methods were utilized.

Historic Traffic Growth

VHB conducted research to determine the historic growth rate for traffic in the study area. Based on information obtained from MassDOT Permanent Count Station 415 (located on Route 128, south of the Massachusetts Turnpike), traffic volumes have decreased between 2002 and 2006. While the traffic count data shows a trend of decreasing volumes, to provide a conservative analysis and account for any potential development in the study area that has not been proposed at this time, a background growth rate of 0.5 percent per year was used.

Site-Specific Growth

In addition to the historic traffic growth, VHB had discussions with representatives of the City of Newton, the Town of Wellesley, and the Town of Weston to identify any other development projects planned that would affect traffic patterns within the study area. The following project was identified:

Mixed-Use Development – 27 Washington Street; Wellesley, Massachusetts
This project involves the redevelopment of the existing 50,600 sf Grossman's building site to consist of 16,000 sf of office space, 17,000 sf of retail space, and 138 residential units (52 assisted living units/86 age-restricted independent-living units). Traffic volumes were obtained from the Traffic Impact Study[2] prepared for the Project and assigned to the study area roadway network based on existing traffic patterns at the study area intersections.

No-Build Traffic Volumes

The 2015 No Build traffic volumes were developed by adding the traffic volumes associated with the Mixed-Use Development at 27 Washington Street and applying the 0.5 percent per year growth rate to the existing conditions volumes. Figures 8 and 9 show the resulting 2015 No Build weekday morning and weekday evening peak hour traffic volumes, respectively.

Future Roadway Conditions

In assessing future traffic conditions, proposed roadway improvements within the study area were considered. Based on discussions with MassDOT Highway Division and the City of Newton, the following roadway improvement projects were identified:

Bridge Rehabilitation – Service Road Over Charles River (Project #605170)
MassDOT Highway Division is undertaking this project that consists of the rehabilitation of the Route 128 northbound Service Road Bridge over the Charles River, located just south of Recreation Road. The rehabilitation includes the reconstruction of the bridge surface and upgrading several other bridge components. This project is currently in the design stage, with the 75-percent design plans received by MassDOT Highway Division in September 2009.

[2] Trip Generation Comparison – 27 Washington Street Mixed Use Development; Conley Associates; January 12, 2010.

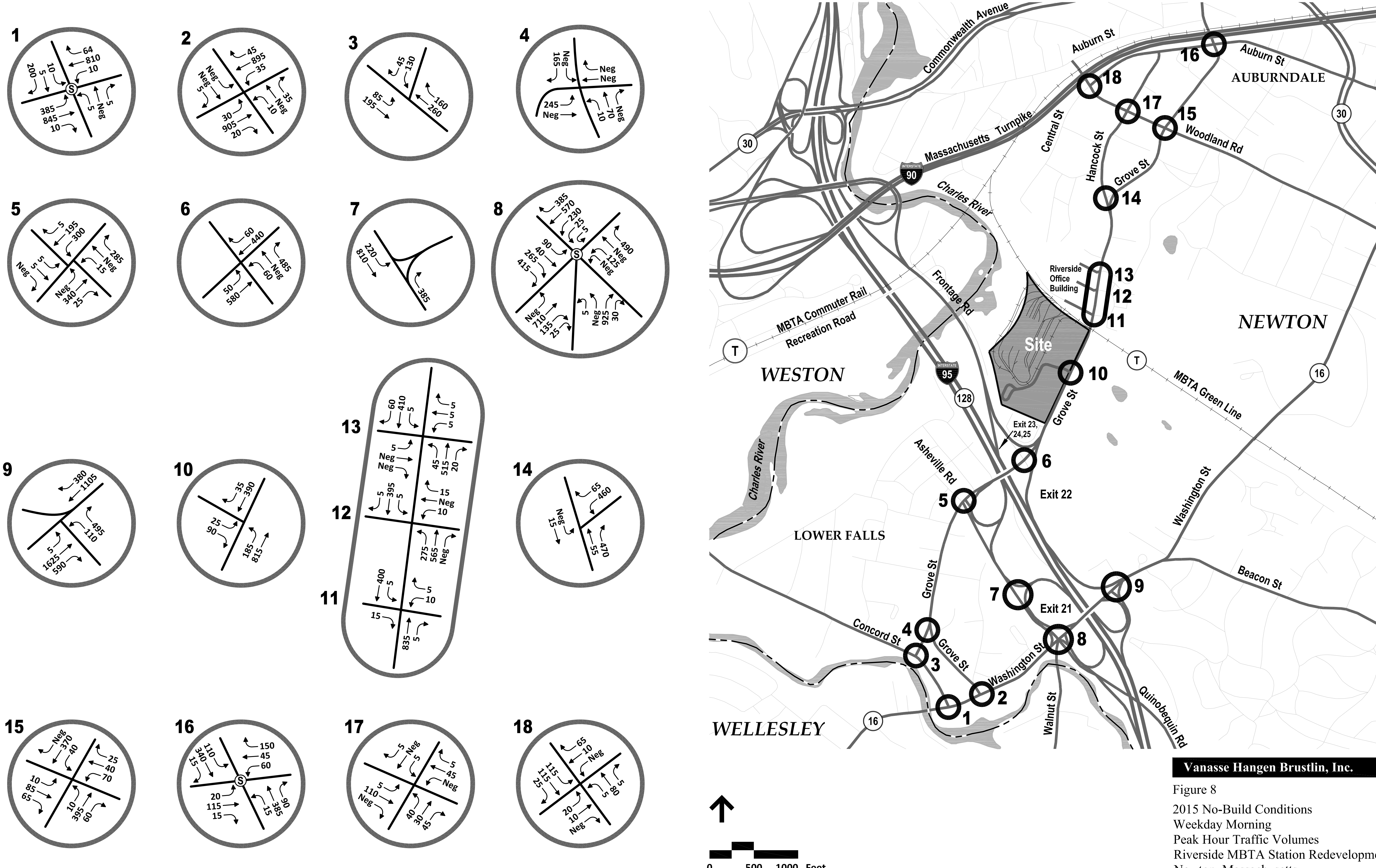

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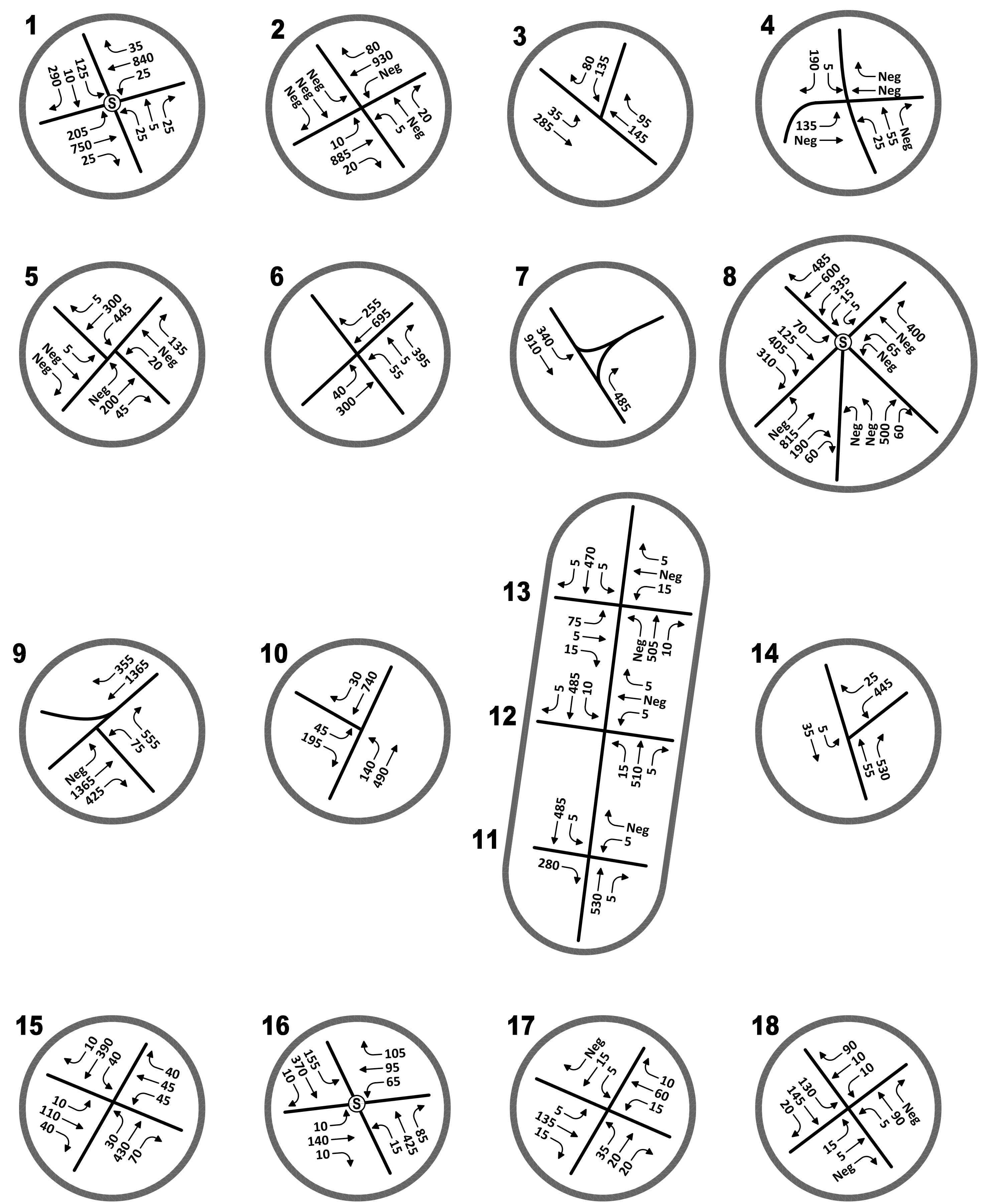
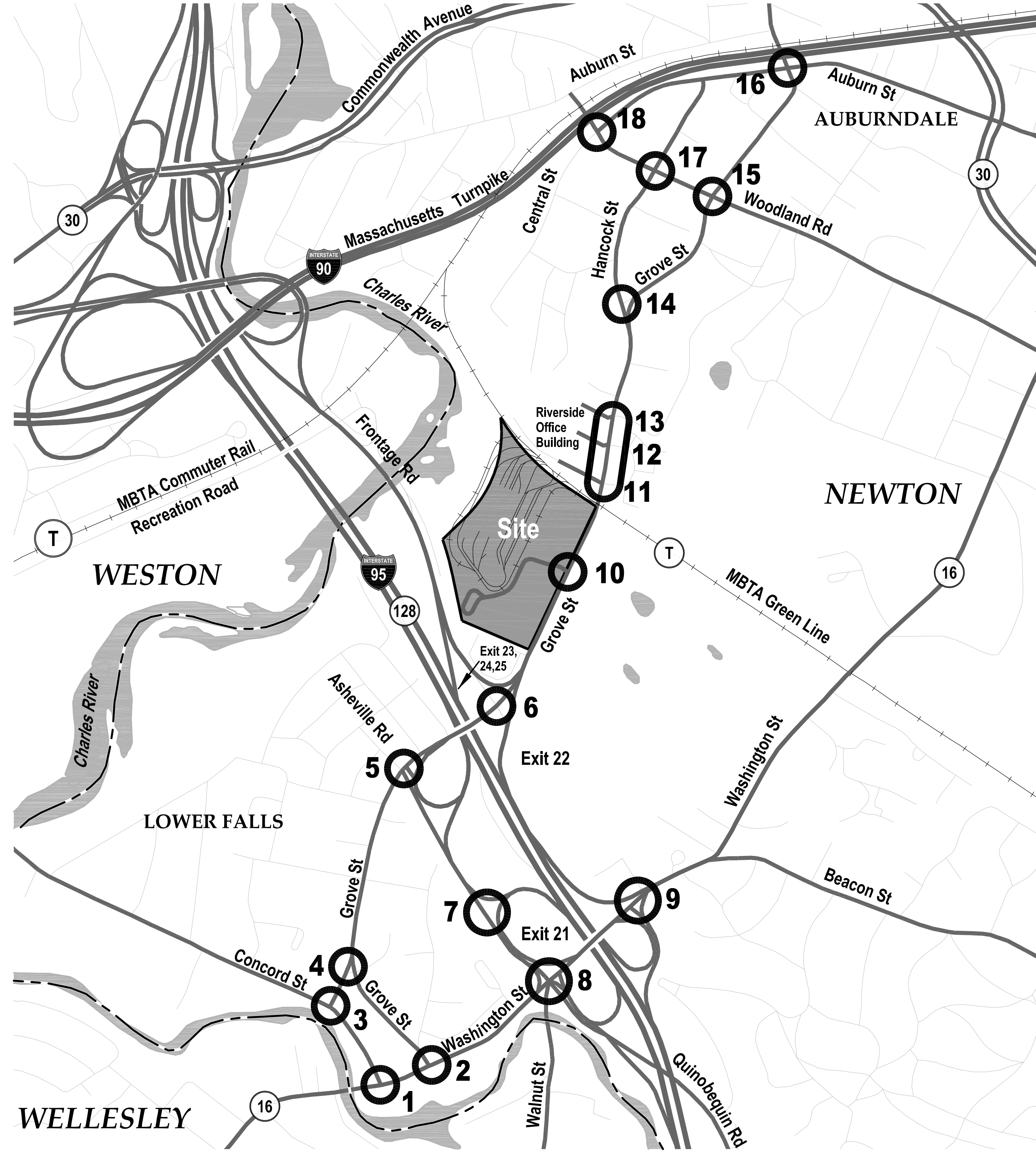
Figure 8

2015 No-Build Conditions
Weekday Morning
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts





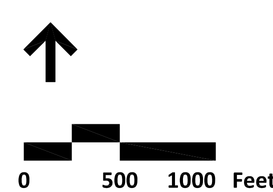


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Figure 9

2015 No-Build Conditions
Weekday Evening
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts

Grove Street Resurfacing
Based on discussions with the City of Newton DPW, there are plans for a pavement resurfacing project on Grove Street between Route 128 and Washington Street. This project is scheduled for implementation during fiscal year 2011 (which begins in July 2010).

Lower Falls Traffic Calming Improvements
Based on discussions with the City of Newton DPW, the following improvements are currently in the planning stage:

- Grove Street at Pine Grove Avenue – implementation of a raised crosswalk
- Grove Street at Cornell Street – implementation of a raised intersection
- Grove Street at Hagar Street/Colgate Road – intersection reconfiguration
- Concord Street – implementation of speed humps

The planning of these improvements is ongoing and partial or full funding could be available from the mitigation fund from the Riverside Center project. Further evaluation will be required to determine costs and schedule for implementation. These measures are geared towards traffic calming along Grove Street and Concord Street as well as improving vehicle and pedestrian safety along this corridor.

Trip Generation

The Project involves the construction of approximately 595,000 sf of office space, 240 residential apartment units encompassing 260,000 sf of building space, and 14,800 sf of ancillary retail space. To estimate the traffic generation for the various components of the site, data provided in the Institute of Transportation Engineers (ITE) Trip Generation, 8th Edition[3] was used. ITE Land Use Code (LUC) 710 – Office, based on 595,000 sf of floor area, ITE LUC 820 – Shopping Center, based on 14,800 sf of floor area, and ITE LUC 220 – Apartment, based on 240 units were used.

Shared Trips

Because the Project contains more than one use, the trip generation characteristics of the site will be different from a single-use project. Some of the traffic to be generated by the proposed development will be contained on site as "internal" or "shared" vehicle trips. The retail portion of the development will provide goods and services that are attractive to the employees and residents on site, which will reduce the need for them to travel off site. While these shared trips represent new traffic to the individual uses, they would not show up as new vehicle trips on the surrounding roadway network. Based on recommended ITE guidelines for shared trip activity

▼

[3] Trip Generation, 8th Edition; Institute of Transportation Engineers; Washington DC; 2008.

contained in Chapter 7 of the ITE Trip Generation Handbook[4], it was determined that the internal capture rate likely to occur between the different uses on this site is 6.5 percent for an average weekday, with 1.7 percent for the weekday morning peak hour and 4.9 percent for the weekday evening peak hour. As such these internal capture rates were applied to the overall trip generation projections for the site. It should be noted that the ITE shared trip methodology results in a very small number of shared trips between the office and retail uses. This is primarily because the proposed building program is so heavily weighted toward the office component. The ITE methodology is based on a wide range of data and instructs the user to compare the empirical calculations bi-directionally from the different data sources (i.e. "trips from retail to office" vs. "trips to office from retail") and select the lower value from the comparison. The proposed retail component of the development is sized to be primarily "service" type of retail uses. Examples might include a coffee shop, dry cleaner, convenient store, and the like which are primarily there to service the existing (MBTA) and proposed uses on site (Office/Residential). While it would be expected that the majority of the retail trips to come from office employees, residents of the site, and transit users (trips that would be internal to the Project site), standard retail projections based on ITE LUC 820 were utilized to provide a conservative estimation. This approachlikley represents an overly conservative estimation of potential retail traffic.

■

Pass-By Trips

Not all of the traffic generated by the Project will be new traffic on the study area roadways. A portion of the vehicle trips generated by the retail component of the Project will be drawn from the existing traffic passing the site in the form of pass-by traffic. Consistent with EOEA guidelines, a pass-by rate of 25 percent was applied to the trip generation for the retail component to determine the amount of "new" traffic that will be generated by the Project.

■

Transit Credit

The Project is conveniently located at the Riverside MBTA Station, providing direct access to both the MBTA Green Line and several MBTA bus routes and making it a true Transit Oriented Development. It is expected that a portion of the employees that will work on-site will use the Green Line and the Commuter Rail to travel to and from the Project site. It is also expected that a portion of the residents living on the site will use the MBTA buses and Green Line to travel to and from the site. To estimate the potential transit usage related to the onsite office uses, a study published

[4] Trip Generation Handbook: An ITE Recommended Practice; Institute of Transportation Engineers; Washington DC; March 2001.

in the ITE Compendium of Technical Papers[5] titled *The Effect of Transit Service on Trips Generated by Suburban Development* was used. This study measures the effects of both rail and bus transit services have on suburban development, such as the proposed project. The study further looks at specific effects on office, residential, and retail developments. Based on the results of the study published by ITE, it was concluded that "suburban office development located within 500 feet of a rail station can expect commuter trip transit mode shares of between 20 and 25 percent." The study also states that office buildings within walking distance of rail stations experience vehicular trip generation rates as low as 50 percent of other typical suburban office buildings. To provide a conservative estimate, a 10 percent transit reduction credit was applied to the vehicular trips related to the office component of the Project.

Residential transit-oriented developments, particularly in suburban locations at the end of a line, such as the Riverside MBTA Station, will be attractive to potential tenants. To determine the potential transit usage for the residential component of the site, data used for other transit oriented residential developments (Woodland Station and Westwood Station) were reviewed. In addition, U.S. Census data was reviewed to determine the effect of the proximity of the MBTA services on the residential component of the site. Based on this review, it was determined that similar developments were expected to experience between a 25 and 46 percent transit reduction for the residential components. To provide a conservative estimate, a 25 percent transit reduction credit was applied to the vehicular trips related to the residential component of the Project. A summary of the trip generation breakdown is shown in Table 6. The detailed Trip Generation calculations are provided in the Appendix.

