16 Bulge Road Proposed Development

Devens, Massachusetts

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Executive Summary

Vanasse Hangen Brustlin, Inc. (VHB) has evaluated the potential traffic impacts associated with the proposed development located at 16 Bulge Road in Devens, Massachusetts. Under existing conditions, the site itself is undeveloped and consists of land previously used by Fort Devens.

The proposed project involves the construction of a 150,843 square foot manufacturing facility supported by 299 parking spaces. Access to the site is proposed via three curb cuts on Bulge Road, which will provide connections to Patton Road and the regional roadway network. The site is located in the Devens Regional Enterprise Zone and is surrounded by undeveloped land and the Red Tail Golf Club.

Based on VHB's knowledge of the area and the development of typical traffic impact and access evaluations, the following intersections were included in this assessment:

- Jackson Road at Patton Road / Lake George Street
- Barnum Road at Patton Road
- Jackson Road at Barnum Road
- Patton Road at Bulge Road (south)
- Patton Road at Bulge Road (north)
- Bulge Road at Bulge Road
- Bulge Road at Country Club Driveway

Manual turning movement counts to collect peak hour data were conducted at each of the study-area intersections during the weekday morning and weekday evening peak periods in October 2020. Concurrent with the TMCs, 24-hour automatic traffic recorder (ATR) counts were conducted on Patton Road and Bulge Road. However, due to the current COVID-19 pandemic, traffic volumes are lower than typical at some locations. Methodology outlined by MassDOT was used to grow April 2015 counts included in the 2015 Devens Traffic Monitoring Report, as these volumes would reflect more typical traffic patterns.

The proposed project is expected to generate approximately 94 new vehicle trips (72 entering/22 exiting) during the weekday morning peak hour and 101 new vehicle trips (31 entering/70 exiting) during the weekday evening peak hour.

Capacity analyses were conducted for each of the study area intersections under 2021 Existing conditions, 2028 No-Build conditions (without the proposed redevelopment), and 2028 Build conditions (with the proposed redevelopment). Based on the results of these

analyses and the anticipated site-generated traffic, the proponent will implement the following measures:

- Site Access Improvements
- Transportation Demand Management Program
- Traffic Monitoring Program
- Signal timing adjustments at the intersection of Jackson Road at Patton Road / Lake George Street

Overall, VHB concludes that the proposed project with the mitigation measures in place will have minimal impacts to traffic operations at the study area intersections.

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1

Introduction

Vanasse Hangen Brustlin, Inc. (VHB) has evaluated the potential traffic impacts associated with the proposed development located at 16 Bulge Road in Devens, Massachusetts (the "Site"). The development proposal for the Site includes an approximately 150,843 square foot (sf) manufacturing facility (the "Project") on a currently undeveloped parcel of land.

This traffic study documents the findings of the traffic evaluation conducted for the Project, including an assessment of existing traffic operations and safety, a projection of future traffic volumes without and with the proposed development, and an analysis of the impacts of the proposed development.

Project Description

The Project Site is located at 16 Bulge Road in Devens, Massachusetts. The site is located in the Devens Regional Enterprise Zone formerly occupied by Fort Devens and is surrounded by undeveloped land and the Red Tail Golf Club. The existing Site is currently vacant with the remnants of the former uses and street network visible from when the Site was part of Fort Devens.

Under proposed conditions, the Site will be occupied by a two-story manufacturing building of 150,843 sf and will be supported by approximately 299 parking spaces. Access to the proposed Project will be via three curb-cuts on Bulge Road. The southern driveway will be one-way into the Site and will provide entering access to both the parking lot in front of the building and the loading/receiving docks behind the building. The middle driveway will be full access into and out of the Site and will provide direct access to the parking lot for

employees and visitors. The northern driveway will be one-way out of the Site and will provide egress from the loading/receiving docks located behind the building.

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; and a review of vehicular crash data.

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 2028, a seven-year time horizon, was selected as the design year for analysis for the preparation of this traffic impact and access assessment in accordance with the MassDOT Traffic Impact Assessment (TIA) 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 potential mitigation measures, if necessary.

2

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. The existing conditions analysis consists of an inventory of the traffic control, roadway geometry, and intersection geometry in the study area, the collection of daily and peak hour traffic volumes, a summary of the pedestrian, bicycle, and public transit accommodations in the area, and a review of recent vehicle crash history. Each of these elements is described in detail below.

Study Area

Based on VHB's knowledge of the area and the development of typical traffic impact and access evaluations, a study area of the following intersections and their approach roadways were selected for review:

- Jackson Road at Patton Road / Lake George Street – *signalized*
- Barnum Road at Patton Road / Saratoga Boulevard – *signalized*
- Jackson Road at Barnum Road – *unsignalized*
- Patton Road at Bulge Road (south) – *unsignalized*
- Patton Road at Bulge Road (north) – *unsignalized*
- Bulge Road at Bulge Road – *unsignalized*
- Bulge Road at Country Club Driveway – *unsignalized*

Under proposed conditions, the study area will also include the following three intersections that do not currently exist under existing conditions:

- Bulge Road at South Site Driveway – *unsignalized*
- Bulge Road at Middle Site Driveway – *unsignalized*
- Bulge Road at North Site Driveway – *unsignalized*

Figure 1 illustrates the location of the Project Site in relation to the existing study area intersections and the surrounding area.

Roadway Geometry

Descriptions of the study area roadways and intersections are provided below, including descriptions of the existing lane configurations, traffic control at the study intersections, and the roadway jurisdiction in this area. Figure 2 illustrates the observed existing geometry and traffic control at each study area intersection.

Study Area Roadways

Jackson Road

Jackson Road is a two-lane roadway (one lane per direction) and generally runs in a north-south direction connecting Devens and Ayer to Route 2. Jackson Road is classified as a local roadway under local jurisdiction. Jackson Road provides two northbound lanes between Route 2 and Patton Road. Bike lanes are provided on both sides of the roadway north of Patton Road. The posted speed limit is 35 mph south of Givry Street and 30 mph north of Givry Street. Land use is mostly commercial and industrial.

Barnum Road

Barnum Road is a two-lane roadway (one lane per direction) and generally runs in an east-west direction connecting Devens to Routes 110, 111, and 2A in the east. Barnum Road is classified as a local roadway under local jurisdiction. Bike lanes are painted in the shoulders on both sides of the roadway. The posted speed limit is 35 mph on Barnum Road. Land use is mostly commercial and industrial.