▼

[5] Hooper, Kevin G., *The Effect of Transit Service on Trips Generated by Suburban Development*, ITE Compendium of Technical Papers, 1990.

Table 6
Proposed Project Trip Generation

Time Period	Direction	Office Trips [a] (A)	Shared Office Trips [b] (B)	10% Transit Credit [c] (C)	New Office Trips (D=A-B-C)	Retail Trips [d] (E)	Shared Retail Trips [b] (F)	25% Pass-By Trips [e] (G)	New Retail Trips (H=E-F-G)	Residential Trips [f] (I)	Shared Residential Trips [b] (J)	25% Transit Credit [g] (K)	New Residential Trips (L=I-J-K)	Total New Trips (M=D+H+L)
Weekday Daily	Enter	5,266	92	518	4,656	1,962	264	424	1,274	1,578	220	340	1,018	6,948
Weekday Morning	Enter	687	1	69	617	30	4	5	21	24	3	5	16	654
Peak Hour	Exit	94	2	9	83	19	3	5	11	97	3	24	70	164
	Total	781	3	78	700	49	7	10	33	121	6	29	86	818
Weekday Evening	Enter	127	3	12	112	87	10	19	58	97	13	21	63	233
Peak Hour	Exit	619	4	62	553	90	14	19	57	52	8	11	33	643
	Total	746	7	74	665	177	24	38	115	149	21	32	96	876

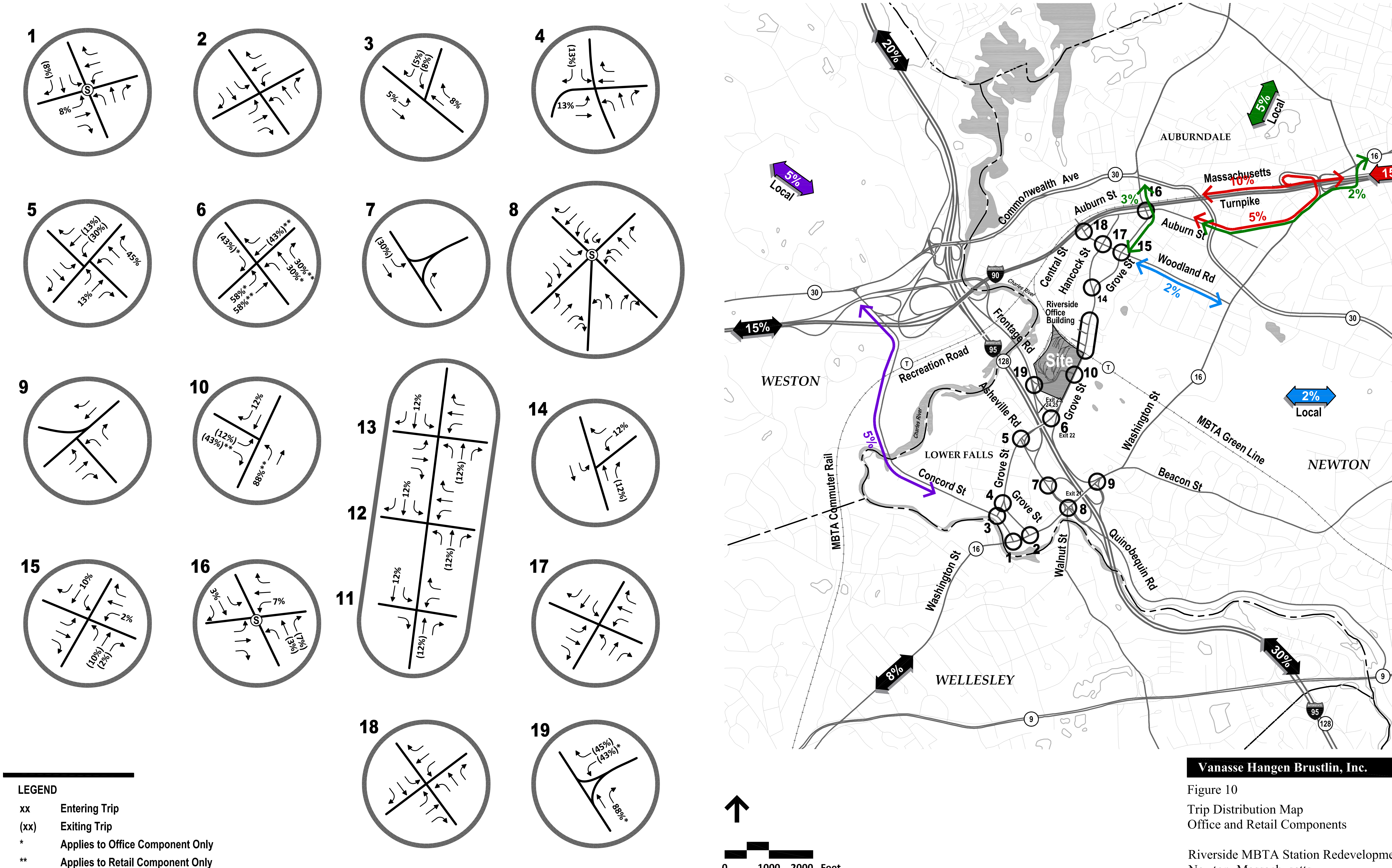
a Based on ITE LUC 710 (Office) for 595,000 sf.
b Based on Mixed Use Shared Trip rates of 6.5 percent for the weekday daily; 1.7 percent for the weekday morning peak hour; and 4.9 percent for the weekday evening peak hour.
c A 10 percent transit credit was applied to the trips associated with the office component of the site.
b Based on ITE LUC 820 (Shopping Center) for 14,800 sf.
e A 25 percent pass-by reduction was applied to the trips associated with the retail component of the site.
f Based on ITE LUC 220 (Apartment) for 240 units.
g A 25 percent transit credit was applied to the trips associated with the residential component of the site.

As shown in Table 6, the Project is anticipated to generate approximately 6,948 (3,474 entering and 3,474 exiting) new vehicle trips during the weekday morning peak hour, with 818 (654 entering and 164 exiting) new vehicle trips during the weekday morning peak hour and 876 (233 entering and 643 exiting) new vehicle trips during the weekday evening peak hour. As mentioned previously, a minor amount of shared trips is expected between uses on site. Additionally, as this can be described as a transit-oriented development, credits were taken to account for some amount of transit usage by the office and residential users of the site.The overall approach used for Trip Generation, including the assumptions made is likely a very conservative estimation of project traffic generation. This conservative approach was a conscious decision made by the project team to ensure that potential project impacts can be identified and ultimately mitigated.

Trip Distribution and Assignment

The directional distribution of traffic approaching and departing the Project is a function of several variables: population densities, existing travel patterns, and the efficiency of the roadways leading to the site. Trip distribution patterns were developed for the office, retail, and residential components of the Project. The trip distribution patterns were determined using journey-to-work data derived from the 2000 U.S. Census for the City of Newton as well as observed driveway usage for similar sites along Grove Street. The assignment of site-generated traffic to specific travel routes was based on existing traffic patterns at the study area intersections and the assumption that most motorists will seek the fastest and most direct routes to and from the site. To account for both the proximity of Exit 16 on the Massachusetts Turnpike in West Newton and for local travel to and from the site, a portion of trips were assigned along Grove Street to the north. It was assumed that approximately one third of the trips oriented to the east along the Massachusetts Turnpike will use Exit 16 and access the site via Grove Street (5 percent of the total office/retail trips and 11 percent of the total residential trips).

The anticipated trip distribution patterns are summarized in Table 7. The trip distribution pattern for the office and retail components of the site are shown in Figure 10, with the trip distribution pattern for the residential component of the site shown in Figure 11. The detailed trip distribution worksheets are provided in the Appendix.



LEGEND

xx	Entering Trip
(xx)	Exiting Trip
*	Applies to Office Component Only
**	Applies to Retail Component Only

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Figure 10

Trip Distribution Map
Office and Retail Components

Riverside MBTA Station Redevelopment
Newton, Massachusetts

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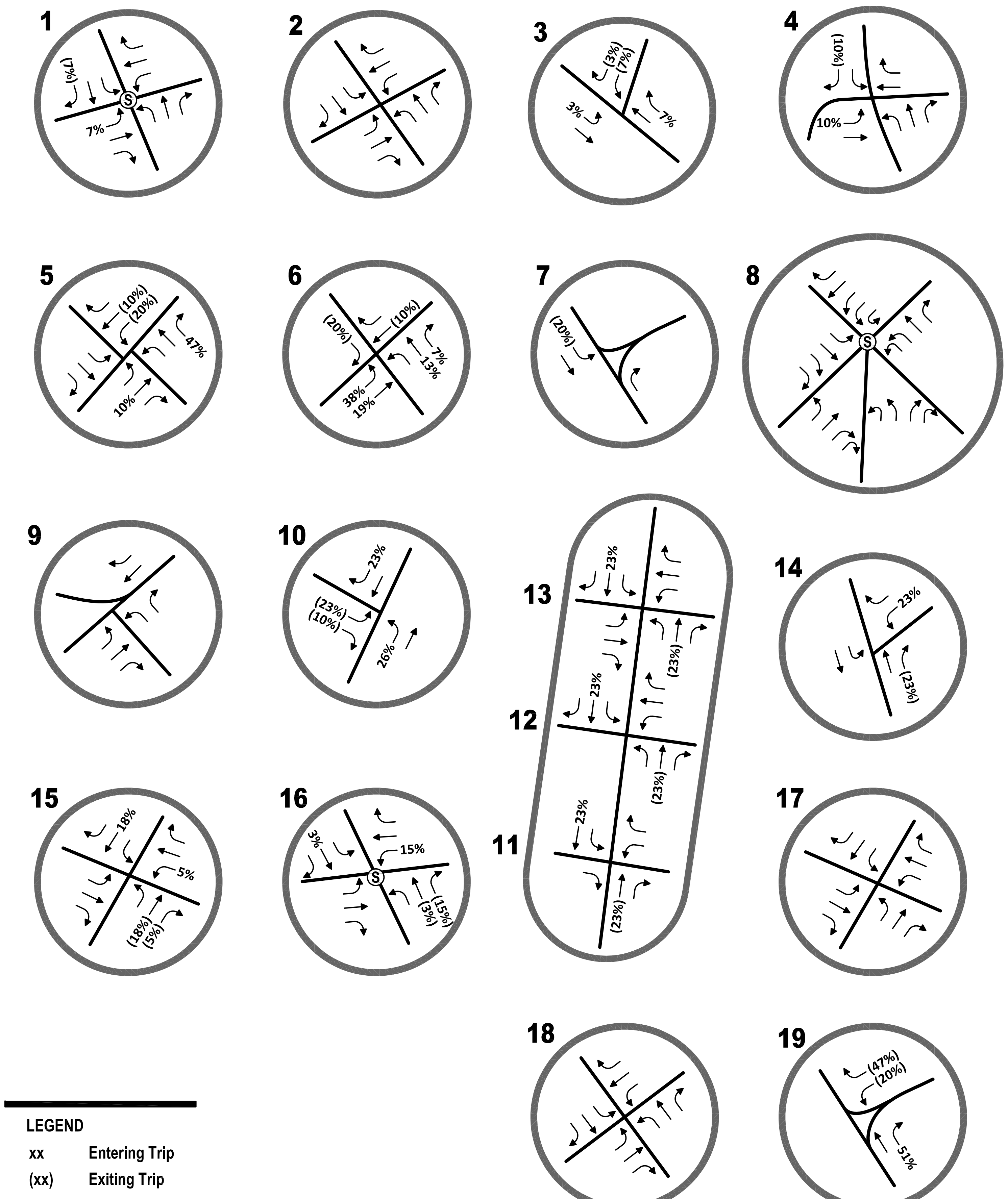

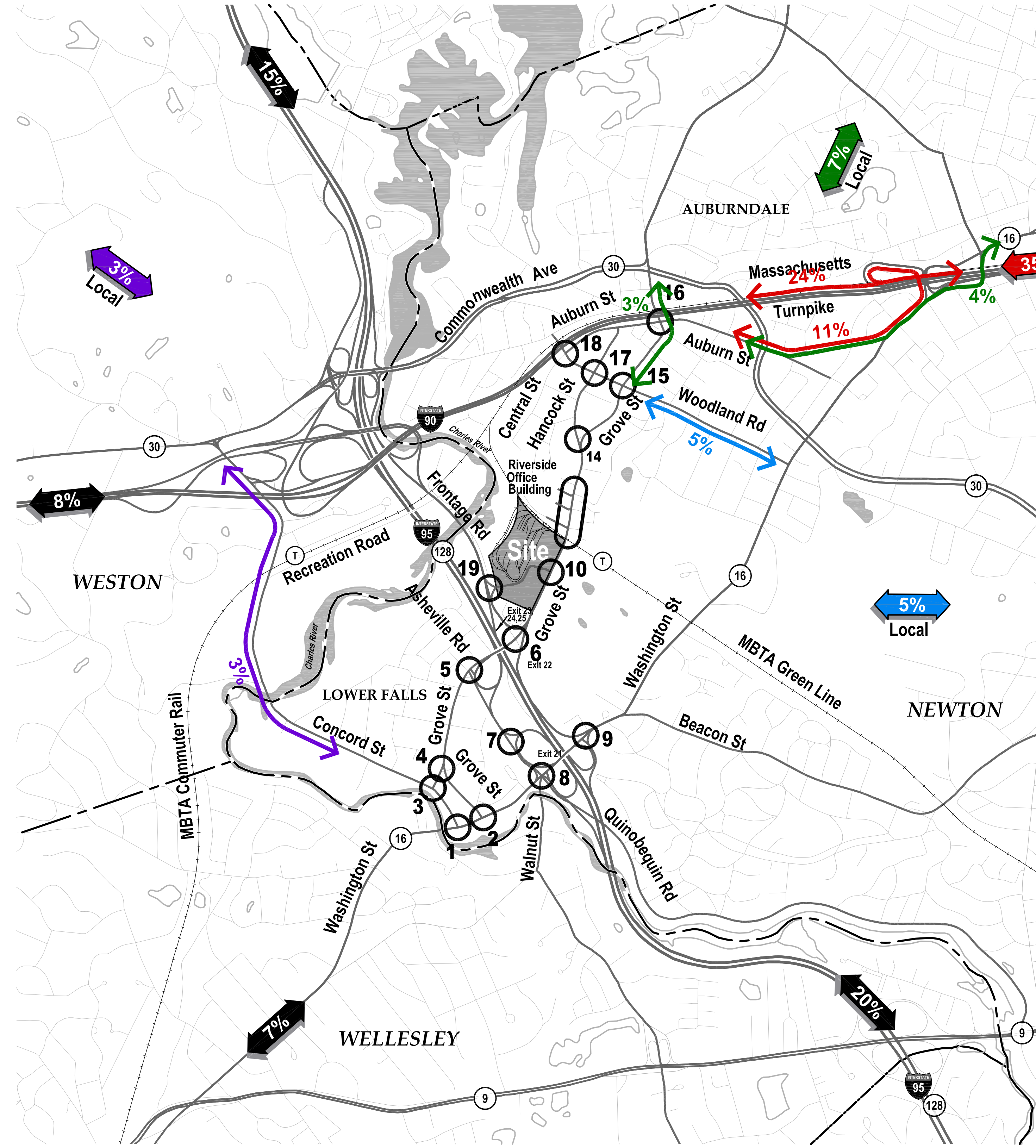

0 1000 2000 Feet

LEGEND

xx Entering Trip

(xx) Exiting Trip

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Figure 11

Trip Distribution Map
Residential Component

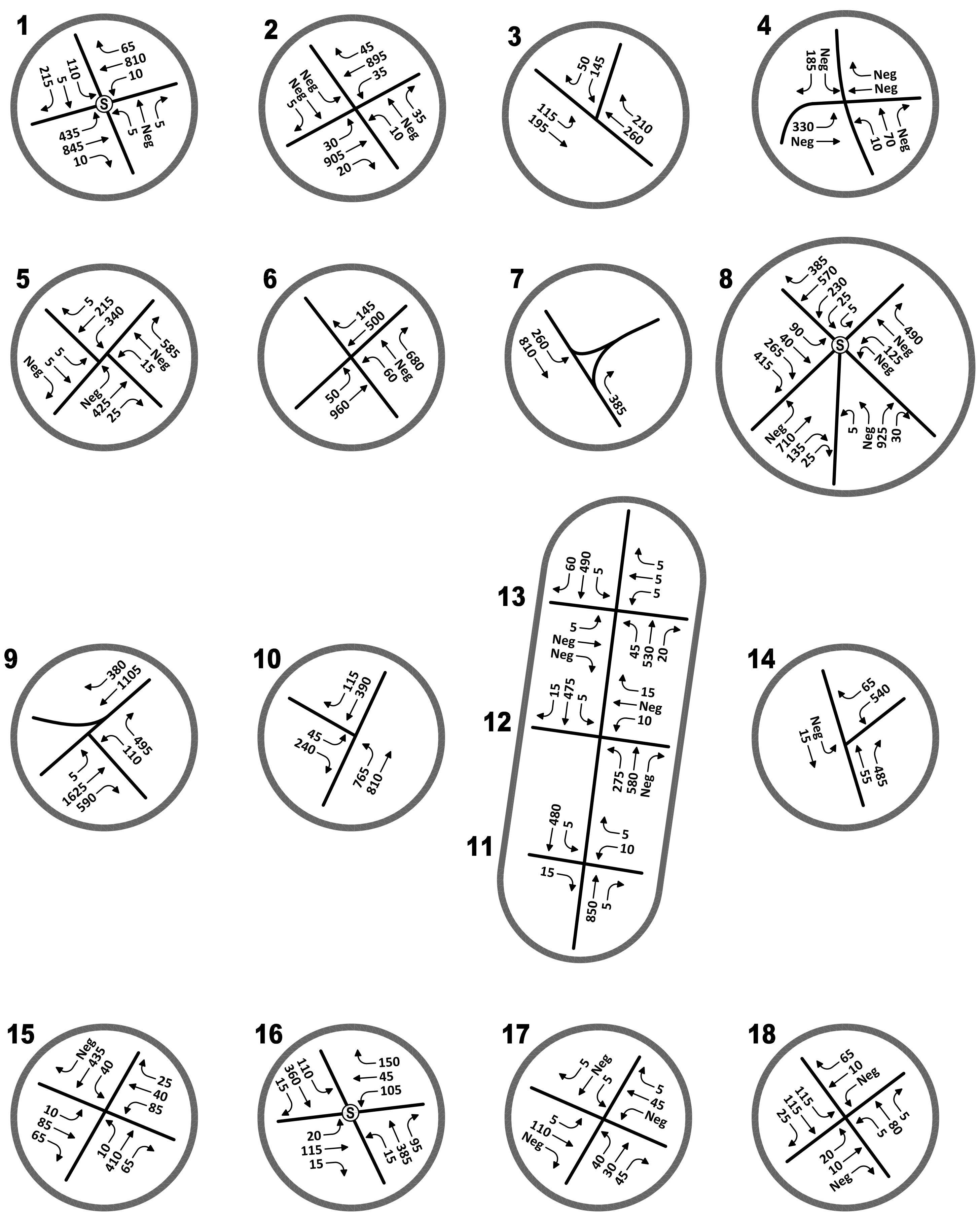
Riverside MBTA Station Redevelopment
Newton, Massachusetts

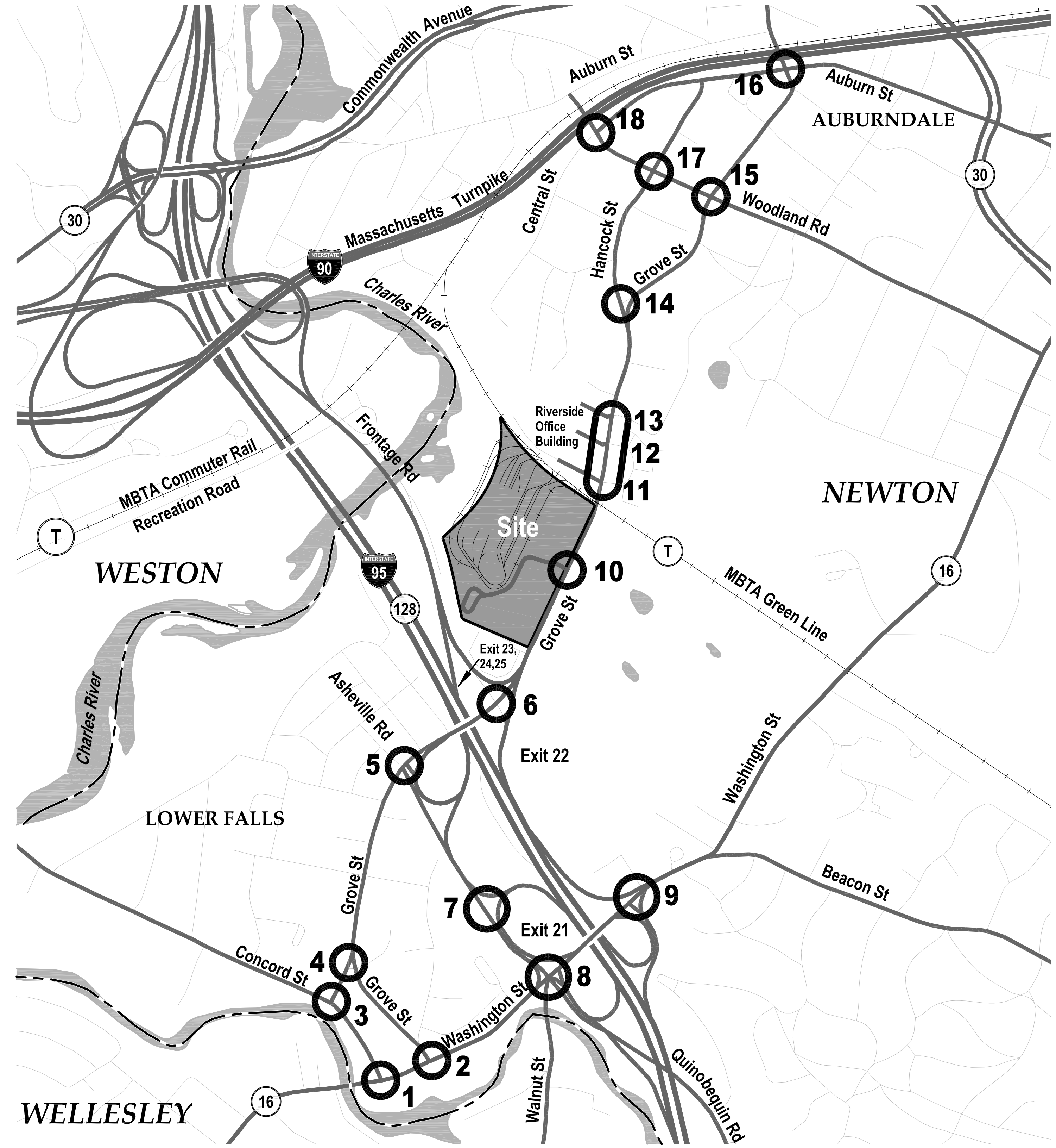
Table 7
Trip Distribution

Direction (To/From)	Travel Route	Office/Retail Components Percent to/from Route	Residential Component Percent to/from Route
North	Route 128/I-95	20%	15%
South	Route 128/I-95	30%	20%
East	Mass. Pike/I-90	15%	35%
West	Mass. Pike/I-90	15%	8%
Southwest	Route 16	8%	7%
Northwest	Concord Street/ Local Roads	5%	3%
Southeast	Woodland Road/ Local Roads	2%	5%
Northeast	Grove Street/ Local Roads	5%	7%
Total	All Routes	100%	100%

Build Traffic Volumes

The projected site-generated traffic volume was distributed on the study area roadways using the trip generation information from Table 6 and the trip distribution patterns shown in Table 7 and added to the 2015 No Build peak hour traffic volumes to develop the 2015 Build peak hour traffic volumes. The 2015 Build weekday morning and weekday evening peak hour traffic volumes are shown in Figures 12 and 13, respectively.





0 500 1000 Feet

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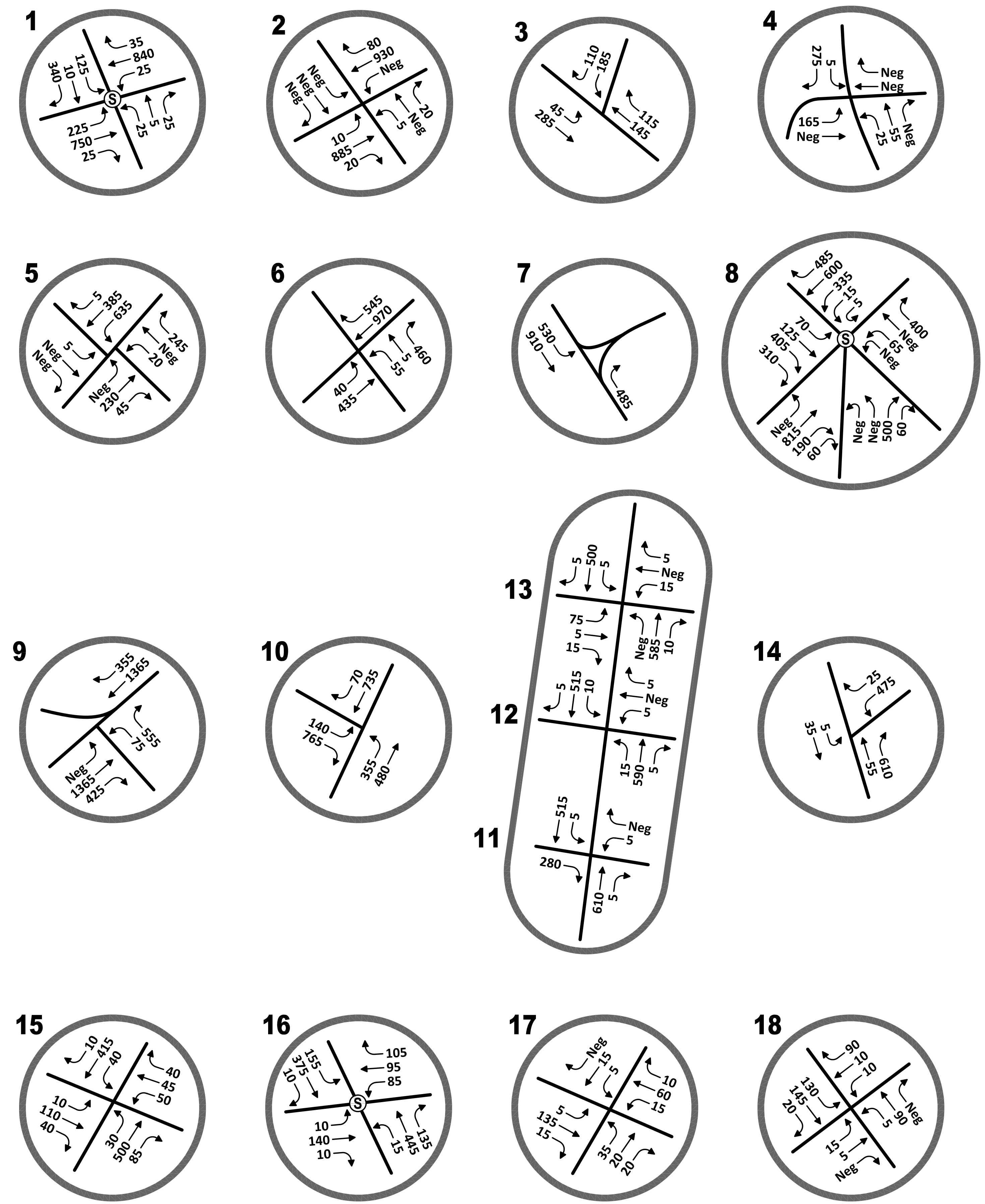
Figure 12

2015 Build Conditions
Weekday Morning
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts



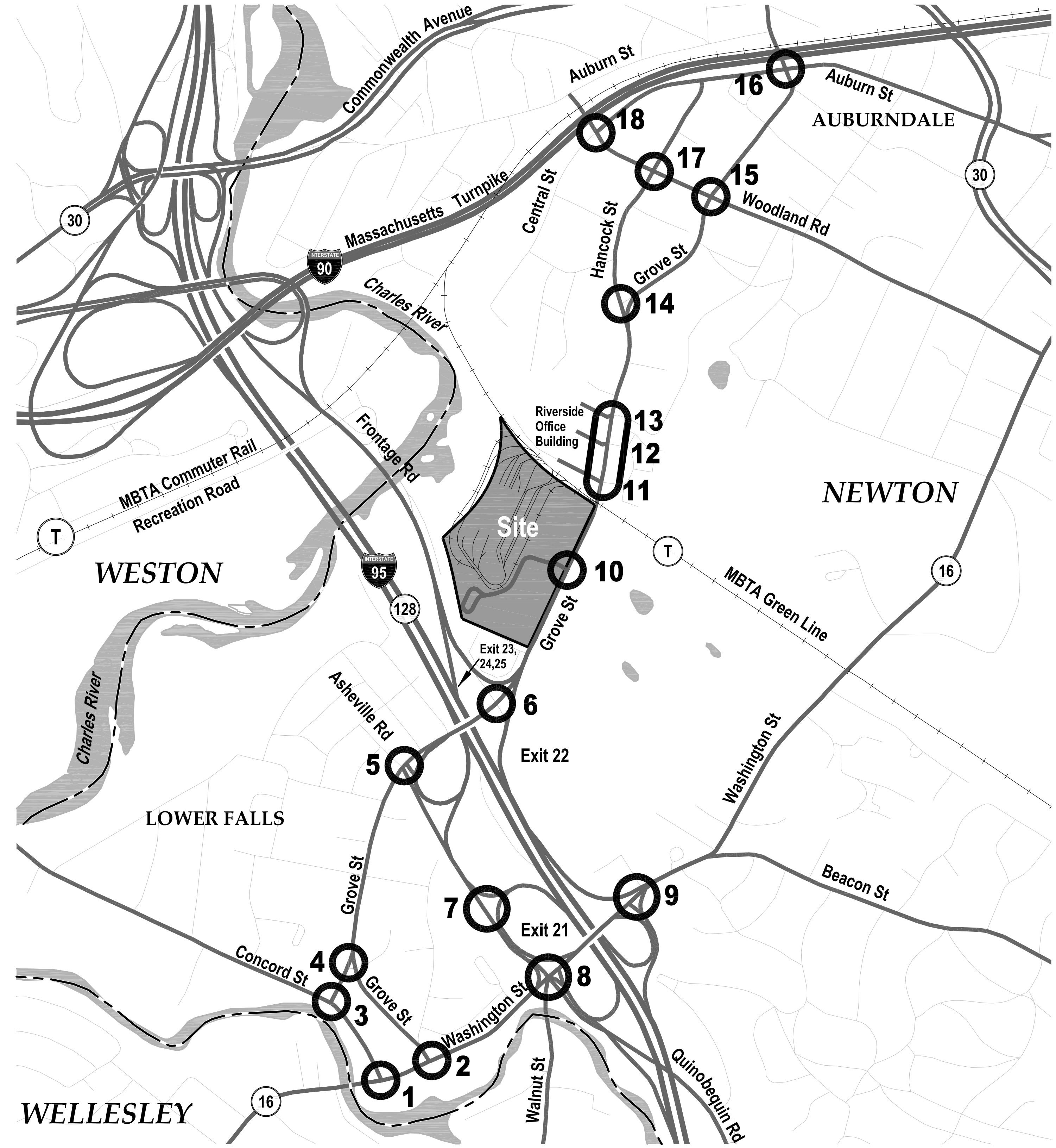


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Figure 13

2015 Build Conditions
Weekday Evening
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts

4

Traffic Operations Analysis

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic within the study area. To assess quality of flow, roadway capacity analyses were conducted with respect to the 2010 Existing conditions and projected 2015 No Build and Build traffic volume conditions. Capacity analyses provide an indication of the adequacy of the roadway facilities to serve the anticipated traffic demands.

Level-of-Service and Delay Criteria

Level-of-service (LOS) is the term used to denote the different operating conditions that occur on a given roadway segment under various traffic volume loads. It is a qualitative measure of the effect of a number of factors including roadway geometrics, speed, travel delay, freedom to maneuver, and safety. Level-of-service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

For this study, capacity analyses were completed for the signalized and unsignalized study area intersections and roadway links. Level-of-service (LOS) designation is reported differently for signalized, unsignalized, and roadway links. For signalized intersections, the analysis considers the operation of each lane or lane group entering the intersection and assigns a LOS designation to each. Overall intersection data is then calculated in order to represent the overall conditions at the intersection. For unsignalized intersections, however, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. The LOS is determined primarily for left turns from the main street and all movements from the minor street. The study of an unsignalized intersection is, for the most part, done by observing the most critical movement, which is most often the left turn out of the side street. The evaluation criteria used to analyze area intersections and roadway links is based on the 2000 Highway Capacity Manual (HCM)[6] and are included in the Appendix.

Level-of-Service Analysis

Levels-of-service analyses were conducted for the 2010 Existing, 2015 No Build, and 2015 Build conditions for the signalized and unsignalized study-area intersections.

Signalized Intersection Capacity Analyses

Table 8 presents a summary of the capacity analyses for the signalized intersections in the study area. The capacity analyses worksheets are included in the Appendix.

As shown in Table 8, the intersections of Route 16 at Concord Street, Grove Street at the Riverside Office Building Center Driveway, and Grove Street at Central Street and Auburn Street were shown to operate at LOS C or better during the peak periods under 2010 Existing, 2015 No Build, and 2015 Build conditions. The intersection of Route 16 at Quinobequin Road/Wales Road/Route 128 Southbound Ramps currently operates at LOS F during the peak periods and is expected to operate at LOS F under future 2015 No Build and 2015 Build conditions.

6 Highway Capacity Manual, HCM2000, Transportation Research Board, Washington, DC. (2000)

Table 8
Signalized Intersection Capacity Analysis

	2010 Existing Conditions					2015 No-Build Conditions					2015 Build Conditions				
				Vehicle Queues					Vehicle Queues					Vehicle Queues	
Location	v/c [a]	Delay [b]	LOS [c]	50th [d]	95th [e]	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Route 16 at Concord Street															
Weekday Morning															
Route 16 EB L	0.97	49	D	93	256	1.01	62	E	118	273	1.15	107	F	162	325
Route 16 EB TR	0.78	11	B	184	336	0.83	13	B	208	485	0.83	13	B	208	485
Route 16 WB LTR	0.74	18	B	142	200	0.77	19	B	152	213	0.77	19	B	152	213
Driveway NB LTR	0.04	19	B	3	10	0.04	19	B	3	10	0.04	19	B	3	10
Grove Street SB LTR	0.76	34	C	67	193	0.80	37	D	73	205	0.82	39	D	75	214
Overall	0.88	22	C	--	--	0.92	26	C	--	--	1.03	34	C	--	--
Weekday Evening															
Route 16 EB L	0.68	15	B	33	108	0.72	18	B	34	116	0.80	25	C	37	137
Route 16 EB TR	0.76	13	B	180	313	0.81	15	B	203	426	0.82	16	B	203	426
Route 16 WB LTR	0.76	19	B	150	206	0.80	20	B	164	225	0.81	21	C	164	225
Driveway NB LTR	0.14	16	B	11	29	0.14	17	B	11	29	0.14	16	B	11	30
Grove Street SB LTR	0.85	35	C	105	238	0.89	41	D	114	254	0.94	49	D	130	285
Overall	0.79	20	B	--	--	0.83	22	C	--	--	0.86	25	C	--	--
Route 16 at Quinobequin Road/ Wales Road/ Route 128 SB Ramps															
Weekday Morning															
Route 16 EB TR	0.95	73	E	471	595	0.98	79	E	512	660	0.98	79	E	512	660
Route 16 WB L	1.90	465	F	477	452	2.17	590	F	368	502	2.17	590	F	368	502
Route 16 WB TR	0.64	30	C	380	398	0.67	31	C	408	425	0.67	31	C	408	425
Route 128 SB Ramps NB L	1.13	189	F	161	278	1.23	224	F	186	308	1.23	224	F	186	308
Route 128 SB Ramps NB R	0.33	1	A	0	0	0.34	1	A	0	0	0.34	1	A	0	0
Quinobequin Road SB LT	0.66	70	E	149	219	0.66	70	E	149	219	0.66	70	E	149	219
Quinobequin Road SB R1	0.69	57	E	281	370	0.71	58	E	287	378	0.71	58	E	287	378
Quinobequin Road SB R2	0.26	0	A	0	0	0.27	0	A	0	0	0.27	0	A	0	0
Wales Road NEB R	1.48	282	F	810	962	1.52	299	F	843	994	1.52	299	F	843	994
Overall	1.69	118	F	--	--	1.88	130	F	--	--	1.88	130	F	--	--
Weekday Evening															
Route 16 EB TR	1.20	156	F	784	810	1.28	188	F	864	884	1.28	188	F	864	884
Route 16 WB L	3.87	1354	F	603	817	4.29	1543	F	641	858	4.29	1543	F	641	858
Route 16 WB TR	0.64	30	C	380	458	0.67	31	C	412	494	0.67	31	C	412	494
Route 128 SB Ramps NB L	1.17	224	F	107	172	1.25	257	F	113	178	1.25	257	F	113	178
Route 128 SB Ramps NB R	0.31	1	A	0	0	0.31	1	A	0	0	0.31	1	A	0	0
Quinobequin Road SB LT	0.86	91	F	206	350	0.89	96	F	211	365	0.89	96	F	211	365
Quinobequin Road SB R1	0.98	95	F	430	648	0.99	98	F	443	672	0.99	98	F	443	672
Quinobequin Road SB R2	0.18	0	A	0	0	0.19	0	A	0	0	0.19	0	A	0	0
Wales Road NEB R	0.94	78	E	363	443	0.95	79	E	372	457	0.95	79	E	372	457
Overall	2.69	175	F	--	--	2.94	198	F	--	--	2.94	198	F	--	--