Patton Road

Patton Road is a two-lane roadway (one lane per direction) and connects Jackson Road in the east with Barnum Road in the west. Patton Road runs generally in an east-west direction between Jackson Road and Marne Street and in a north-south direction between Marne Street and Barnum Road. Patton Road is classified as a local roadway under local jurisdiction and serves as a truck route connecting the industrial areas on Saratoga Boulevard and Barnum Road with Route 2. No bicycle accommodations are provided along Patton Road and the posted speed limit is 35 mph. Land use is mostly industrial, institutional, and undeveloped land.

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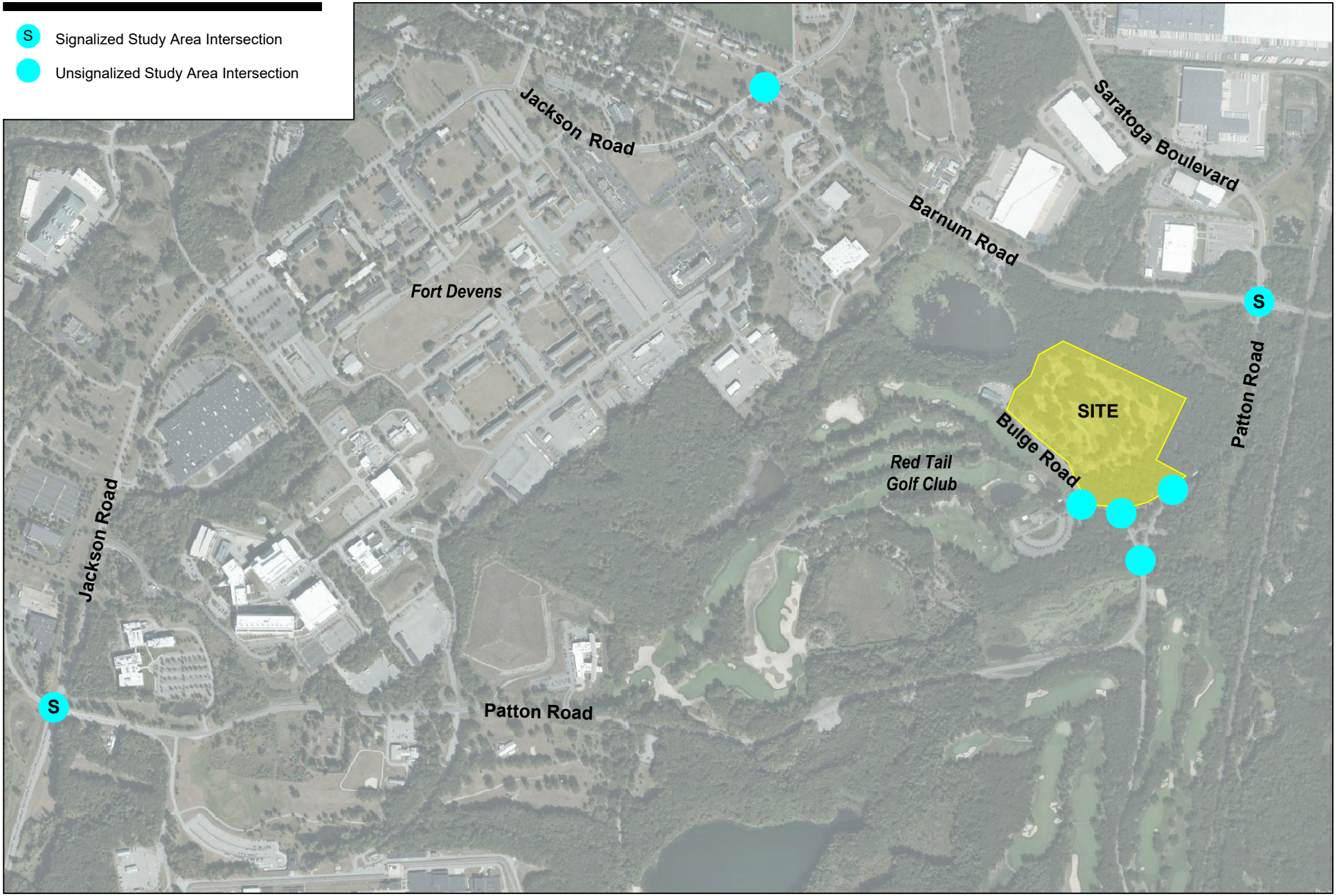