Table 8 (Continued)
Signalized Intersection Capacity Analysis

	2010 Existing Conditions					2015 No-Build Conditions					2015 Build Conditions				
				Vehicle Queues					Vehicle Queues					Vehicle Queues	
Location	v/c [a]	Delay [b]	LOS [c]	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Grove Street at Riverside Office Building Center Driveway															
Weekday Morning															
Apartment Driveway WB LTR	0.27	24	C	3	17	0.27	24	C	3	17	0.28	25	C	4	17
Grove Street NB L	0.68	19	B	51	165	0.69	19	B	52	171	0.70	20	B	63	171
Grove Street NB TR	0.46	3	A	0	98	0.47	3	A	0	103	0.48	3	A	0	107
Grove Street SB LTR	0.64	14	B	63	198	0.66	15	B	67	203	0.75	18	C	91	268
Overall	0.63	10	B	--	--	0.65	10	B	--	--	0.70	12	B	--	--
Weekday Evening															
Apartment Driveway WB LTR	0.23	25	C	1	11	0.26	27	C	1	12	0.26	27	C	1	12
Grove Street NB L	0.55	40	D	2	20	0.63	60	E	2	21	0.63	60	E	2	21
Grove Street NB TR	0.38	2	A	0	90	0.39	2	A	0	93	0.45	2	A	0	114
Grove Street SB LTR	0.46	5	A	0	182	0.47	5	A	0	190	0.49	5	A	0	205
Overall	0.48	4	A	--	--	0.50	4	A	--	--	0.52	4	A	--	--
Grove Street at Central Street and Auburn Street															
Weekday Morning															
Central Street EB LTR	0.32	12	B	24	76	0.33	12	B	26	81	0.30	12	B	29	85
Auburn Street WB LTR	0.43	12	B	25	96	0.43	13	B	26	100	0.57	14	B	47	148
Grove Street NB LTR	0.53	7	A	59	155	0.55	8	A	63	162	0.58	9	A	81	168
Auburn Street SB LTR	0.62	9	A	63	173	0.64	9	A	67	181	0.69	11	B	87	193
Overall	0.56	9	A	--	--	0.57	10	A	--	--	0.65	11	B	--	--
Weekday Evening															
Central Street EB LTR	0.31	13	B	30	94	0.32	14	B	33	96	0.31	14	B	36	96
Auburn Street WB LTR	0.55	15	B	46	143	0.56	16	B	49	144	0.60	17	B	59	163
Grove Street NB LTR	0.54	8	A	76	160	0.54	8	A	80	165	0.61	9	A	102	194
Auburn Street SB LTR	0.70	11	B	89	200	0.73	12	B	97	215	0.76	13	B	110	231
Overall	0.65	11	B	--	--	0.67	11	B	--	--	0.71	12	B	--	--

a volume to capacity ratio
b average delay in seconds per vehicle
c level of service
d 50th percentile queue length, measured in feet
e 95th percentile queue length, measured in feet

Unsignalized Intersection Capacity Analyses

The analytical methodologies typically used for the analysis of unsignalized intersections use conservative analysis parameters, such as high critical gaps[7]. Actual field observations indicate that drivers on minor streets generally accept smaller gaps in traffic than those used in the analysis procedures and therefore experience less delay than reported by the analysis software. Consequently, the analysis results tend to overstate the actual delays experienced in the field. For this reason, the results of the unsignalized intersection analyses should be considered highly conservative.

Table 9 presents a summary of the capacity analyses for the unsignalized intersections in the study area. The capacity analyses worksheets are included in the Appendix.

[7] 'critical gap' is defined as the minimum time, in seconds, between successive major-stream vehicles, in which a minor-street vehicle can make a maneuver

Table 9
Unsignalized Intersection Capacity Analysis

Location	Critical Side Street Movement	Peak Period	2010 Existing Conditions				2015 No-Build Conditions				2015 Build Conditions			
			Dem [a]	v/c [b]	Del [c]	LOS [d]	Dem	v/c	Del	LOS	Dem	v/c	Del	LOS
Route 16 at Grove Street	NB LTR	Weekday Morning	45	0.21	25	C	45	0.23	27	D	45	0.23	27	D
		Weekday Evening	25	0.12	19	C	25	0.14	21	C	25	0.14	21	C
Hagar Road at Concord Street	WB LR	Weekday Morning	170	0.54	26	D	175	0.57	28	D	195	0.76	47	E
		Weekday Evening	205	0.46	17	C	215	0.49	18	C	295	0.70	27	D
Grove Street at Hagar Road and Colgate Road	EB LT	Weekday Morning	235	0.35	10	B	245	0.37	10	B	330	0.48	12	B
		Weekday Evening	130	0.24	9	A	135	0.25	9	A	165	0.30	10	B
Grove Street at Route 128 SB Ramps and Asheville Rd.	SB LTR	Weekday Morning	10	0.26	107	F	10	0.28	120	F	10	Err	Err	F
	NB LT	Weekday Evening	20	0.94	404	F	20	1.05	475	F	20	6.31	Err	Err
Grove Street at Route 128 NB Ramps	NB R	Weekday Morning	475	1.05	85	F	485	1.10	104	F	680	2.79	846	F
	NB LT	Weekday Evening	60	0.47	53	F	60	0.50	59	F	60	1.34	383	F
Route 128 C-D Road at Route 128 SB Ramps	SB L	Weekday Morning	215	0.21	9	A	220	0.22	9	A	260	0.26	9	A
		Weekday Evening	330	0.33	10	A	340	0.34	10	B	530	0.53	12	B
Route 16 at Route 128 NB Ramps	NB L	Weekday Morning	105	6.15	Err	F	110	7.47	Err	F	110	7.47	Err	F
		Weekday Evening	75	2.29	825	F	75	2.58	973	F	75	2.58	973	F
Grove Street at Riverside MBTA Driveway	EB L	Weekday Morning	25	0.63	146	F	25	0.71	179	F	45	Err	Err	F
		Weekday Evening	45	0.59	93	F	45	0.65	110	F	140	6.75	Err	F
Grove Street at Riverside Office Building (South Driveway)	WB LTR	Weekday Morning	15	0.15	41	E	15	0.16	45	E	15	0.20	59	F
		Weekday Evening	5	0.32	144	F	5	0.38	180	F	5	0.53	285	F
Grove Street at Riverside Office Building (North Driveway)	EB LTR	Weekday Morning	5	0.06	36	E	5	0.07	38	E	5	0.08	47	E
		Weekday Evening	95	0.52	39	E	95	0.55	44	E	95	0.70	69	F
Grove Street at Hancock Street	SB LR	Weekday Morning	15	0.05	12	B	15	0.05	12	B	15	0.05	13	B
		Weekday Evening	40	0.12	14	B	40	0.12	14	B	40	0.13	15	C
Grove Street at Woodland Road	NB LTR	Weekday Morning	450	0.95	48	E	465	0.83	60	F	485	1.09	90	F
		Weekday Evening	520	1.00	66	F	530	1.04	76	F	615	1.24	143	F
Woodland Road at Hancock Street	NB LTR	Weekday Morning	115	0.22	8	A	115	0.22	8	A	115	0.21	8	A
	EB LTR	Weekday Evening	150	0.21	8	A	155	0.22	9	A	155	0.21	9	A
Woodland Road at Central Street	EB LTR	Weekday Morning	245	0.37	10	A	255	0.38	10	A	255	0.37	10	A
		Weekday Evening	285	0.39	10	B	295	0.40	10	B	295	0.37	10	A

a demand in vehicles per hour for the most critical street approach or lane group
b volume-to-capacity ratio for the critical movement
c delay of critical approach only
d level of service of the critical movement
L left
T through
R right

As shown in Table 9, the critical movements at the intersections of Route 16 at Grove Street, Hagar Road at Concord Street, Grove Street at Hagar Road, Route 128 C-D Road at the Route 128 Southbound Ramps, Grove Street at Hancock Street, Woodland Road at Hancock Street, and Woodland Road at Central Street currently operate at LOS D or better during the peak periods. These intersections are expected to continue to operate at LOS D or better under 2015 No Build conditions. Under 2015 Build conditions, with the exception of Hagar Road at Concord Street, these intersections will continue to operate at LOS D or better. The intersection of Hagar Road at Concord Street is expected to experience slightly higher delays during the weekday morning peak hour, operating at LOS E.

The intersections of Grove Street at the Route 128 Southbound Ramps/Asheville Road, Grove Street at the Route 128 Northbound Ramps, Route 16 at the Route 128 Northbound Ramps, Grove Street at the Riverside MBTA Driveway, Grove Street at the Riverside Office Building South Driveway, Grove Street at the Riverside Office Building North Driveway, and Grove Street at Woodland Road currently operate at or over capacity (LOS E or F, respectively) during both the weekday morning and evening peak hours. These intersections are expected to experience additional delay and will continue to operate at or over capacity under both 2015 No Build and 2015 Build conditions during both the weekday morning and evening peak hours assuming no improvements are implemented. As mentioned above, the results of the unsignalized intersection analyses should be considered highly conservative. Specific improvements are beingproposed at the intersections of Grove Street at the Route 128 Southbound Ramps and Asheville Road, Grove Street at the Route 128 Northbound Ramps, and Grove Street at the Riverside MBTA Driveway as mitigation in conjunction with the Project. A discussion of the intersection and roadway improvements are contained in Chapter 5 - *Mitigation*.

■

Freeway Weave Analyses

The analyses of weaving conditions along freeways facilities is based on procedures presented in Chapter 24 – Freeway Weaving Methodology, in the HCM. The procedure focuses on the interaction between two or more crossing traffic streams traveling in the same direction. A common weaving segment is formed by a one-lane freeway on-ramp followed by a one-lane freeway off-ramp, with the two connected by an auxiliary lane. The analysis takes into account geometric and operational factors such as the length of the weaving section; free-flow vehicle speed along the freeway facility; and the number of vehicles in the weaving lanes. The focus of the analysis is within the weaving segment itself, where vehicles must attempt to find gaps and also accelerate or decelerate as they traverse the weaving segment. Table 10 shows the Level-of-Service criteria for weaving segments.

Table 10
Level-of Service Criteria for Weave Areas

	Vehicle Density [1]	
Level of Service	Freeway Weaving Segment	Multilane and Collector-Distributor Weaving Segments
A	≤10	≤12
B	>10 – 20	>12 – 24
C	>20 – 28	>24 – 32
D	>28 – 35	>32 – 36
E	>35 – 43	>36 – 40
F	>43	>40

Source: Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C., 2000.
1 Passenger cars per mile per lane. (pc/mi/ln)

Weave analyses were conducted for the existing weave along Route 128 northbound between the Route 16 westbound on-ramp to Route 128/I-95 and the Route 128/I-95 off-ramp to Grove Street for 2010 Existing, 2015 No Build, and 2015 Build conditions. A summary of the weave analysis is presented in Table 11, with the detailed analysis sheets provided in the Appendix.

Table 11
Weave Segment Capacity Analysis Summary

	2010 Existing Conditions			2015 No-Build Conditions			2015 Build Conditions		
Location/Period	Demand [a]	Density [b]	LOS [c]	Demand	Density	LOS	Demand	Density	LOS
Route 128 Northbound between Route 16 and Grove Street									
Weekday Morning	2439	32.3	D	2500	33.4	D	2711	39.2	E
Weekday Evening	2276	28.4	C	2334	29.4	C	2543	34.9	D
Route 128 NB Frontage Road between Grove Street and Recreation Road									
Weekday Morning	2383	27.9	C	2440	28.6	D	Weave Eliminated under Build Conditions [d]		
Weekday Evening	2748	34.3	D	2816	35.3	E			

a demand, in vehicles per hour
b density, in passenger cars per mile per lane
c level of service
d details of the elimination of this weave are provided in Chapter 5, Mitigation.

As shown in Table 11, the Project is expected to have only a minor impact along Route 128 and is expected to eliminate the existing substandard weave section along the frontage road with the implementation of the proposed infrastructure improvements, which are discussed in detail in Chapter 5, *Mitigation*. As outlined in the table, the Route 128 northbound weave between Route 16 and Grove Street is expected to drop in level of service between the No-Build and Build conditions.

While the peak hour demand and density changes for this movement between the No-Build and the Build are relatively minor, the calculated densities (which define LOS) are at or very near the upper threshold for the reported LOS prior to the Project traffic being added. In addition, through preliminary discussions with MassDOT, the proposed configuration of the frontage road, which eliminates a critical weave between the northbound on ramp from Grove Street and the frontage road to Recreation Road movement, is a desired change and results in traffic oriented to Recreation Road to utilize Exit 22 to the northbound on-ramp, thereby contributing some peak hour volume to this movement. Overall the peak hour change in operations is relatively minor, even with the LOS change expected.

■

Freeway Diverge Analyses

The analysis of diverge operations at ramps is based on procedures presented in Chapter 25, Ramps and Ramp Junctions, of the Highway Capacity Manual. The procedure focuses on the interaction between freeway mainline through traffic and traffic diverging to ramps. The analysis takes into account geometric and operational factors such as the length and taper of the acceleration/deceleration lanes; free-flow vehicle speed along the freeway and on the ramps themselves; and the number of vehicles in the right-most (or left-most for left exits) two lanes of the freeway. The diverge movement forces exiting vehicles to shift in advance and occupy the correct travel lane in order to exit the freeway causing temporary instability as the vehicles shift lanes and decelerate. According to the HCM, the influence area for this movements is approximately 1,500 feet before the diverge areas (including deceleration lanes). Table 12 shows the Level-of-Service criteria for freeway diverging segments.

Table 12
Level-of Service Criteria for Diverge Areas

Level of Service	Density Range[1]
A	≤10
B	>10 - 20
C	>20 - 28
D	>28 - 35
E	>35
F	Demand exceeds capacity

Source: Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C., 2000.
1 Passenger cars per mile per lane.

Ramp diverge capacity analyses were conducted for the existing Route 128/I-95 Northbound Interchange off-ramp at Exit 22 (Grove Street) and the Route 128/I-95 Southbound Interchange off-ramp at Exit 22 for 2010 Existing and 2015 No-Build and Build conditions. A summary of the diverge analysis is presented in Table 13 and are contained in the Appendix.

Table 13
Diverge Segment Capacity Analysis Summary

	2010 Existing Conditions			2015 No-Build Conditions			2015 Build Conditions		
Location/Period	Demand [a]	Density [b]	LOS [c]	Demand	Density	LOS	Demand	Density	LOS
Route 128 Northbound Diverge to Grove Street Off-Ramp									
Weekday Morning	3923	32.8	D	4022	33.7	D	4239	35.5	E
Weekday Evening	3549	29.6	D	3638	30.4	D	3708	31.0	D
Route 128 Southbound Diverge to Grove Street Off-Ramp									
Weekday Morning	3474	31.0	D	3562	31.7	D	3892	34.6	D
Weekday Evening	3423	30.5	D	3510	31.3	D	3629	32.3	D

a demand, in vehicles per hour
b density, in passenger cars per mile per lane
c level of service

On-Site Circulation/Operations

In previous sections, the impacts of the Project on the study area have been discussed in detail. This section provides a detailed description of the following internal transportation related elements of the Project:

- Traffic Circulation
- Internal Intersection Operations

As previously described, the Project involves redevelopment and consolidation of the existing 960 surface parking spaces, and all vehicle transit services into a new parking structure to be located in close proximity to the existing MBTA rail platform. The consolidation of all existing surface parking and vehicle transit services to the proposed parking structure will allow for redevelopment on site. The development proposed includes the construction of the following:

- Approximately 595,000 square feet (sf) of office space;
- 240 residential apartment units encompassing 260,000 sf of building area;
- 14,800 sf of ancillary retail space.

A total of approximately 2,720 parking spaces will be provided throughout the site to support the MBTA and Project parking demands primarily through structured parking facilities. Overall, the site master plan is still being developed and should be considered preliminary for the purposes of this document. However the primary access roadway and two major intersections internally have been evaluated, including the proposed roundabout located at the new northwest access driveways, and the three-way intersection created at the entrance to the proposed MBTA parking garage. All other access and circulation aspects of the site should be considered preliminary and will be developed as the site plan for the project is developed. The primary access road through the site which connects the intersections described above has been designed, in conceptual form, to provide safe and efficient travel by passenger vehicles, buses, trucks, pedestrians, and bicycles.

Site Access and Circulation

Access to the redeveloped facility will be improved under the current plan and will include two full access driveways. Under existing conditions, the facility is accessed through a single point of access located along Grove Street approximately 1,000 feet to the east of the Route 128/I-95 Ramp terminal with Grove Street. The existing driveway that currently serves the Riverside MBTA station will continue to provide access to the site, although this intersection will be upgraded from an unsignalized driveway and placed under traffic signal control and reconstructed to consist of separate left and right-turn lanes exiting the site. It will also provide an exclusive left-turn lane and a through travel lane along Grove Street northbound, and a through lane with an exclusive right-turn lane along Grove Street southbound. The north/south lanes along Grove Street will be separated by a landscaped island in the immediate vicinity of the signalized intersection.

A new driveway will be constructed off of the existing frontage road that provides access from Grove Street to Route 128 northbound, the Massachusetts Turnpike, and Route 30. This driveway will provide right-turn access into the site and will allow both left and right turning vehicles to exit the site. To accomplish this improvement, a section of the existing northbound on-ramp/frontage road, between Grove Street and the point of access to the site will become a two-way roadway. All movements entering and exiting the site will be free movements with exclusive lanes. Entering and exiting movements to and from Grove Street will be grade separated with both site access roadways traveling under the frontage road so that there will be no conflicting turning movements at this access point. To accomplish the site access plan along the frontage road, the Proponent will seek a break in the "no-access" line along this section of state highway. As such, the Proponent has been working with representatives of MassDOT during the development of the access improvements and it is expected that this action will be possible. The improvements at the two site driveways are described in detail in Chapter 5 – *Mitigation* and shown on Figure 14.

Site Plan and Infrastructure Rendering;
For Conceptual Infrastructure Plan refer
to Figure 15 and the Appendix.

Vanasse Hangen Brustlin, Inc.

Figure 14

Architectural Rendering
Option B - Off-Site Improvements
Riverside MBTA Station Redevelopment
Newton, Massachusetts

It is expected that Project-related traffic will select a driveway based on the destination within the site and on the prevailing traffic operations along Grove Street and at the intersection of Grove Street at the Route 128 northbound ramps. It is also expected that a portion of the existing MBTA traffic will use the new driveway on the frontage road. Given the free flow nature of the access and egress at the frontage road driveway, it was assumed that 75 percent of the MBTA traffic oriented to and from the south along Grove Street will use the new driveway. Furthermore, the Proponent plans to implement an aggressive way-finding program on-site to encourage the use or the new frontage road access as the primary access to the proposed facility.

Traffic will travel throughout the site by way of a primary roadway that connects both of the driveways described above at each terminus. To accommodate vehicular traffic entering and exiting the parking structures located in the southwestern portion of the site (adjacent to the Route 128 frontage road), a single-lane, four-legged modern compact roundabout will be installed approximately 300 feet to the east of the Route 128 frontage road. A three-legged unsignalized intersection will provide full access to the primary MBTA garage closest to the Riverside station. Movements at this intersection will be placed under STOP-sign control from the westbound approach (from Grove Street) and from the garage approach. A secondary, entrance-only driveway will provide access to the MBTA garage along the westbound leg of the driveway entering from Grove Street.

Internal Traffic Distribution

A two-step gravity model was created in order to assess the traffic conditions within the Project site. The first step in this approach was to assign the external traffic to the site driveways based on the trip distribution patterns developed. The second step involved routing the traffic through the site to/from each of the parking structures. The traffic was routed to/from each of the parking structures based on the intended uses of the buildings, their size, and their location. For example, the MBTA traffic was assigned to the parking structure closest to the Riverside MBTA station and a portion of the office-related traffic was assigned to the parking structures closest to the office buildings located in the southwesterly portion of the site. Traffic volume networks for the internal roadways are provided in the Appendix.

Internal Intersection Operations

Capacity analyses of the two primary internal intersections were performed for the weekday morning and evening peak hours. The results of the capacity analysis are shown in Table 14 and indicate that the two intersections will operate at LOS C or better during the peak periods.

Table 14
Internal Intersection Operations

	2015 Build Conditions			
Location	v/c [a]	Delay [b]	LOS [c]	Queues 95th [d]
Internal Roundabout Intersection				
Weekday Morning				
Driveway Northeastbound	0.58	9	A	151
Driveway Southwestbound	0.24	9	A	35
Building B Driveway Southeastbound	0.05	8	A	7
Building A/Parking P1 Driveway Northwestbound	0.10	15	B	16
Overall	0.58	9	A	
Weekday Evening				
Driveway Northeastbound	0.21	7	A	35
Driveway Southwestbound	0.33	8	A	55
Building B Driveway Southeastbound	0.42	12	B	74
Building A/Parking P1 Driveway Northwestbound	0.32	14	B	58
Overall	0.42	10	B	
Unsignalized Intersection at MBTA Garage Driveway				
Weekday Morning				
Driveway Westbound (from Grove Street) L	0.14	13	B	13
Driveway Westbound (from Grove Street) R	0.15	10	B	13
Driveway Northbound TR	0.13	0	A	0
Garage SB LT	0.05	3	A	4
Weekday Evening				
Driveway Westbound (from Grove Street) L	0.13	17	C	11
Driveway Westbound (from Grove Street) R	0.18	10	A	16
Driveway Northbound TR	0.11	0	A	0
Garage SB LT	0.11	4	A	9

a volume to capacity ratio
b average delay in seconds per vehicle
c level of service
d 95th percentile queue length, measured in feet

As shown in Table 14, the internal roundabout intersection is expected to operate at LOS A during the weekday morning peak hour and LOS B during the weekday evening peak hour. The intersection at the MBTA Garage entrance is expected to operate at LOS A during both the weekday morning and weekday evening peak hours. Both intersections are expected to experience manageable queues that will not create any internal congestion during peak hours.

Public Transportation Capacity Analysis

As mentioned in Chapter 2 - *Existing Conditions*, the Riverside MBTA Station is an integral component of the MBTA regional transit service. Not only is it the terminus point of the Green (D) Line, but it also provides connections to multiple MBTA bus lines, inter-city bus service provided by Peter Pan and Greyhound bus lines, and multiple privately operated shuttle bus services. As part of this study, a detailed review and analysis of existing and future transit operations was conducted. The results of this assessment are summarized in the following text.

Existing Transit Demand

The MBTA Green Line and bus route services at the site have been evaluated based on specific ridership information obtained through the MBTA. The analyses of the transit demand are based on the peak-hour demand only, which generally represents the most constrained periods for transit operations in this area. Where available, daily demand was also evaluated and presented.

MBTA Green Line

In order to determine the demand on the Riverside Green (D) Line, ridership information was collected from the MBTA. As demonstrated in Table 15 the morning and evening peak period demands on the MBTA's Green (D) Line occur between 7:00AM to 9:00AM and 4:00PM to 7:00PM, respectively.

Table 15
MBTA Green (D) Line Service at Riverside Station

	Trains	Boardings	Alightings
Weekday Daily	71	2,355	2,306
Weekday Morning[a]	23	630	244
Weekday Evening[b]	21	480	718

Source: MBTA December 2007 Ridership and Service Statistics along with supplemental data provided by MBTA
a 7:00AM to 9:00AM
b 4:00PM to 7:00PM

As demonstrated in Table 15, 630 passengers board the Green (D) Line at the Riverside Station in the morning and 718passengers alight during the evening peak period. This data reveals that the morning peak is very likely the critical demand on the Green (D) Line due to a more confined morning window of service, within 7AM-9AM. In the evening, commuters are more likely to stagger departure from 4PM-7PM. Supporting data is included in the Appendix.

MBTA Bus Routes

To determine current demands on bus routes that operate within the site, existing boarding data provided by the MBTA was utilized. The peak hour capacity information is presented later with detailed summary of available capacity for use by the redevelopment of Riverside station. The peak hour demands are shown in Table 16. Supporting data is included in the Appendix.

Table 16
MBTA Bus System Demands

Bus Route	Daily Boardings
500	202
555	120
558	332

Source: MBTA December 2007 Ridership and Service Statistics

As demonstrated in Table 16, Bus Route 558, which provides connections in Waltham, Newton Corner and downtown Boston, is ranked highest in daily boarding. Future condition capacity is discussed in detail in the following Transit Capacity Evaluation section.

Transit Capacity Evaluation

Because the project site will be integrated with the existing transit station, public transit plays an important role in how people will get to and from the site. As such, an in depth analysis of the existing transit system and its ability to accommodate future demands was prepared. This section contains the following information:

- Existing MBTA Green (D) Line Capacity
- Existing MBTA Bus Service Capacity
- Distribution of Project Generated Transit Trips
- Future Transit Service Capacity

As previously shown, current demands on existing transit lines have been established based on counts provided by the MBTA. In an effort to understand the potential for additional ridership, available capacity was estimated on transit lines that could be utilized for access to and from the site. This effort focused on the volume-to-capacity (v/c) ratio, which is used to compare the demand for transit with the capacity of the system to accommodate that demand. This v/c ratio is often known as a “load factor”. For the subway and bus lines, each segment to be utilized for access to the proposed redevelopment project was reviewed to determine where and when the maximum v/c ratio exists, which provides the basis for analysis of capacity and ridership.

The capacity of the transit services is based on the MBTA's Service Delivery Policy[8]. This document's stated purpose is *to ensure that the MBTA provides quality transit service that meet the needs of the riding public.* Once criteria specified in this document is vehicle load. The vehicle load standard defines the levels of crowding that are acceptable by mode and time period. Based on this definition a v/c ratio of 1.00 implies an acceptable level of crowding on transit services. Additional reserve capacity exists on these transit services beyond that assumed in this analysis and by the acceptable levels of crowding. This additional capacity is the increment between the service planning capacity, which assumes the total capacity of a transit service is the number of available seats plus some standing passengers, and "crush capacity" of the vehicles. Crush capacity is an industry term which assumes all available seats are occupied and standing passengers have the ability to maneuver. An evaluation of existing and future transit capacity is summarized below.

Existing MBTA Green (D) Line Capacity

Table 17 below summarizes the calculated v/c ratios for the Green (D) Line between Riverside Station and Fenway Station based on existing demand and capacity for services. This table is based on the maximum load point on the line in the peak period. Maximum load point is defined as the point along the line that carries the greatest number of passengers. It should be noted that the most recent ridership data available from the MBTA was utilized to conduct this analysis. However, data at some stations is dated. In order to conduct this analysis, all boarding and alighting information was conservatively adjusted upwards by a conversion factor to reflect present day conditions.

Table 17
Green (D) Line V/C Ratios

Time Period	Inbound		Outbound	
	Policy V/C	Crush V/C	Policy V/C	Crush V/C
Weekday Morning Peak Hour	1.02	0.38	0.67	0.25
Weekday Evening Peak Hour	0.47	0.17	0.90	0.34

Source: MBTA December 2007 Ridership and Service Statistics and observations made Thursday October 15, 2009
Reflects typical day conditions

[8] MBTA Service Delivery Policy; Massachusetts Bay Transportation Authority; January 14, 2009.

Table 17 demonstrates that peak service under existing conditions occurs on the inbound trains during the morning peak hour with a policy v/c ratio of 1.02. As previously noted, a policy v/c ratio greater than one does not mean that there is no reserve capacity for additional ridership, but rather that the ideal crowding level on a train has been reached. The crush v/c ratio, the ratio that represents the absolute capacity of a train, during the same time period is only 0.38. It should also be noted that these peak v/c ratios occur at points at the opposite end of the Green (D) Line than the Riverside Station. During the critical directional peak periods (inbound in the morning and outbound in the evening) the peak load point of the line occurs between the Longwood and Brookline Village Stations. Supporting calculations are included in the Appendix.

Existing MBTA Bus Service Capacity

Table 18 shows the peak capacities on each bus route and Table 19 shows the calculated v/c ratios on the bus routes serving the Riverside station. These v/c ratios are for morning and evening peak hour service as well as midday non-peak service.

Table 18
Existing MBTA Bus System Capacity

Route/Time Period	Peak Trips[a]	Total Peak Hour Passenger Capacity[b]	
		Crush[c]	Planning[d]
Route 500			
Morning Peak	1	74	54
Evening Peak	1	74	54
Route 555			
Morning Peak			
Evening Peak	1	74	54
Route 558			
Morning Peak	2	148	108
Evening Peak	2	148	108

Source: MBTA December 2007 Ridership and Service Statistics and Route information
a From MBTA Line Statistics
b Capacity based on peak headway
c Based on 74 occupants (assuming 40' bus)
d Based on 54 occupants (assuming 40' bus)

MBTA bus Route 555 only operates in the evening with the first departure scheduled for 7:50 PM, outside of the commuting peak for the proposed office redevelopment. For the purposes of this analysis only Routes 500 and 558 were considered. As shown in Table 18, peak hour passenger planning capacity on these two routes is currently 162 passenger (120 seated passengers based on a 40 seat bus with an additional 42-passenger capacity for standing).

Table 19
Existing MBTA Bus Routes V/C Ratios

Time Period	Bus Route 500		Bus Route 558	
	Policy V/C	Crush V/C	Policy V/C	Crush V/C
Morning Peak (Inbound)	0.39	0.28	0.65	0.47
Morning Peak (Outbound)	0.06	0.04	0.26	0.19
Evening Peak (Inbound)	0.02	0.01	0.19	0.14
Evening Peak (Outbound)	0.28	0.20	0.59	0.43

Source: MBTA

As shown in Table 19, based on the existing routes and ridership, the v/c ratios for both routes serving the site show that current demand are at levels that would indicate surplus capacity. Supporting calculations are included in the Appendix.

■

Non-Automobile Mode Future Projections

Future transit service projections have been developed in order to evaluate the likely impacts and the transit needs of the Riverside Redevelopment Project. The previous sections described the available transit opportunities at the existing Riverside Station. This section examines the potential impact of expected transit demands based on the likely participation of employees and residents of the Project.

Non-Automobile Trip Generation

As presented in the Future Conditions section of this report, future projections for site-generated trips assume that 10 percent of the office traffic and 25% of the residential traffic will arrive to site via transit modes. These are conservative assumptions given the existing industry data which indicates that 20-25% of trips to and from suburban office development with 500 feet of transit stations can be expected to be transit trips. Additionally other area residential developments near transit stations indicate that 25-40% of the total residential trips could be transit trips. It should be noted that the Proponent is committed to providing a robust TDM program for the Project that will encourage the use of non-automobile modes to access the site. Therefore, the 10 and 25 percent transit credits are conservative and actual mode splits will likely reflect a higher reliance on non-automobile modes (including biking and walking) once the Project is in place. Table 20 demonstrates the distribution of Project trips between the transit modes, which are based on the overall City of Newton mode splits adjusted to reflect the 10 and 25 percent transit credit for the office and residential portions of the site respectively.

Table 20
Transit Mode Trip Generation

Mode	Office Mode Split	Residential Mode Split
Rail (subway)	7.50%	18.75%
Bus	2.50%	6.25%
TOTAL	10.00%	25.00%

Source: 2000 US Census for the City of Newton adjusted to reflect site characteristics

As presented in Table 20, transit modes include new site-generated trips that arrive/depart by rail (subway) and bus. Supporting calculations are included in the Appendix.

Distribution of Project Generated Transit Trips

Project-generated transit trips were distributed to the services described previously in this analysis based on journey-to-work Census data derived from the 2000 U.S. Census for the City of Newton and existing travel patterns in this area including existing boarding and alighting activity of the existing transit services on site. To assign the site-generated trips to the transit options, the percentage of the traffic trips to be converted to transit trips were first converted to person trips (assuming a vehicle occupancy ratio of 1.02, typical for office buildings) and then were assigned to specific transit routes based on the assumption that most people will seek the fastest and most direct routes to and from the site with the fewest number of transfers. Table 21 summarizes the trip distribution pattern used to assign trips generated by the Project.

Table 21
Transit Distribution

Transit Service	Line Segment/Route	Percentage of Project Transit Trips Only
MBTA Green (D) Line	Green (D) Line	75%
MBTA Bus Routes	Route 500	8.3%
	Route 558	16.7%
	Total Local Bus Routes	25.0%
Total	All Transit Services (Rail and Bus)	100.0%

The distribution of transit demand to the two MBTA bus routes was determined using journey-to-work Census data derived from the 2000 U.S. Census for the City of Newton. That data provides the proportion of Routes 500 and 558 trips that arrive via existing MBTA bus routes. For the purpose of the analysis, it was assumed that the existing transit routes serving the site would continue to operate the same service in the future. To determine the future ridership and identify any potential capacity constraints in the existing public transportation system serving the Project site, person trips were assigned to the Green (D) Line and both bus routes. Table 22 summarizes the proposed transit demand on the public transportation services that serve the Project site.

Table 22
Proposed Transit Demand

Route/Time Period	Existing Policy V/C	Existing Crush V/C	Proposed Additional Demand by Site Commuters	Future Policy V/C	Future Crush V/C
MBTA Green Line					
Morning Peak (Inbound)	1.02	0.38	9	1.03	0.39
Morning Peak (Outbound)	0.47	0.17	70	0.49	0.18
Evening Peak (Inbound)	0.67	0.25	66	0.70	0.26
Evening Peak (Outbound)	0.90	0.34	13	0.91	0.34
Route 500					
Morning Peak (Inbound)	0.39	0.28	3	0.44	0.32
Morning Peak (Outbound)	0.06	0.04	6	0.17	0.12
Evening Peak (Inbound)	0.02	0.01	6	0.07	0.05
Evening Peak (Outbound)	0.28	0.20	3	0.30	0.22
Route 558					
Morning Peak (Inbound)	0.65	0.47	6	0.70	0.51
Morning Peak (Outbound)	0.26	0.19	13	0.39	0.28
Evening Peak (Inbound)	0.19	0.14	13	0.43	0.31
Evening Peak (Outbound)	0.59	0.43	6	0.63	0.46

As shown in Table 22, all transit routes serving the site provide capacity to support future ridership by the proposed redevelopment. It should be noted that the volume to capacity calculations assume that passengers originating/destined to the site ride the respective transit line for the entire length of the route. This presents a conservative analysis because of the likelihood that a number of site passengers will board and alight at intermediate stops along each respective line.

It is also worth noting that the peak additional passenger demand associated with commuters from the Project site for each transit option is in the outbound direction in the morning and the inbound direction in the evening, both in the opposite direction as the peak demand for the respective transit lines.

5

Mitigation

The preceding analysis of the 2010 Existing conditions and projected future traffic demands in the 2015 No Build and Build conditions indicate that traffic volumes during the peak-hour periods demonstrate that the project is expected to have impact at select study area intersections. In addition, evaluation of existing condition operations and a general safety review indicate that there are improvements needed in the area today, with or without the proposed project. In consideration of these facts, the proponent is proposing to implement a combination of both structural and non-structural mitigation measures that are designed to address existing area deficiencies, address the potential impacts of the proposed Project, and create an improved pedestrian and vehicle corridor in the vicinity of the site. The proposed measures have been broken into the following components:

- Site Access and Circulation
- Intersection/Roadway Mitigation
- Transportation Demand Management

The following text provides a detailed description of the mitigation measures proposed as part of the Project.

Alternatives Evaluation

Access to the site is a vital element to the success of the proposed redevelopment project. As described previously, Riverside Station is currently served by a single full access driveway located along Grove Street approximately 1,000 feet to the east of the existing Route 128/I-95 Northbound Ramp to Grove Street. The existing roadway system in the vicinity of the proposed development represents a complex network of interchange ramps, critical weave sections, and intersections that provide access to and from one of the busiest corridors (Route 128/I-95) in the Commonwealth of Massachusetts. It is also served by roadways that travel through residential areas of the City of Newton. Careful consideration of maintaining and enhancing the mobility in this area and accommodating project traffic is essential.

Throughout the process of developing the master plan for this project and the development of the Traffic Impact and Access Study (TIAS) the Proponent has participated in numerous meeting with MassDOT, MBTA, Federal Highway Administration (FHWA), City of Newton, and local interested residents. Meetings regularly held with MassDOT have engaged representatives from all levels of the MassDOT organization from the Secretary of Transportation to technical staff. Much of the early discussions were considered working sessions where ideas were exchanged and the general feasibility of alternative improvements were discussed. All parties that participated in the meetings, as represented above, provided useful suggestions and ideas, many of which have been vetted through this process. For the purpose of demonstrating some of the ideas for site access and improvements that have been considered, a supplemental chapter of this documents has been created, Section A-1, which is attached in the Appendix.

Infrastructure Improvements

Throughout the discussion with MassDOT, MBTA, City of Newton, and the local community, there were many varying ideas about what is necessary and appropriate for access and improvements in this area, to improve existing issues and to address the project needs. To the extent possible, the Proponent has attempted to be responsive to these ideas and has vetted many of the options and suggestions that have been made by most parties. Throughout the many discussions in the City, there were several themes that we heard regularly and which inspired a lot of review and consideration. These include the following:

- Direct Access from Route 128 Northbound to the Site is needed
- Minimizing potential traffic along Grove Street should be a priority
- Improving the Pedestrian Experience along the corridor is necessary.