Figure 1
Site Location Map

16 Bulge Road
Devens, Massachusetts

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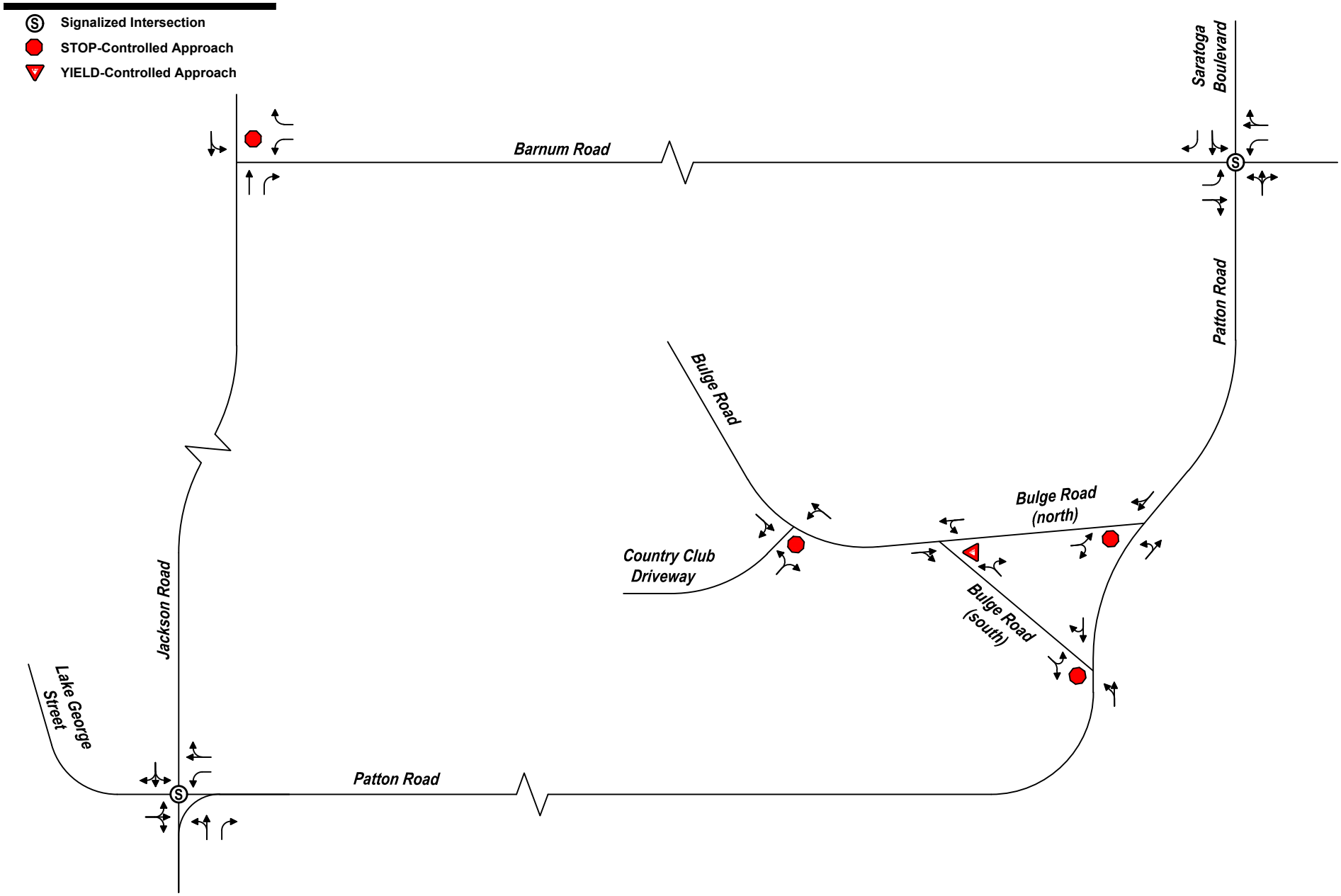

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Figure 2
Intersection Lane Geometry and Traffic Control

16 Bulge Road
Devens, Massachusetts

Bulge Road

Bulge Road is a two-lane roadway (one lane per direction) and generally runs in a northwest-southeast direction connecting Patton Road with the Red Tail Golf Club and the currently undeveloped Site. Bulge Road runs for approximately 1,700 feet and dead ends at a maintenance facility for the golf club. Bulge Road is classified as a local roadway under local jurisdiction. No bicycle accommodations are provided along Bulge Road and there are no posted speed limits. Land use consists mostly of the golf course and undeveloped land.

Study Area Intersections

Jackson Road at Patton Road / Lake George Street

Jackson Road generally runs in the north-south direction and is intersected by Lake George Street from the west and Patton Road from the east to form a four-legged signalized intersection. The Lake George Street eastbound approach consists of one all-purpose lane. The Patton Road westbound approach consists of an exclusive left-turn lane and a shared through/right-turn lane. The Jackson Road northbound approach consists of a shared left-turn/through lane and a channelized right-turn lane and the Jackson Road southbound approach consists of one all-purpose lane.

Pedestrian accommodations include sidewalks on the east side of Jackson Road north of the intersection, on the north side of Patton Road east of the intersection, and approximately 150 feet of sidewalk on the north side of Lake George Street connecting the commercial property at 7 Jackson Road to the intersection. There is also an unpaved path on the east side of Jackson Road south of the intersection. Signalized crosswalks are provided across the southbound and westbound approaches and the northbound channelized right turn. Bicycle accommodations are not provided at this intersection, although bike lanes are provided on Jackson Road approximately 100 feet north of the intersection in the northbound direction and 500 feet north of the intersection in the southbound direction. Land use around the intersection is mostly commercial or undeveloped land.

Barnum Road at Patton Road

Barnum Road generally runs in the east-west direction and is intersected by Saratoga Boulevard from the north and Patton Road from the south to form a four-legged signalized intersection. The Barnum Road eastbound and westbound approaches both consist of an exclusive left-turn lane and a shared through/right-turn lane. The Patton Road northbound approach consists of one all-purpose lane and the Saratoga Boulevard northbound approach consists of a shared left-turn/through lane and an exclusive right-turn lane.

Pedestrian accommodations include sidewalks on the south side of Barnum Road west of the intersection, on the north side of Barnum Road east of the intersection, and on the west side of Saratoga Boulevard north of the intersection. Signalized crosswalks are provided across the eastbound and southbound approaches. On-road bike lanes are painted in the eastbound and westbound shoulders of Barnum Road east and west of the intersection but end approximately 250 feet prior to the intersection in both directions. Land use around the intersection is mostly industrial or undeveloped land.

Jackson Road at Barnum Road

Jackson Road generally runs in the north-south direction and is intersected by Barnum Road from the east to form a three-legged unsignalized intersection. The intersection has an emergency-only signal that is triggered by the Devens Fire Station located on the northeast corner of the intersection. The default operations for the signal heads are flashing yellow on the Jackson Road northbound and southbound approaches and flashing red on the Barnum Road westbound approach. The Barnum Road westbound approach is under STOP control and consists of an exclusive left-turn lane and an exclusive right-turn lane. The Jackson Road northbound approach consists of an exclusive through lane and an exclusive right-turn lane and the Jackson Road southbound approach consists of one all-purpose lane.

Pedestrian accommodations include sidewalks on both sides of Jackson Road and on the south side of Barnum Road. The sidewalk on the west side of Jackson Road ends approximately 300 feet north of the intersection. Crosswalks are provided across the westbound and northbound approaches. Bike lanes are provided in both direction on Jackson Road and are painted in the shoulders of Barnum Road in each direction but end approximately 250 feet east of the intersection. Land use around the intersection is mostly commercial and residential, with the fire station located on the northeast corner of the intersection.

Patton Road at Bulge Road (south)

Patton Road generally runs in the north-south direction and is intersected by the southern leg of Bulge Road from the northwest to form a three-legged unsignalized intersection. Bulge Road splits into a northern leg and a southern leg approximately 400 feet west of Patton Road. All approaches to the intersection consist of one all-purpose lane and the Bulge Road (south) eastbound approach is under STOP control. There are no dedicated pedestrian or bicycle accommodations on any of the approaches and no crosswalks are provided. However, a golf-cart crossing is located approximately 250 feet north of the intersection and consists of an at-grade crossing across the Bulge Road (south) westbound approach and a grade-separated crossing under the Patton Road southbound approach. Land use around the intersection consists mostly of the Red Tail Golf Course and undeveloped land.