While there were many other comments and considerations mentioned, these three things were very consistently the topics of discussion at nearly all the meetings in the City where the Proponent was a participant. As a result, the Proponent has made great efforts to ensure that these and other requests are fully considered and incorporated into the proposed plan to the extent possible. The proposed infrastructure improvement plan that is presented in this study is a preliminary conceptual plan that will require further, formal vetting during both the Massachusetts Environmental Policy Act (MEPA) process, and during formal design review with MassDOT, FHWA, and the City of Newton. We expect that refinements will be needed as the project and the process evolve, but based on the work completed to date, consultations with MassDOT, FHWA, and the City of Newton, the conceptual improvement plan presented herein represents a plan with overall operational and safety benefits, will provide more than ample capacity to accommodate future traffic conditions, will slow traffic flows down along Grove Street in the area of the project site and beyond, and is a plan that appears to be reasonable and "approvable" by MassDOT and FHWA. In addition, the proposed infrastructure improvements, particularly the site access modifications, significantly enhance the direct access to the regional roadway system from Riverside Station thereby minimizing future traffic conditions on certain sections of Grove Street. Refer to Figures 15 and 16 which represent a preliminary rendering of the site master plan and aconceptual infrastructure improvement plan which is proposed in support of the proposed Project. A detailed full-size conceptual improvement plan is also provided in the Appendix. Specific aspects of the plan our discussed in narrative form below:

Site Access

Access to the redeveloped facility will be improved under the current plan and will include two full access driveways. Under existing condition, the facility is accessed through a single point of access located along Grove Street approximately 1,000 feet to the east of the Route 128/I-95 Ramp terminal with Grove Street. The existing driveway that currently serves the Riverside MBTA station will continue to provide access to the site. This intersection will be upgraded from an unsignalized driveway and placed under traffic signal control and reconstructed to consist of separate left and right-turn lanes exiting the site, an exclusive left-turn lane and a through travel lane along Grove Street northbound, and a through lane with an exclusive right-turn lane along Grove Street southbound. The north/south lanes along Grove Street will be separated by a landscaped island in the immediate vicinity of the signalized intersection. The following sections describe the two access points in detail.

Grove Street at Riverside MBTA Station Driveway

Access to the Riverside MBTA Station is currently provided by way of a single unsignalized driveway located along the west side of Grove Street. As previously presented in Table 9, the driveway is currently operating at LOS F and operations are expected to deteriorate in the future under 2015 No Build and 2015 Build conditions without improvements. To address the capacity deficiencies at this location and to provide efficient access to both the Riverside MBTA Station and the Project site, the Proponent will implement the following improvements at this location:

- Install a new traffic signal at the intersection
- Provide the following lane geometry to increase capacity at the intersection:
  - An exclusive left-turn lane and a through lane along Grove Street northbound;
  - A through lane and an exclusive right-turn lane along Grove Street southbound;

    - Exclusive left-turn and right-turn lanes along the Riverside MBTA Station Driveway eastbound.
- Provide a landscaped island areas along Grove Street

Traffic signal warrant analyses were conducted in accordance with the Manual on Uniform Traffic Control Devices (MUTCD)[9] for this intersection. The warrant analysis indicates that under 2010 Existing conditions, traffic volumes at this intersection meet the criteria necessary to satisfy Warrant 3 (Peak-Hour Warrant). Under 2015 No-Build and 2015 Build conditions, traffic volumes are expected to increase and will further the need for a traffic control device at this intersection.

As shown in Table 23, with the installation of a traffic signal and geometric improvements, this intersection was shown to improve to an overall LOS A during the weekday morning peak hour and LOS B during the weekday evening peak hour under 2015 Build with Mitigation conditions.

Frontage Road at Right-In/Full Egress-Out Site Driveway

To accommodate traffic volumes associated with the full build-out of the Project and to limit the overall impact along Grove Street, a second access point to the site will be provided along the Route 128 Northbound ramp system adjacent to the site. The existing frontage road and the Route 128 Northbound On-Ramp will be reconstructed to accommodate a right-turn in and full-egress out (right and left turns allowed) unsignalized driveway for the site. Vehicles would enter the site by way of a free movement along the reconstructed frontage road/Route 128 Northbound on-ramp. Vehicles destined to Route 128 northbound, the Massachusetts Turnpike, and Route 30 (also to the north) will exit the site by way of an exclusive right-turn lane that eventually merges with the frontage road. Vehicles destined to the west and south will exit the site by way of an exclusive left-turn lane that will pass under the frontage road and will intersect with Grove Street at the Route 128 northbound ramps (providing a southbound approach to the intersection). By allowing vehicles to have direct access to the regional highway system, the overall impact along Grove Street will be limited, particularly east of the Route 128 northbound ramp. We expect that this driveway will be the "gateway" entrance into the site accommodating the majority of the site traffic making the Grove Street Driveway secondary. In addition, all bus activity oriented to the highway system can be directed to use this driveway, which could eliminate all bus activity on Grove Street. Overall, the provision of the frontage road driveway achieves the goal of minimizing traffic increases along Grove Street in this area.

▼

[9] Manual on Uniform Traffic Control Devices (MUTCD); Federal Highway Administration; Washington, D.C.; 2003.

As referenced above, the currently proposed layout of this driveway is illustrated in Figure 15, which shows a left-hand exiting movement for vehicles destined for the site. It should be noted that because discussions with MassDOT, a slightly different layout is also being evaluated, which provides a right-hand exiting movement for vehicles destined for the site. An illustration of this layout is included in the Appendix. As discussions with MassDOT continue, the final layout of the proposed driveway will be established prior to the design phase of these improvements.

Intersection/Roadway Mitigation

As shown in Tables 8 and 9, some study area intersections currently operate at LOS F and will continue to operate at LOS F regardless of the development of the Riverside MBTA Station site. With the addition of the Project-related traffic, operations at some of the study area intersections were shown to operate over capacity. To address these conditions, the Proponent has worked with the City of Newton and MassDOT to develop a transportation improvement mitigation program to address existing and potential capacity and safety deficiencies within the study area.

Given the location of the site adjacent to Route 128 and its current use as a major public transit hub, it is imperative that adequate infrastructure be put in place to improve on existing area deficiencies and to accommodate future access and egress to the site. In an effort to increase the operating capacity of the roadways and intersections adjacent to and in the vicinity of the site, the Proponent will implement a comprehensive roadway infrastructure improvement program. The mitigation program involves improvements along Grove Street between Route 128 Southbound ramps and the Riverside MBTA Station Driveway, including the signalization of the Site Driveway and installation of modern roundabouts at the Route 128 ramp terminals. The Proponent will also reconstruct and reconfigure a portion of the frontage road and the Route 128 Northbound on-ramp that is adjacent to the site.

The following text provides a detailed discussion of the improvements. The intersection and roadway improvements are also shown on Figure 15.

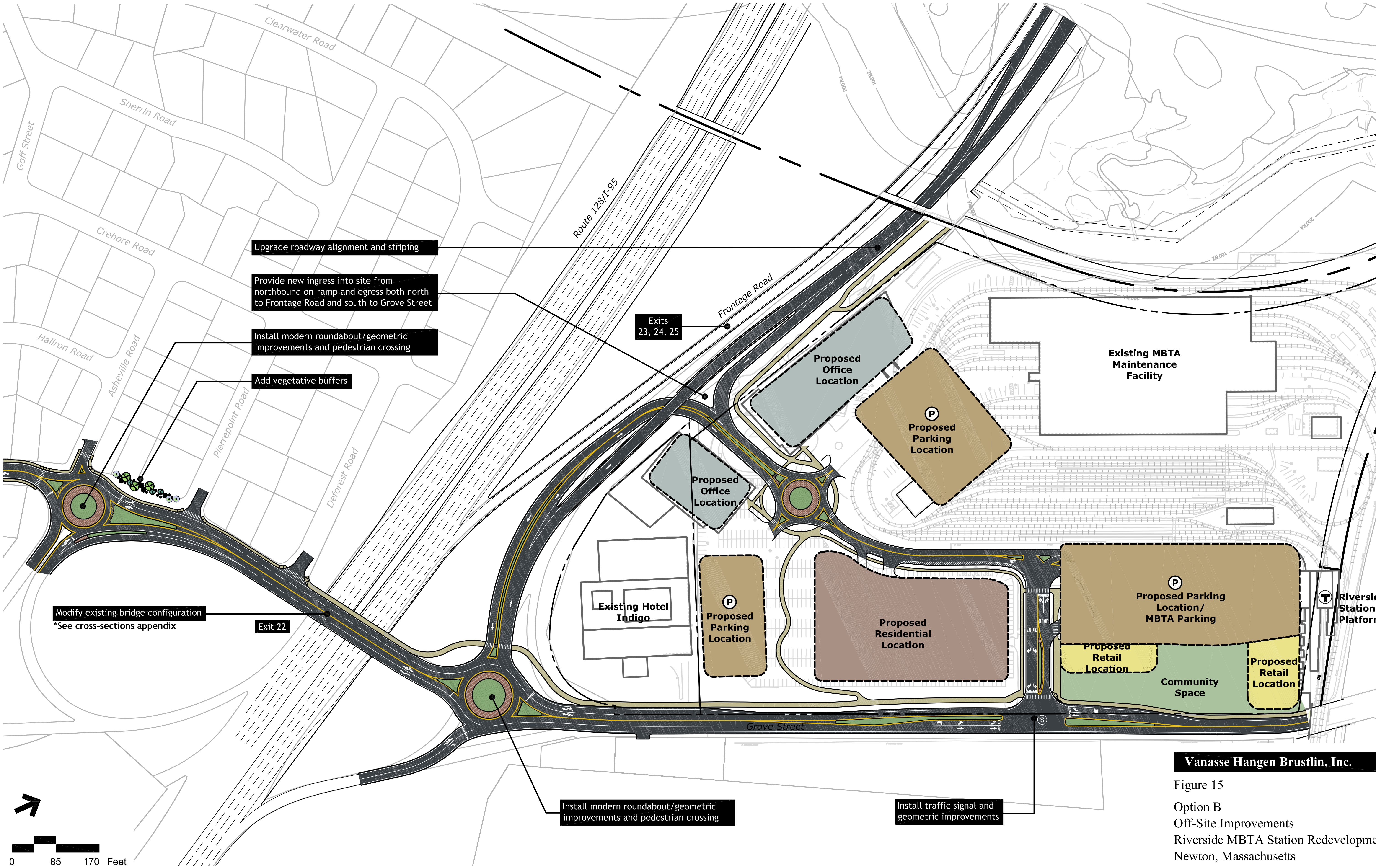

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Figure 15

Option B
Off-Site Improvements
Riverside MBTA Station Redevelopment
Newton, Massachusetts

Intersections

During the development of the conceptual improvement plan, VHB met with MassDOT and City of Newton officials on numerous occasions. Since both ramp terminals with Grove Street are state highway locations, MassDOT will hold ultimate jurisdiction regarding the improvements to be implemented. With this in mind, the Proponent has considered alternative improvement options at both ramp intersections with Grove Street. This includes the installation of traffic signal controls and the implementation of modern day roundabouts. As a result of numerous meetings and technical discussions where preliminary information was exchanged regarding both options, MassDOT appears to favor the roundabout option at this time and therefore the proposed conceptual plan has included roundabout s at both ramp terminals for further consideration moving forward.

Grove Street at Route 128 Southbound Ramps/Asheville Road

Under 2015 No Build conditions, independent of the proposed Project, some movements at this unsignalized intersection were shown to operate at LOS F during both the weekday morning and evening peak hours. To address the capacity deficiencies at this location, the Proponent will implement the following improvements:

- Install a modern roundabout at the intersection and shift the intersection southeast to create a buffer for the neighborhood where possible
- Provide the following lane geometry to increase capacity at the intersection:
  - An single lane approaching the roundabout along Grove Street eastbound, with a single adjacent departure lane;
  - Two through lanes along Grove Street westbound with one lane dedicated for traffic continuing on Grove Street westbound and the other lane for traffic destined south towards Route 128, with a single adjacent departure lane; and
  - A single lane entering the roundabout from Route 128 southbound and a free-flow right-turn lane for traffic heading eastbound on Grove Street, with a single adjacent departure lane.
- Based on an initial review of available information, these improvements can be implemented within the existing right-of-way at the intersection.
- To the extent that MassDOT will allow, natural vegetative plant screen will be introduced between the relocated roadway and the neighborhood as represented on Figure 15.

The 2015 Build with Mitigation traffic volumes are shown in Figures 16 and 17 for the weekday morning and evening peak hours, respectively. As shown in Table 24, with the installation of a modern roundabout, this intersection was shown to operate at an overall LOS A during both the weekday morning and weekday evening peak hours under 2015 Build with Mitigation conditions.

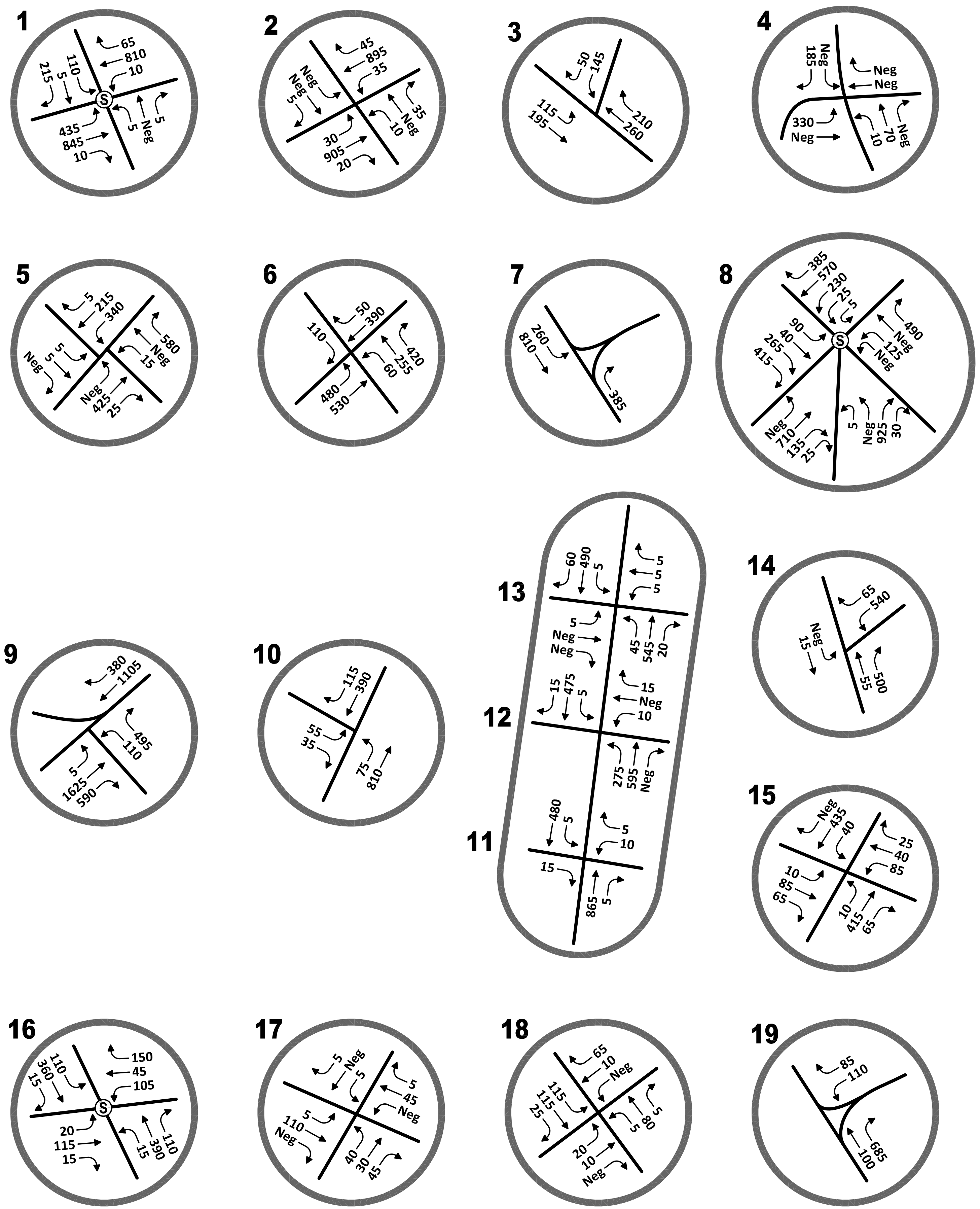
Grove Street at Route 128 Northbound Ramps

Under 2015 No Build conditions, independent of the proposed Project, some movements at this unsignalized intersection were shown to operate at LOS F during both the weekday morning and evening peak hours. To address the capacity deficiencies at this location, the Proponent will implement the following improvements:

- Install a modern roundabout at the intersection
- Provide the following lane geometry to increase capacity at the intersection:
  - Two lanes approaching the roundabout along Grove Street eastbound, with two adjacent departure lanes;
  - Two lanes approaching the roundabout along Grove Street westbound, with two adjacent departure lanes;
  - A through lane and an exclusive right-turn lane entering the roundabout from Route 128 northbound, with no adjacent departure lanes (the approach is one-way in the northbound direction); and
  - A single lane approaching the roundabout on the north approach, with a single adjacent departure lane.
- Based on an initial review of available information, these improvements can be implemented within the existing right-of-way at the intersection.

In addition to the operational benefits realized from this improvement, it should also be noted that there are important safety benefits as well. In particular, the proposed geometry includes bringing the existing northbound off ramp into the roundabout, which not only slows vehicles down as they exit from Route 128, which is currently a high-speed movement heading east along Grove Street, but it also significantly improves sight distance from the ramp and from driveways along the east side of Grove Street.

As shown in Table 24, with the installation of a modern roundabout, this intersection was shown to operate at an overall LOS B during the weekday morning peak hour and LOS A during the weekday evening peak hour under 2015 Build with Mitigation conditions. As part of this study, an informational document about roundabouts was assembled, which is provided in the Appendix.



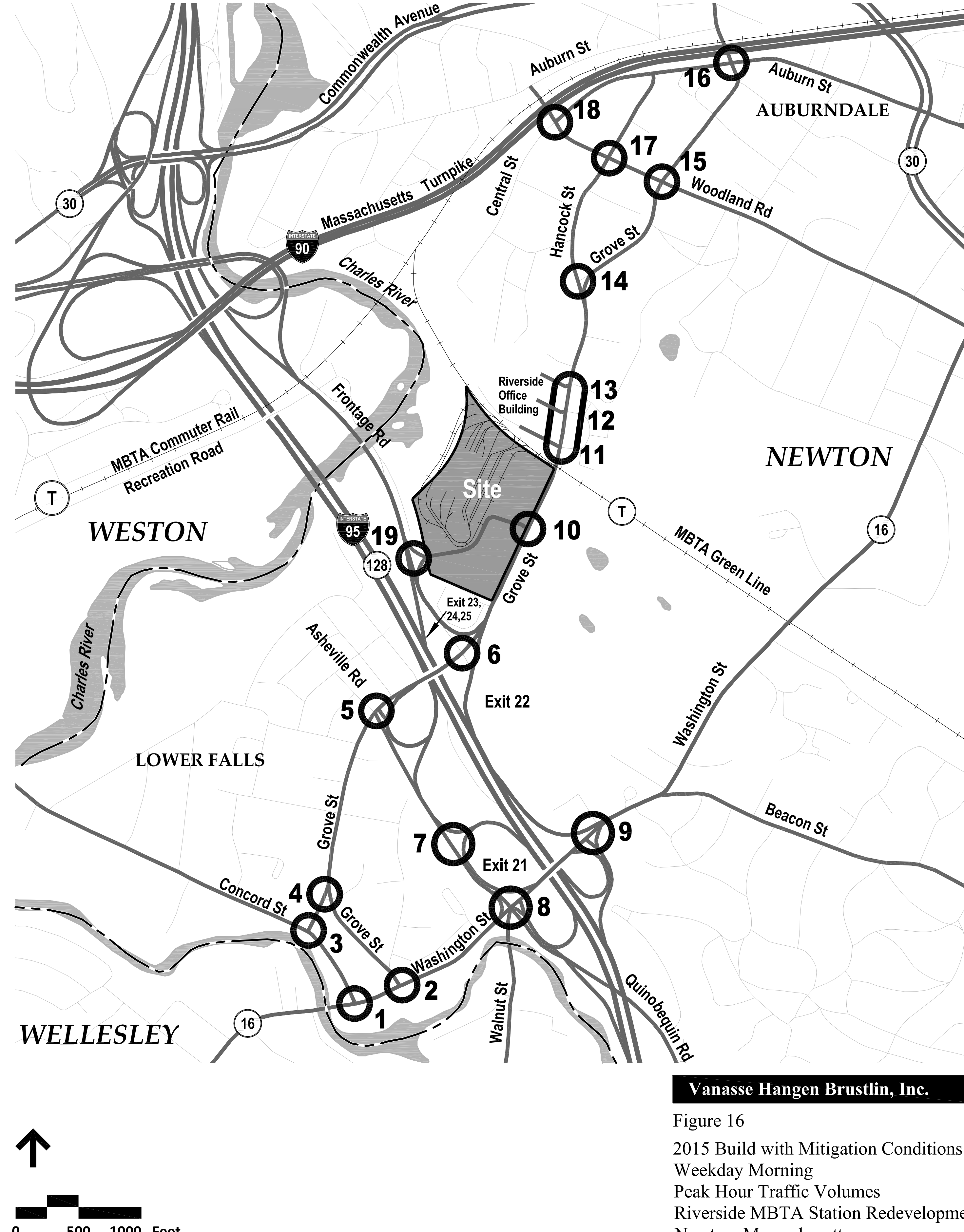


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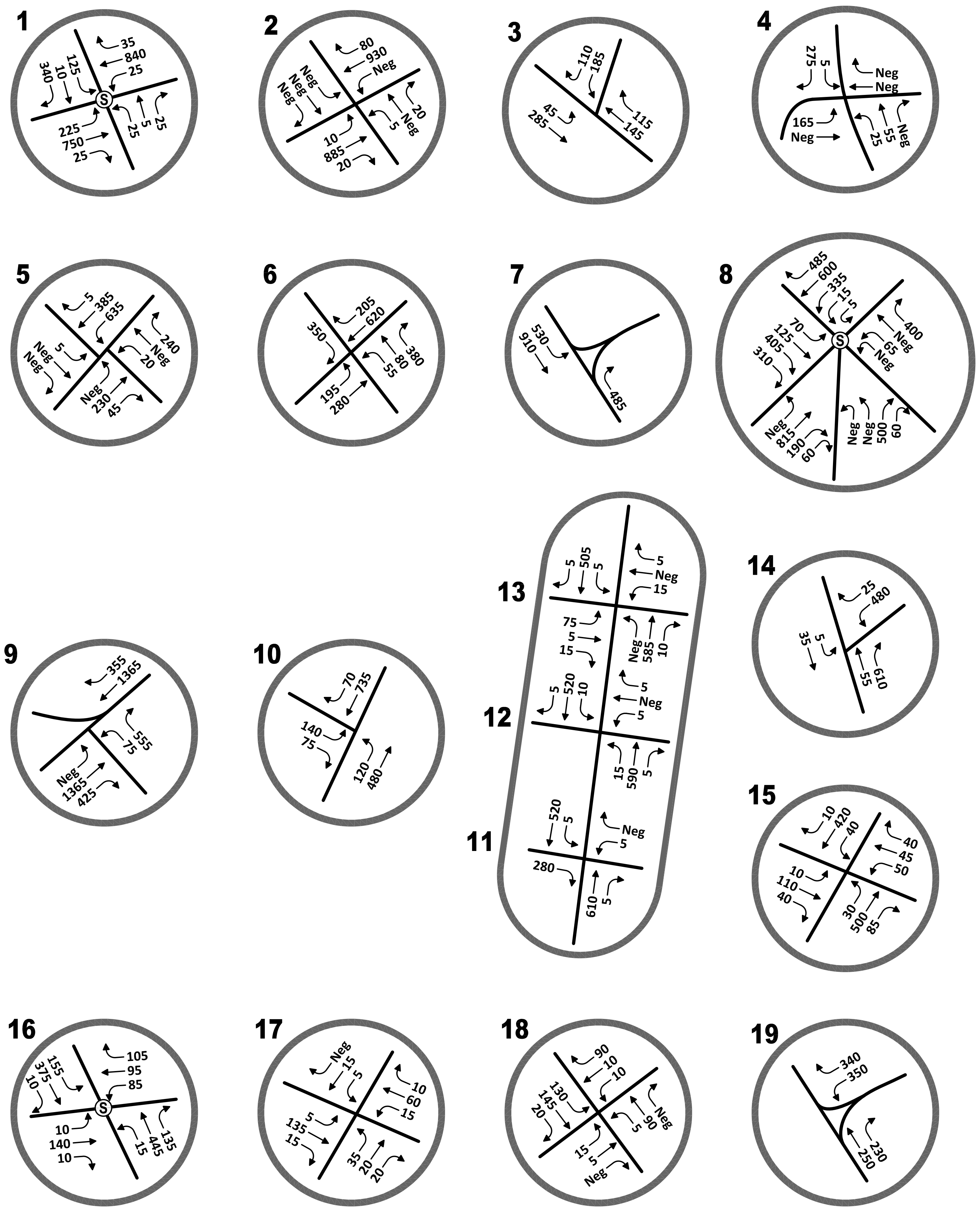
Figure 16

2015 Build with Mitigation Conditions
Weekday Morning
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts



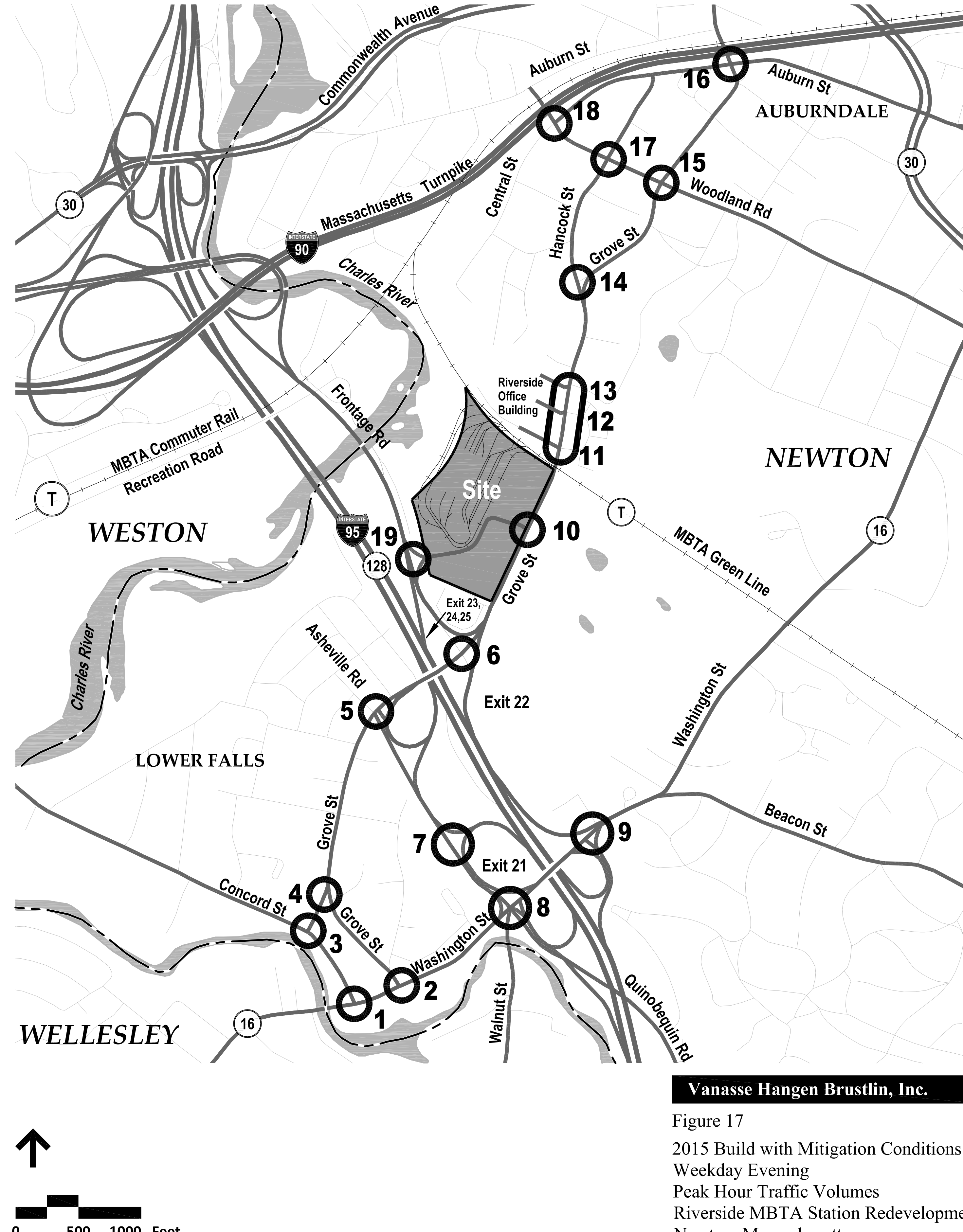


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Figure 17

2015 Build with Mitigation Conditions
Weekday Evening
Peak Hour Traffic Volumes
Riverside MBTA Station Redevelopment
Newton, Massachusetts

Roadways

Specific roadway improvements have been proposed as part of the transportation improvement program to further enhance the capacity of the surrounding roadway network in an effort to provide safe and efficient access to the Project site, the Riverside MBTA Station, along the Grove Street corridor, and along the Route 128 ramp system at the Grove Street interchange. The following sections describe the proposed roadway improvements.

Grove Street Corridor Improvements

In conjunction with the improvements to the intersections and site access listed above, the Grove Street corridor between the intersection with Route 128 Southbound ramps and the intersection with Riverside MBTA Station driveway will be reconstructed to accommodate additional lanes in an effort to provide more capacity and to manage any potential queuing both along Grove Street and along the Route 128 ramp system. Grove Street will be reconstructed to accommodate four lanes of travel between the Route 128 Southbound ramps and the Route 128 Northbound ramps. The Grove Street bridge over Route 128 is currently 46 feet in width from curb to curb and will be reconfigured and restriped to accommodate four lanes of travel and a single wide sidewalk on the northside of the structure. Conceptual cross section plans have been prepared for the bridge and are included in the Appendix. Between the Route 128 Northbound ramps and the MBTA Green Line bridge over Grove Street (just to the northeast of the Riverside MBTA Station Driveway), Grove Street will be widened to accommodate additional travel and turn lanes, with landscaped islands along portions of the site frontage.

Based on an initial review of available information, these improvements can be implemented within the existing available right-of-way or on land under the control of the Proponent.

Frontage Road/ Route 128 Northbound Ramp Improvements

As discussed previously, secondary access is proposed via a right-turn in/full-egress driveway off of the frontage road. As part of the construction of this access, additional improvements are proposed to reconstruct a portion of the frontage road. Access to the site will be provided by way of an exclusive ramp that intersects the west side of the frontage road. The ramp would be constructed parallel to the frontage road and will pass under the frontage road by way of a proposed grade separation. Entering and exiting movements to and from Grove Street will be grade separated with both site access roadways traveling under the Frontage Road so that there will be no conflicting turning movements at this access point. To accomplish the site access plan along the frontage road, the Proponent will seek a break in the "no-access" line along this section of state highway. As such, the Proponent has been working with representatives of MassDOT during the development of the access improvements and we expect that this action will be possible. This configuration would also prohibit access to Recreation Road from the Route 128 Northbound Off-Ramp at Exits 23-24-25. By restricting access to Recreation Road from Exits 23-24-25, access would be provided by way of the Route 128 Northbound exit at Grove Street, increasing the traffic volume (only slightly) at the proposed roundabout at the intersection of Grove Street at the Route 128 Northbound ramps. Based on an initial review of available information, this alternative can be implemented within the existing available right-of-way or on the Project site.

Based on the proposed improvements described above, capacity analyses for the 2015 Build Conditions with Mitigation were performed and are summarized in Tables 23 and 24.

Pedestrian Facilities

Specific improvements to the pedestrian environment in the vicinity of the Riverside MBTA Station have been proposed in conjunction with the roadway and intersection improvements recommended above. A new sidewalk will be installed along the north side of Grove Street between the Route 128 Southbound Ramps and the Grove Street bridge over Route 128. A wide sidewalk will be constructed along the north side of the bridge and will continue along the north side of Grove Street, providing access to the Project site. A comprehensive network of pedestrian and multi-use paths, and a linear-style park will be provided along the site frontage to allow for an enhanced pedestrian experience in this area. In addition, a thorough network of sidewalk is proposed throughout the site providing enhanced pedestrian circulation. A multi-use path connection will also be provided to the currently abandoned railroad bridge in the northwesterly portion of the site. This will allow for a direct connection to be provided for non-vehicular access between the Riverside MBTA Station and residential areas of the Newton Lower Falls neighborhood that does not currently exist. A pedestrian plaza/community area is proposed adjacent to the parking garage serving the Riverside MBTA station. Crosswalks will be provided at the proposed roundabouts at the Route 128 Southbound and Route 128 Northbound ramp intersections with Grove Street. Crosswalks and a pedestrian signal phase will also be provided at the intersection of Grove Street at the Riverside MBTA Driveway. The proposed pedestrian facilities are shown in Figure 18.

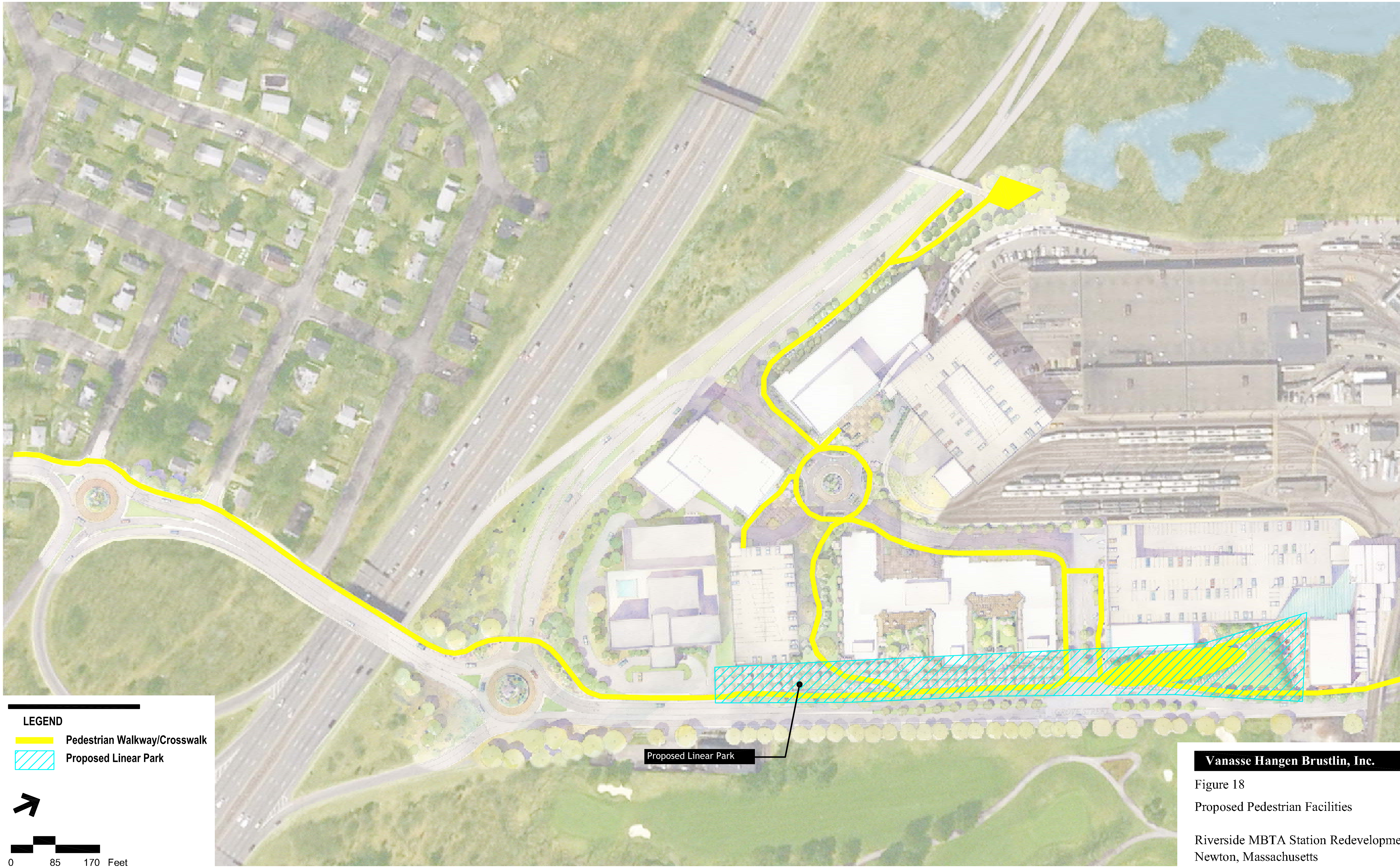

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Figure 18

Proposed Pedestrian Facilities

Riverside MBTA Station Redevelopment
Newton, Massachusetts

Table 23
Mitigated Signalized Intersection Capacity Analysis

	2015 No Build Conditions				2015 Build Conditions				2015 Build with Mitigation Conditions				
				Queues[d]				Queues				Queues	
Location	v/c [a]	Delay [b]	LOS [c]	95th	v/c	Delay	LOS	95th	v/c	Delay	LOS	50th	95th
Grove Street at Riverside MBTA Station Driveway													
Weekday Morning													
Driveway EB L	0.71	179	F	71	Err	Err	F	Err	0.38	21	C	22	41
Driveway EB R	0.20	12	B	19	0.53	17	C	77	0.03	12	B	0	11
Grove Street NB LT	0.21	6	A	20	0.95	38	E	407	--	--	--	--	--
Grove Street NB L	--	--	--	--	--	--	--	--	0.16	4	A	8	20
Grove Street NB T	--	--	--	--	--	--	--	--	0.80	10	A	185	299
Grove Street SB TR	0.27	0	A	0	0.32	0	A	0	--	--	--	--	--
Grove Street SB T	--	--	--	--	--	--	--	--	0.46	9	A	85	164
Grove Street SB R	--	--	--	--	--	--	--	--	0.07	4	A	0	9
Overall									0.74	9	A		
Weekday Evening													
Driveway EB L	0.65	110	F	76	6.65	Err	F	Err	0.83	47	D	57	119
Driveway EB R	0.64	31	D	105	2.55	729	F	1,825	0.06	14	B	0	22
Grove Street NB LT	0.20	5	A	18	0.52	11	B	77	--	--	--	--	--
Grove Street NB L	--	--	--	--	--	--	--	--	0.47	9	A	13	30
Grove Street NB T	--	--	--	--	--	--	--	--	0.41	4	A	66	112
Grove Street SB TR	0.50	0	A	0	0.52	0	A	0	--	--	--	--	--
Grove Street SB T	--	--	--	--	--	--	--	--	0.83	17	B	241	461
Grove Street SB R	--	--	--	--	--	--	--	--	0.04	4	A	0	7
Overall									0.81	14	B		

a volume to capacity ratio
b average delay in seconds per vehicle
c level of service
d 50th and 95th percentile queue lengths, measured in feet