Patton Road at Bulge Road (north)

Patton Road generally runs in the northeast-southwest direction and is intersected by the northern leg of Bulge Road from the west to form a three-legged unsignalized intersection. Bulge Road splits into a northern leg and a southern leg approximately 400 feet west of Patton Road. All approaches to the intersection consist of one all-purpose lane and the Bulge Road (north) eastbound approach is under STOP control. There are no dedicated pedestrian or bicycle accommodations on any of the approaches and no crosswalks are provided. Land use around the intersection consists mostly of undeveloped land.

Bulge Road at Bulge Road

Bulge Road splits into a northern leg and a southern leg approximately 400 feet west of Patton Road with the northern leg of Bulge Road intersecting from the east, the southern leg of Bulge Road intersecting from the southeast, and the main trunk of Bulge Road intersecting from the west to form a three-legged unsignalized intersection. All approaches consist of one all-purpose lane and the Bulge Road (south) northbound approach is under YIELD control but is unsigned. A sidewalk is provided on the south side of Bulge Road west of the intersection, but it is in poor condition and extends for less than 200 feet without connecting to any other pedestrian facilities. There are no dedicated bicycle accommodations on any of the approaches and no crosswalks are provided. Land use around the intersection consists mostly of the Red Tail Golf Course and undeveloped land.

Bulge Road at Country Club Driveway

Bulge Road generally runs in the northwest-southeast direction and is intersected by the driveway for the Red Tail Golf Club from the west to form a three-legged unsignalized intersection. All approaches to the intersection consist of one all-purpose lane and the Country Club Driveway westbound approach is under STOP control but is unsigned. A sidewalk is provided on the southwest side of Bulge Road southeast of the intersection, but it is in poor condition and extends for less than 200 feet without connecting to any other pedestrian facilities. There are no dedicated bicycle accommodations on any of the approaches and no crosswalks are provided. Land use around the intersection consists mostly of the Red Tail Golf Course and undeveloped land.

Traffic Volume Data

Manual turning movement counts (TMCs) to collect peak hour data were conducted at each of the study-area intersections on Tuesday, October 6, 2020 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. These counts were conducted while many businesses and commuters were continuing to deal with challenges associated with the COVID-19 virus; however, they were conducted after local schools started their hybrid remote learning and in-person classes. 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. These periods represent the most critical traffic volume conditions. The weekday morning peak period occurred from 7:15 AM to 8:15 AM and the evening peak period occurred from 4:00 PM to 5:00 PM. The traffic count data is included in the Appendix to this report.

However, due to the current COVID-19 pandemic, peak hour traffic volumes on main commuter roadways are noticeably lower than are typical for these times of the year. Therefore, historical traffic count data from the 2015 Devens Traffic Monitoring Report[1] was reviewed within the study area. As outlined in the Traffic Monitoring Report, traffic volumes were counted in April 2015 at the following three study area intersections:

1 Devens Traffic Monitoring Program, 2015 Five-Year Traffic Report, Devens, Massachusetts; Prepared by BSC Group; December 2015.

- Jackson Road at Patton Road / Lake George Street
- Barnum Road at Patton Road / Saratoga Boulevard
- Jackson Road at Barnum Road

Methodology that has been reviewed and outlined by MassDOT for adjusting historical traffic volumes[2] was used to adjust the April 2015 counts at these intersections to represent the 2021 Existing Conditions, as these volumes reflect more typical traffic patterns than the traffic counts conducted during the pandemic.

For those remaining intersections that were not counted as part of the 2015 Devens Traffic Monitoring Report, the traffic counts conducted by VHB in October 2020 were utilized. While a comparison of the April 2015 volumes and October 2020 volumes showed that overall traffic volumes in the study area have decreased between 2015 and 2020 due to the effects of the COVID-19 pandemic, traffic volumes along Patton Road have actually stayed the same or increased slightly between 2015 and 2020. Therefore, no adjustments were made to the traffic counts at the remaining intersections along Patton Road and Bulge Road that were not counted as part of the 2015 Devens Traffic Monitoring Report to account for the effects of the ongoing pandemic.

Concurrent with the TMCs conducted in October 2020, 48-hour automatic traffic recorder (ATR) counts were conducted along Bulge Road and Patton Road. A summary of the ATR traffic data is presented in Table 1.

Table 1 Existing Traffic Volumes

	Weekday	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
	ADT [a]	Volume [b]	K [c]	Dir. Dist [d]	Volume [b]	K [c]	Dir. Dist [d]
Patton Road, south of Bulge Road	2,800	240	8.5%	76% NB	295	10.6%	70% SB
Bulge Road, north of Country Club Driveway	115	20	15.5%	56% NB	6	5.2%	50% NB

Source: VHB based on automatic traffic recorder counts conducted in October 2020, average of 48-hour counts conducted over two consecutive weekdays.

a daily traffic expressed in vehicles per day, average of 48-hour counts conducted over two consecutive weekdays in October 2020.

b peak period volumes expressed in vehicles per hour.

c percent of daily traffic that occurs during the peak period.

d directional distribution of peak period traffic.

Note: Peak hours do not necessarily coincide with the peak hours of the individual intersection turning movement counts.

As shown in Table 1, Patton Road south of Bulge Road carries approximately 2,800 vehicles per day on a typical weekday, with approximately 8.5 percent of all daily traffic occurring during the weekday morning peak hour and approximately 10.6 percent occurring during the weekday evening peak hour. The directionality of peak hour traffic flow on Bulge Road is heavier in the northbound direction during the weekday morning peak period and heavier in the southbound direction during the weekday evening peak period.

2 Guidance on Traffic Count Data, Revised April 2020; Massachusetts Department of Transportation, Highway Division

Bulge Road north of the Country Club driveway carries approximately 115 vehicles per day on a typical weekday, with approximately 15.5 percent of all daily traffic occurring during the weekday morning peak hour and approximately 5.2 percent occurring during the weekday evening peak hour. It should be noted that Bulge Road north of the Country Club driveway currently only serves a maintenance facility for the country club and dead-ends approximately 1,000 feet past the driveway.