Table 24
Mitigated Roundabout Intersection Capacity Analysis

	2015 No Build Conditions				2015 Build Conditions				2015 Build with Mitigation Conditions			
				Queues[d]				Queues				Queues
Location	v/c [a]	Delay [b]	LOS [c]	95th	v/c	Delay	LOS	95th	v/c	Delay	LOS	95th
Grove Street at Route 128 SB Ramps/ Asheville Road												
Weekday Morning												
Grove Street EB LTR	0.00	0	A	0	0.00	0	A	0	0.71	13	B	255
Grove Street WB L	0.38	10	B	45	0.49	12	B	69	0.24	11	B	51
Grove Street WB TR	0.17	0	A	0	0.19	0	A	0	0.18	4	A	35
CD Road NB LT	0.28	94	F	24	0.53	229	F	43	--	--	--	--
CD Road NB L	--	--	--	--	--	--	--	--	0.03	14	B	5
CD Road NB R	0.48	16	C	65	1.12	105	F	488	0.46	5	A	0
Asheville Road SB LTR	0.28	122	F	24	Err	Err	F	Err	--	--	--	--
Overall									0.71	9	A	
Weekday Evening												
Grove Street EB LTR	0.00	0	A	0	0.00	0	A	0	0.57	17	B	147
Grove Street WB L	0.52	11	B	79	0.77	16	C	207	0.45	11	B	131
Grove Street WB TR	0.28	0	A	0	0.36	0	A	0	0.33	4	A	81
CD Road NB LT	1.05	475	F	73	6.31	Err	F	Err	--	--	--	--
CD Road NB L	--	--	--	--	--	--	--	--	0.03	12	B	4
CD Road NB R	0.19	11	B	17	0.35	12	B	39	0.19	5	A	0
Asheville Road SB LTR	0.33	302	F	22	2.46	3,317	F	41	--	--	--	--
Overall									0.57	9	A	
Grove Street at Route 128 NB Ramps												
Weekday Morning												
Grove Street EB L					--	--	--	--	0.37	10	B	102
Grove Street EB LT	0.05	1	A	4	0.06	2	A	5	0.36	4	A	99
Grove Street WB T					--	--	--	--	0.48	16	B	115
Grove Street WB TR	0.34	0	A	0	0.44	0	A	0	0.48	15	B	121
Route 128 NB Off-Ramp NB LT	0.49	59	F	57	1.23	335	F	140	0.63	17	B	126
Route 128 NB Off-Ramp NB R	1.10	104	F	424	2.79	846	F	1,514	0.73	18	C	176
Route 128 NB Ramp SB LR					--	--	--	--	0.19	8	A	26
Overall									0.73	12	B	
Weekday Evening												
Grove Street EB L					--	--	--	--	0.18	10	A	42
Grove Street EB LT	0.06	2	A	4	0.07	2	A	6	0.18	4	A	43
Grove Street WB T					--	--	--	--	0.48	7	A	104
Grove Street WB TR	0.60	0	A	0	0.96	0	A	0	0.48	8	A	104
Route 128 NB Off-Ramp NB LT	0.50	59	F	59	1.35	386	F	152	0.29	12	B	40
Route 128 NB Off-Ramp NB R	0.62	18	C	107	0.89	44	E	261	0.53	10	B	104
Route 128 NB Ramp SB LR					--	--	--	--	0.68	13	B	152
Overall									0.68	9	A	

As demonstrated in Tables 23 and 24, the conceptual improvements proposed are designed to add additional traffic capacity to the area, not just to bring the system back to predevelopment conditions. The improvements are important in that they are expected to improve peak hour operations as indicated in the table, but also introduce traffic control at the site access driveway and modern roundabouts at the ramp intersections with Grove Street, which will have the effect of slowing vehicle movements along this corridor. The slowing of traffic along with the pedestrian enhancements that are proposed as part of this project will make the post development conditions far more pedestrian friendly. Modern day roundabouts are well known for improving safety and enhancing the pedestrian environment. For informational purposes, we are including some important information relative to roundabouts in the Appendix of this document.

Grove Street Traffic Calming

Throughout the planning stages of this project, the Proponent has had numerous meetings with representatives of the City of Newton to discuss the transportation related components of the project. In addition, multiple community meetings have been held to get an understanding of any concerns the surrounding neighborhoods have with the Project. Some of the common themes that have resulted from these meetings are related to Grove Street. In particular, residents feel that certain sections of Grove Street experience unsafe vehicle speeds, cut-through traffic is present along Grove Street north of the site, and overall pedestrian accommodations are inadequate.

VHB met with representatives of the City of Newton DPW and Planning Department to discuss these issues specifically. As part of that discussion, some ongoing initiatives were mentioned for Grove Street in the Lower Falls area. In particular, the following improvements are currently in the planning stage:

- Grove Street at Pine Grove Avenue – implementation of a raised crosswalk
- Grove Street at Cornell Street – implementation of a raised intersection
- Grove Street at Hagar Street/Colgate Road – intersection reconfiguration
- Concord Street – implementation of speed humps

The planning of these improvements is ongoing. Further evaluation will be required to determine costs and schedule for implementation. These measures are geared towards traffic calming along Grove Street and Concord Street as well as improving vehicle and pedestrian safety along this corridor.

Another common comment we have heard through the development of the project is that safety in the area of the Williams School is a concern. Discussions with the City of Newton revealed that establishment of a "blue zone", which is essentially a traffic management area during drop-off and pick-up time periods had been successful under a past administration at the Williams School. However, this system has not been managed successfully in recent years and there is a need for management of bus/car/pedestrian interaction in this area. As part of the Project, the Proponent will work with the City to identify opportunities to implement management measures to ensure vehicular and pedestrian safety in this area. In addition, the Proponent will coordinate with the City of Newton to establish opportunities to participate in traffic calming measures along Grove Street in Auburndale similar to those proposed in the Lower Falls area. Further discussions will be held to determine the ideal locations for these measures within the Auburndale neighborhood and determine the feasibility/desirability of various traffic calming treatments. Ultimately, the goal of these initiatives would be to improve safety and deter cut-through traffic along this corridor and within the adjacent neighborhoods.

Event Traffic

As discussed previously, in addition to being used heavily by commuters on a daily basis, Riverside Station is also used as an alternative means of transportation to sporting events like Boston Red Sox games and Boston College football and basketball games. During these events, traffic in the vicinity of Riverside Station can increase by approximately 6 to 12 percent, depending on location. The increased volumes at the site commonly result in vehicle queues along Grove Street that extend several vehicles on the eastbound approach, thus decreasing operational efficiency along Grove Street. Operational efficiency is most impacted in the eastbound direction as through traffic is impeded by vehicles turning left into the MBTA Driveway. Aside from the additional volume at the MBTA Driveway, additional delays are often caused by inefficient parking fee collection within the site. As discussed in previously in this chapter, the Proponent is proposing geometric improvements and traffic signal control at the intersection of Grove Street at the MBTA Driveway, which will improve operations from LOS F during peak hours to LOS B with the improvements in place. In addition, a second access driveway is proposed via a right-turn in/full egress driveway on the Route 128 frontage road. This will alleviate the additional demand at the MBTA Driveway during Red Sox games by providing an alternative entrance and exit point for MBTA riders. An analysis of operations under 2015 Build Conditions during a special event is provided in the Appendix. Based on the analysis, the proposed improvements will adequately accommodate the additional demand under 2015 Build with special event traffic conditions. It is also expected that the parking garage operations will be significantly improved upon completion of the proposed MBTA garage, providing an additional benefit for both vehicles entering and exiting the site during these special events.

To supplement the operational benefits that will be realized on Grove Street during Red Sox games as a result of the proposed traffic improvements, the Proponent will also work with the MBTA to establish an efficient means of handling parking fees on game days. While the primary MBTA garage will be equipped with a ticketing system as well as a staffed kiosk, the Proponent wants to ensure that game day traffic can be accommodated efficiently on site without adverse impacts to the neighborhood streets or to its own parking supply. While a final plan for event traffic management has not been established, the Proponent will continue to work with the MBTA and the City of Newton to establish appropriate measures. It is anticipated that with the proposed improvements in place, traffic operations on game days will be significantly better than existing conditions. Analysis of 2015 Build Conditions with Mitigation has been conducted and is included in the Appendix.

Transportation Demand Management

The goal of the Transportation Demand Management (TDM) plan is to reduce the Project's overall traffic impact through the implementation of measures that are aimed at affecting the demand side of the transportation equation, rather than the supply side. By their very nature, TDM programs attempt to change people's behavior, and to be successful, they must rely on incentives or disincentives to make these shifts in behavior attractive to the commuter or retail customer.[10] TDM programs are designed to maximize the people-moving capability of the existing transportation infrastructure by increasing the number of persons in a vehicle, providing and/or encouraging the use of alternate modes of travel, or influencing the time of, or need to, travel.

The term TDM encompasses both alternatives to driving alone and the techniques or supporting strategies that encourage the use of these alternatives.[11] TDM alternatives to driving alone include carpools and vanpools, public and private transit, and non-motorized travel, including bicycling and walking. TDM alternatives can also influence when trips are made. For example, alternative work hours (compressed work weeks, flextime, and telecommuting) can affect what time of day trips are made, or if trips occur at all on certain days. On an area-wide basis, the provision of park and ride facilities and transit services can also provide a competitive alternative to drive-alone commuting. TDM strategies are the supporting measures that encourage the use of alternatives to driving alone. TDM strategies include financial incentives, time incentives, the provision of new or enhanced commuter services, dissemination of information, and marketing alternative services. TDM strategies

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10 Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience, prepared by Comsis Corporation and the Institute of Transportation Engineers, for the U.S. Department of Transportation, DOT-T-94-02, September, 1993, p. I-1.

11 Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience, prepared by Comsis Corporation and The Institute of Transportation Engineers, for the U.S. Department of Transportation, DOT-T-94-02, September, 1993, P. 1-2.

include all the incentives and disincentives that increase the likelihood for people to change their existing travel behavior.

Transportation Demand Management Program

The Proponent is committed to implementing an extensive TDM program. The site's mix of uses and proximity to transit opportunities will help promote alternative modes of travel and reduce the number of cars traveling to the site. The following initiatives are proposed by the Proponent and are described in further detail in the following pages:

- Commitment to membership in the 128 Business Council
- Provide an on-site direct connection to MBTA platform from the office and residential uses
- Provide an TDM coordinator
- Provide comprehensive commuter information on the site
- Promote carpool/rideshare programs
- Promote guaranteed ride home programs
- Promote alternate transportation modes
- Facilitate bicycle and pedestrian travel

General TDM Measures

TDM Coordinator
A TDM coordinator will be appointed or hired to oversee site-related transportation demand management. The person (or persons) in this role will coordinate with other parties within the site area to help alleviate the reliance on single-occupant motor-vehicle travel to the site. To that end, the TDM measures identified in the following section will be implemented under the direction and supervision of this person. The duties of the TDM Coordinator will include, but not be limited to: disseminating information on alternate modes of transportation and developing related marketing materials; developing and implementing appropriate TDM measures; and monitoring the effectiveness of those measures.

Commuter Information
The TDM coordinator will provide central commuter information centers within the buildings on site to assist employees and visitors. These locations could include the lobby of the office buildings, the entrance of retail facilities, common areas, and locations that have high visibility to customers and employees. Available information will include schedules for the MBTA bus and train routes. Specific measures to promote ridership are also noted below for specific uses.

Facilitate Bicycle and Pedestrian Travel

Travel to the site by biking or walking will be promoted by the Proponent through the provision of convenient bicycle and pedestrian amenities. Bike racks will be provided throughout the site at locations in the vicinity of various buildings within the overall redevelopment. Due to the site's proximity to residential neighborhoods, walking to/from and within the site will be encouraged by the provision of a pedestrian-friendly site layout, which features an extensive network of sidewalks and crosswalks at key points both within the site and connecting to the existing pedestrian network. As part of the Project, a multi-use path is proposed along the site frontage that will travel across the north side of the Route 128 Bridge and connect to existing sidewalk facilities in the Lower Falls area. As mentioned previously, the proposed roundabouts at the Route 128 ramp terminals will also enhance the pedestrian safety in this area by slowing vehicles down on Grove Street. In addition, roundabouts are well known for improving the safety of roadway crossings, which is important in this area with adjacent residential neighborhoods and nearby schools. The on-site pedestrian network will also provide a connection to the existing access points to the Charles River.

Specific TDM Measures

The TDM coordinator will require employers within the site to implement all possible and practical TDM measures. As not every TDM program will be suitable for every type of employer, such as telecommuting or flexible work hours, the coordinator will offer technical assistance to individual tenant employers to evaluate potential programs and to implement them when appropriate. Potential employer-based TDM measures may include the following:

- Provide flexible hours so that employees have the option of commuting outside the peak traffic periods. Similar benefits can also be realized through staggered work hours so that employee trips occur over a broader period and thereby reduce peak hour demands.
- Massachusetts' employers have the ability to finance the cost of their employees' parking, transit or vanpool expenses. These benefits are not considered taxable income for the employee, and employers may write off these costs as a transportation expense. Alternatively, employees' may use pre-tax dollars for the purchase of transit passes, pay vanpool fares, and to cover qualified parking costs.
- Consider telecommuting options.
- Hold promotional events for bikers and walkers.
- Provide incentives for bicycle and HOV commuting.
- Prioritize local hiring.
- Offer direct deposit to employees.

- Provide a guaranteed ride home program to eliminate an often-cited deterrent to carpool and vanpool participation.
- Sponsor vanpools and subsidize expenses.
- Provide preferential carpool and vanpool parking within the parking garages and spaces near office building entrances as a convenience to participants and to promote ridesharing.
- Provide subsidies to employees who purchase monthly or multiple trip transit passes.

6

Conclusion

Vanasse Hangen Brustlin, Inc. (VHB) has prepared a Traffic Impact and Access Study (TIAS) for the proposed Riverside MBTA Station Redevelopment (the "Project") in Newton, Massachusetts. The Project site is situated at the Riverside MBTA Station located on Grove Street and adjacent to the Route 128 northbound ramp frontage road in Newton, Massachusetts. The Project involves redevelopment and consolidation of the existing 960 surface parking spaces, and all vehicle transit services into a new parking structure to be located in close proximity to the existing MBTA rail platform. The consolidation of all existing surface parking and vehicle transit services to the proposed parking structure will allow for redevelopment on site. The development proposed includes: the construction of approximately 595,000 square feet (sf) of office space, 240 residential apartment units encompassing 260,000 sf of building area, and 14,800 sf of ancillary retail space. A total of approximately 2,720 parking spaces will be provided throughout the site to support the MBTA and Project parking demands primarily through structured parking facilities.

The proposed Project is a cooperative development proposal between the Proponent and the MBTA, under which the Proponent will lease the land to support the uses from the MBTA, thereby generating a yearly revenue stream to the public agency. Access to the site will be provided by two driveways: one full-access, signalized driveway along Grove Street at the location of the existing driveway to the site, and a second, new, unsignalized driveway to be located along a reconstructed frontage road (northwest portion of site) providing right-turn-in access and full egress (allowing both left and right turning vehicles to exit the site), adjacent to the Route 128 Northbound ramp to Route 30 and the Massachusetts Turnpike. The Project site provides convenient vehicular access to the major regional highways in the area such as Route 128/Interstate 95 and the Massachusetts Turnpike/Interstate 90. The proposed access plan, with new connection directly to the frontage road significantly enhances the site connection to the regional roadway system. The Project site also provides convenient access to public transportation opportunities including the D Line of the MBTA Green Line and MBTA Bus Routes 500, 555, and 558.

The proposed Project is expected to generate approximately 6,948 (3,474 entering and 3,474 exiting) new vehicle trips during an average weekday, with 818 (654 entering and 164 exiting) new vehicle trips during the weekday morning peak hour and 876 (233 entering and 643 exiting) new vehicle trips during the weekday evening peak hour.

Capacity analyses were conducted for each of the study area intersections and weave/diverge sections under 2010 Existing conditions, 2015 No-Build conditions (without the proposed development), and 2015 Build conditions (with the proposed development). Based on the results of these analyses and the anticipated site-generated traffic, the Proponent will implement the following measures:

- Comprehensive Transportation Demand Management Program
- Intersection capacity enhancements at:
  - Grove Street at Route 128 Northbound Ramps
  - Grove Street at Route 128 Southbound Ramps
  - Grove Street at Riverside Station Driveway
- Proposed right-turn in/full-egress out access off of Northbound Ramp access to the frontage road
- Roadway improvements along the Route 128 frontage road
- Pedestrian enhancements on-site and off-site
- Traffic calming improvements along Grove Street

Overall, VHB concludes that the implementation of the above-mentioned mitigation measures not only accommodates future site-generated traffic but also improves some existing operational deficiencies in the vicinity of the site. As part of the development, the Proponent has been involved in numerous meetings with the City of Newton, MassDOT, FHWA, MBTA, and the local community to come up with an access plan that will operate safely and efficiently and also satisfy the concerns of the community to the greatest extent possible. The proposed infrastructure plan offers numerous operational improvements to this area, improves vehicular and pedestrian safety, and provides enhanced access to the site making the proposed Project a positive addition to the surrounding community.