Seasonal Variation

The turning movement counts collected for the study area were obtained during the months of April 2015 and October 2020. To quantify the seasonal variation of traffic volumes in the area, historic traffic data available from MassDOT were reviewed. Specifically, 2018 (the most recent year with a full year of data) monthly traffic volumes were reviewed at a nearby MassDOT permanent counting station along Route 2 in Lancaster. This count station represents the closest permanent count stations to the Site. Based on the review of the data from the count station, traffic volumes on average in October are higher than average-month conditions while traffic volumes on average in April are approximately four percent lower than average month conditions. To present a conservative analysis, no adjustments were applied to the October traffic volumes while the April traffic volumes were adjusted upward by four percent to reflect average-month conditions. The seasonal adjustment factors are included in the Appendix to this report.

The 2021 Existing traffic volume networks for the weekday morning and weekday evening, peak hours are presented in Figures 3 and 4, respectively.

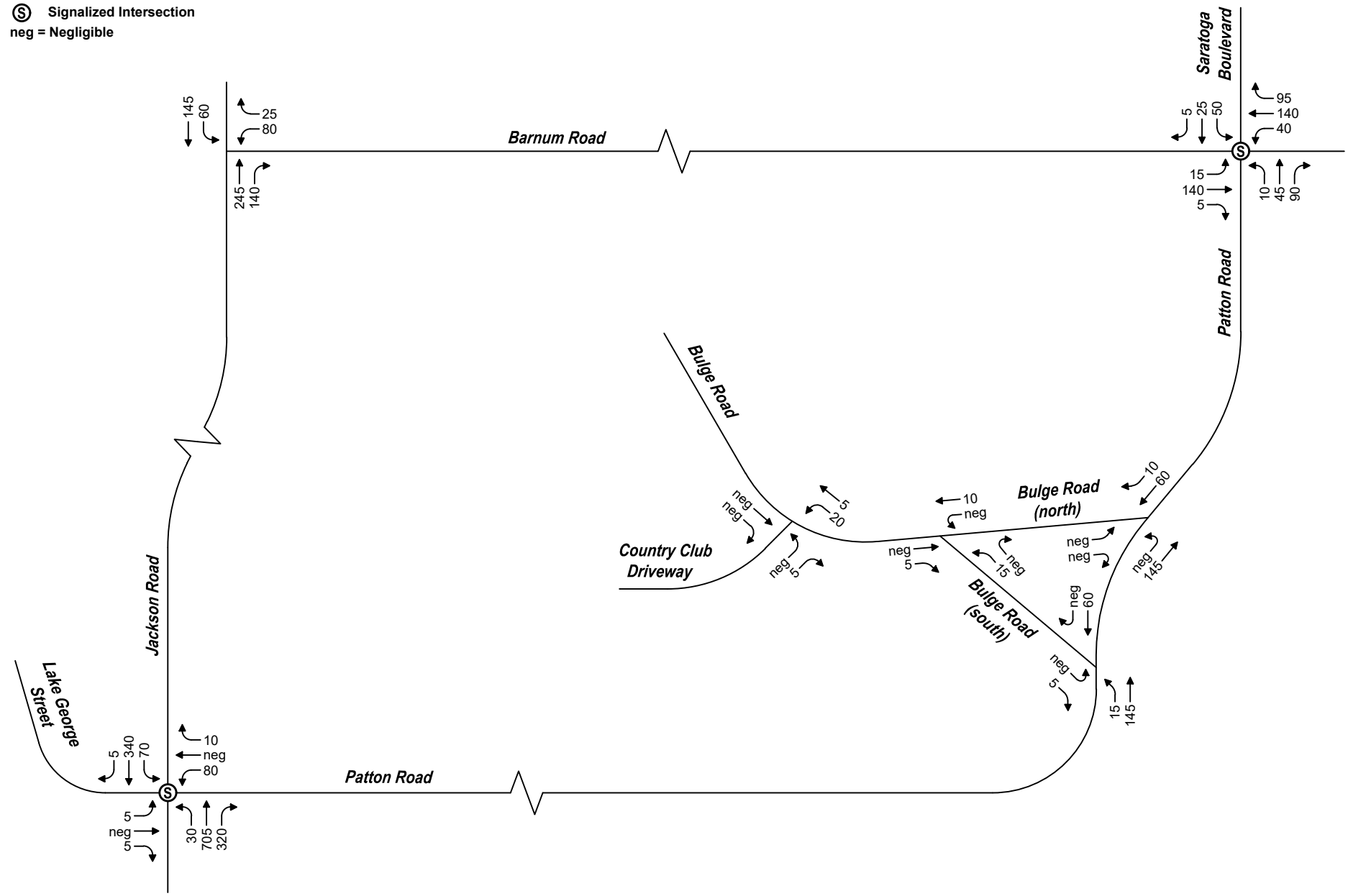

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Figure 3
2021 Existing Conditions
Weekday Morning Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

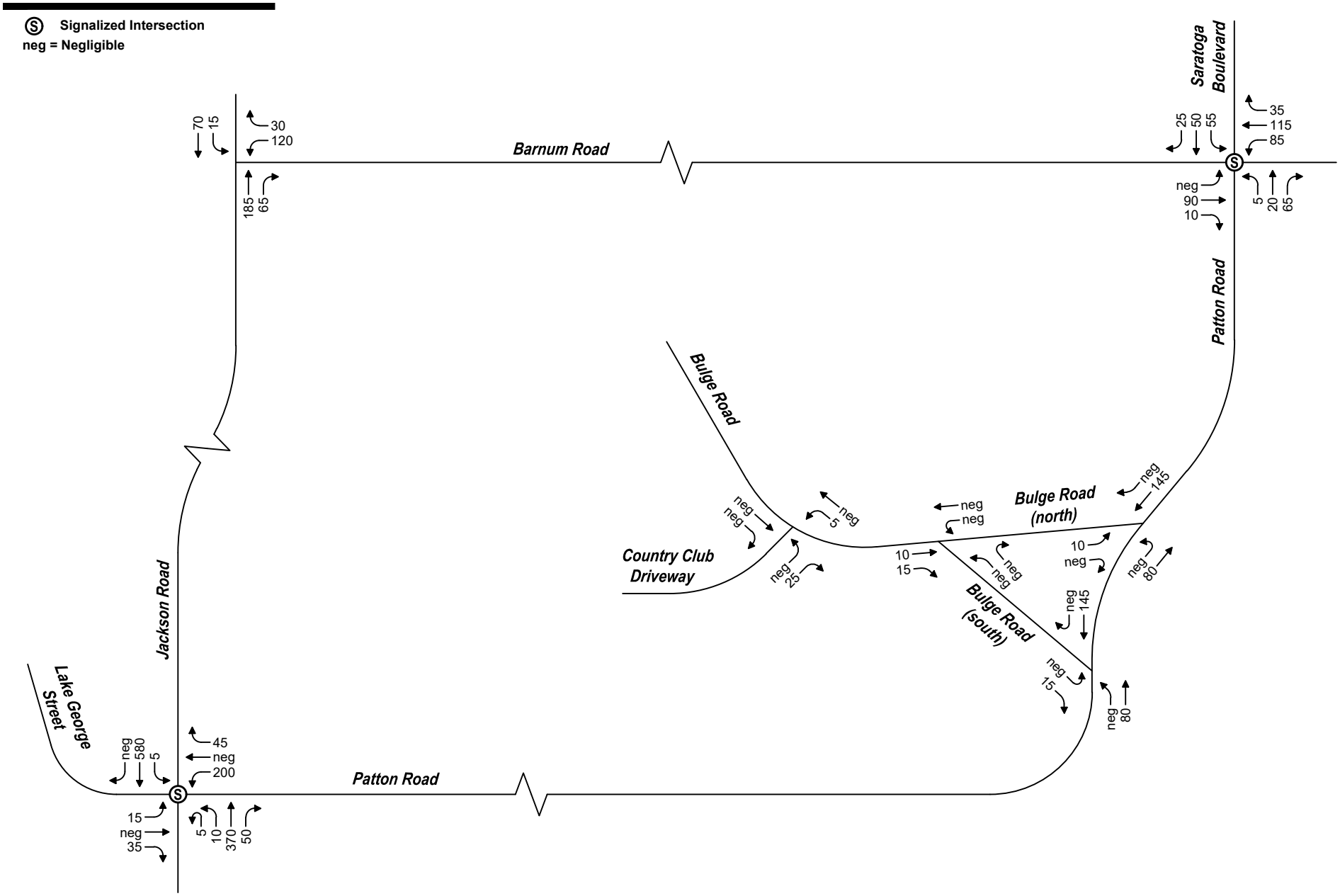

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Figure 4
2021 Existing Conditions
Weekday Evening Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

Pedestrian and Bicycle Accommodations

Sidewalks are provided on at least one side of Jackson Road and Barnum Road throughout the study area, and on the north side of Patton Road between Jackson Road and Queenstown Street. Signalized pedestrian crossings are provided at the intersections of Jackson Road at Patton Road / Lake George Street and Barnum Road at Patton Road / Saratoga Boulevard. The signalized pedestrian crossings have push buttons, pedestrian signal heads, and are ADA compliant with crosswalk ramps and tactile warning strips.

On-road bike lanes are provided in both directions on Jackson Road and Barnum Road through the majority of the study area. The Barnum Road on-road bike lanes are painted in the shoulders of the roadway. On both roadways, the bike lanes are discontinuous through major intersections where turning lanes are provided.

In proximity to the Site along Patton Road and Bulge Road, no dedicated bicycle accommodations are provided. A sidewalk is provided on the southwest side of Bulge Road between the Bulge Road at Bulge Road intersection and the Country Club Driveway, but it is in poor condition and extends for less than 200 feet without connecting to any other pedestrian facilities. In addition, a sidewalk is located on the east side of Bulge Road along the Site frontage, but it also is in poor condition and extends for approximately 500 feet without connecting to any other pedestrian facilities.

Public Transportation

Public transportation within Devens consists of bus service and nearby commuter rail service. Both services are described below in detail.

Bus Service

Bus service in Devens and in northern Worcester County and northwestern Middlesex County is provided by the Montachusett Regional Transit Authority (MART). MART operates a total of 21 bus routes throughout their service area; 12 local bus routes in the cities of Fitchburg, Leominister, and Gardner, seven regional bus routes serving outlying communities, and two out-of-town routes that connect the service area with hospitals in Worcester and Boston.

The community of Devens is served by one MART regional bus route: the Devens Shuttle. This service connects Fitchburg and Leominister with Shirley, Devens, and Ayer, and operates three fixed routes on weekday mornings and two fixed routes on weekday evenings. Service within Devens is a flag-down service where passengers can board or depart the bus at any point along the route. Service on the weekends is an on-demand taxi service that must be reserved ahead of time. The nearest stop to the Site is at the Loaves and Fishes Food Pantry on Barnum Road, approximately one-mile north of the Site, but the service operates on Barnum Road and can be flagged at the intersection of Barnum Road at Patton Road / Saratoga Boulevard, which is approximately ½-mile north of the Site.

It should be noted that the Devens Shuttle is temporarily suspended as of November 2020 due to the ongoing COVID-19 pandemic and is operating as an on-demand taxi service at all times. A PDF of the pre-pandemic bus schedule is included in the Appendix to this report.

Commuter Rail Service

Commuter rail service in eastern Massachusetts is operated by the Massachusetts Bay Transportation Authority (MBTA). The MBTA operates 12 commuter rail routes, with the Fitchburg Line serving the Devens region.

The nearest stations to the Site are Ayer Station, approximately three miles north of the Site, and Shirley Station, approximately four miles west of the Site. The Devens Shuttle provides connections to both stations. Service from Ayer and Shirley is provided to Fitchburg and Wachusett to the west and to Boston's North Station to the east. Service is provided seven days a week, with service every 40-60 minutes during peak periods.

A PDF of the Fitchburg Line schedule is included in the Appendix to this report.

Vehicular Crash History

A detailed crash analysis was conducted to identify potential vehicle accident trends and/or roadway deficiencies in the traffic study area. The most current vehicle accident data for the traffic study area intersections were obtained from MassDOT for the years 2014 to 2018. The MassDOT database is comprised of crash data from the Massachusetts Registry of Motor Vehicles (RMV) Division primarily for use in traffic studies and safety evaluations. Data files are provided for an entire city or town for an entire year, though it is possible that some crash records may be omitted either due to individual crashes not being reported, or the city crash records not being provided in a compatible format for RMV use.

Crash rates are calculated based on the number of accidents at an intersection and the volume of traffic traveling through that intersection on a daily basis. Rates that exceed MassDOT's average for accidents at intersections in the MassDOT district in which the town or city is located could indicate safety or geometric issues for a particular intersection. For our study area, the calculated crash rates for the study area intersections were compared to MassDOT's District 3 (the MassDOT district for Devens) average. The current MassDOT average crash rates for signalized and unsignalized intersections in District 3 are 0.89 crashes per million entering vehicles and 0.61 crashes per million entering vehicles, respectively. In other words, on average, 0.89 crashes occurred per million vehicles entering signalized intersections, and 0.61 crashes occurred per million vehicles entering unsignalized intersections throughout District 3.

A summary of the study area intersections vehicle accident history based on the available RMV data is presented in Table 2 and the detailed crash data is provided in the Appendix to this report.

Table 2 Vehicular Crash Summary (2014 – 2018)

	Jackson Rd at Patton Rd / Lake George St	Barnum Rd at Patton Rd / Saratoga Blvd	Jackson Rd at Barnum Rd	Patton Rd at Bulge Rd (south)	Patton Rd at Bulge Rd (north)	Bulge Rd at Bulge Rd	Bulge Rd at Country Club Dwy
Signalized?	Yes	Yes	No	No	No	No	No
MassDOT Average Crash Rate	0.89	0.89	0.61	0.61	0.61	0.61	0.61
Calculated Crash Rate	0.62	0.63	0.34	0.00	0.00	0.00	0.00
Exceeds Average?	No	No	No	No	No	No	No
Year							
2014	2	0	0	0	0	0	0
2015	3	2	1	0	0	0	0
2016	5	2	0	0	0	0	0
2017	2	2	2	0	0	0	0
2018	3	0	0	0	0	0	0
Total	**15**	**6**	**3**	**0**	**0**	**0**	**0**
Collision Type							
Angle	5	6	2	0	0	0	0
Head-on	0	0	0	0	0	0	0
Rear-end	7	0	0	0	0	0	0
Sideswipe, opposite direction	0	0	0	0	0	0	0
Sideswipe, same direction	1	0	0	0	0	0	0
Single Vehicle Crash	2	0	1	0	0	0	0
Not reported	0	0	0	0	0	0	0
Severity							
Fatal Injury	0	0	0	0	0	0	0
Non-Fatal Injury	1	3	1	0	0	0	0
Property Damage Only	13	3	1	0	0	0	0
Not Reported	1	0	1	0	0	0	0
Time of day							
Weekday, 7:00 AM - 9:00 AM	3	0	0	0	0	0	0
Weekday, 4:00 – 6:00 PM	1	3	0	0	0	0	0
Saturday, 11:00 AM – 2:00 PM	1	0	0	0	0	0	0
Weekday, other time	9	3	2	0	0	0	0
Weekend, other time	1	0	1	0	0	0	0
Pavement Conditions							
Dry	13	5	2	0	0	0	0
Wet	0	0	0	0	0	0	0
Snow	2	1	1	0	0	0	0
Not reported	0	0	0	0	0	0	0
Non-Motorist (Bike, Pedestrian)	0	0	0	0	0	0	0

Source: Crash data was obtained from MassDOT crash portal and accessed in March 2021.

As shown in Table 2, over the five-year period there were reported crashes at three of the study area intersections: Jackson Road at Patton Road/Lake George Street, Barnum Road at Patton Road/Saratoga Boulevard, and Jackson Road at Barnum Road. None of the intersections recorded a calculated crash rate that exceeds the MassDOT average crash rate for District 3. In addition, none of the study area crashes during the five-year period involved pedestrians or bicycles and none of the crashes resulted in a fatality. The majority of crashes that occurred at the study area intersections were angle crashes, or rear-end crashes resulting in property damage only and occurring on dry pavement.

Highway Safety Improvement Program

In addition to calculating the crash rate, study area intersections should also be reviewed in MassDOT's Highway Safety Improvement Program (HSIP) database. An HSIP-eligible cluster is one in which the total number of "equivalent property damage only"[3] crashes in the area is within the top 5-percent of all clusters in that region. Being HSIP-eligible makes the location eligible for FHWA and MassDOT funds to address the identified safety issues at these locations.

As part of this effort, VHB reviewed this database and found that none of the study area intersections are listed as an HSIP-eligible cluster.

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

3

Future Conditions

Traffic volumes in the study area were projected to the year 2028, reflecting a typical seven-year traffic-planning horizon. Independent of the Project, volumes on the roadway network under year 2028 No Build Conditions were assumed to include existing traffic and new traffic resulting from background traffic. Anticipated Site-generated traffic volumes were added to the 2028 No Build Conditions traffic volumes to reflect the 2028 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 and apply that increase to study-area traffic volumes. An alternative procedure is to identify estimated traffic generated by specific planned major developments that would be expected to affect the project study area roadways. For the purpose of this assessment, both methods were utilized.

Historic Traffic Growth

In the 2015 Devens Traffic Monitoring Report, the Montachusett Regional Planning Commission (MRPC) indicated that traffic counts showed a decrease or minimal increase in surrounding communities. The 2015 Devens Traffic Monitoring Report used a 1.77 percent annual growth rate simply to be consistent with previous traffic monitoring reports. For this study, recognizing that there has been limited generic background growth in the region and in order to present a slightly conservative estimate of potential traffic growth, a one percent

per year background traffic growth rate was determined to be appropriate and was utilized to produce a conservative analysis in this assessment.

Site-specific Growth

In addition to accounting for background growth, the traffic associated with other planned and/or approved developments near the Site was considered. Based on communications with staff at MassDevelopment (the organization responsible for development in Devens), the following planned development projects in the vicinity of the Site may influence traffic conditions:

- **Emerson Green:** Emerson Green is a currently under construction residential project along Grant Road in Devens. The project consists of 124 residential units in a mix of single-family homes, townhomes, and apartment units. While the first phase of the project is complete as of October 2020, the project-generated trips for the full development (including Phase 1) have been added to the existing roadway network to account for the fact that some of the 2020 Existing Conditions traffic volumes were developed based on traffic counts from 2015, as discussed in Chapter 2. Trips to be generated by this project were estimated based on data from the Institute of Transportation Engineers (ITE).
- **45/75 Jackson Road:** This first phase of this development consists of a proposed 150,000 sf research and development building to be located on Jackson Road north of Lake George Street and recently received its Level 2 permits. Plans for the second phase of the project were recently submitted, which include 220,000 sf of biomanufacturing space. Trips to be generated by this project were estimated based on data from ITE.
- **Commonwealth Fusion Systems:** This development consists of a proposed 162,000 sf manufacturing building and a proposed 146,835 sf mechanical building primarily housing specialized scientific equipment to be located at 111 Hospital Road and is currently in the planning stages. Trips to be generated by this project were estimated based on data from ITE.
- **Bristol Myers Squibb (BMS):** This proposed development includes a new 240,000 sf building on the BMS campus located at 38 Jackson Road that is currently under construction. Because the majority of the employees of this facility will be working 12-hour shifts starting at either 6:00 AM or 6:00 PM, the peak traffic volumes expected to be generated by this project occur before the peak hour of the adjacent roadways (approximately 5:45 AM to 6:45 AM). A portion of the workforce (approximately 100 employees) will work a more standard shift from 8:00 AM to 5:00 PM. Traffic associated with this shift were estimated using ITE data and distributed based on existing travel patterns.
- **64 Jackson Road**: This development, located at 64 Jackson Road, proposes the re-use and loading dock expansion of the existing 354,500-sf American Superconductor building by Quest Diagnostics for warehousing purposes. Primary access to the site will still be provided via the existing driveway along Jackson Road, with truck traffic accessing the site via a secondary driveway along Givry Street. Traffic volumes expected to be generated by

this project are based on the traffic impact assessment memorandum prepared by MDM Transportation Consultants, Inc. in March 2019[4].

- **4 MacArthur Avenue:** The development, located at 4 MacArthur Avenue, proposes a 55,000-sf building for manufacturing and associated office space. Traffic volumes expected to be generated by this project are based on ITE-based trip generation information provided by the proponent, Mr. Gene Sullivan, in their application to the Devens Enterprise Commission in December 2020. Distribution and assignment of traffic volumes was developed by VHB based on information in this study and ITE data, which is included in the Appendix materials.

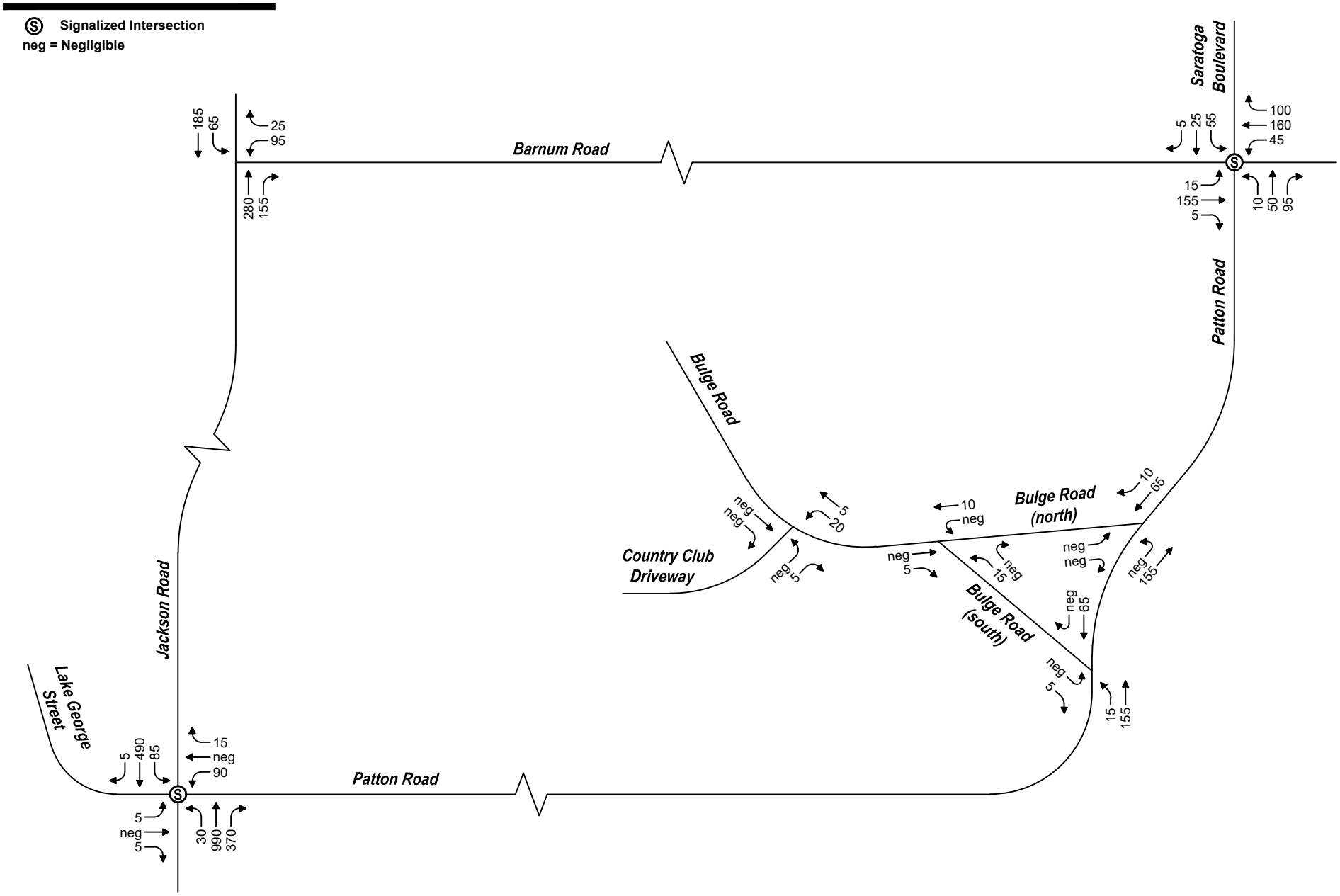
Future Roadway Conditions

In assessing future traffic conditions, proposed roadway improvements within the study area were considered. Based on communications with staff at MassDevelopment, there are no proposed roadway improvements within the immediate study area that are expected to impact traffic conditions within the next seven years.

No Build Traffic Volumes

The 2028 No Build traffic volumes were developed by applying the one percent annual growth rate over the seven-year study horizon to the 2021 Existing traffic volumes and adding the traffic volumes associated with the site-specific background projects. The resulting 2028 No Build Conditions weekday morning and weekday evening peak hour traffic volume networks are presented in Figures 5 and 6, respectively.

[4] *MEMORANDUM, Proposed Warehouse Use/Loading Dock Expansion, 64 Jackson Road, Devens, Massachusetts*. MDM Transportation Consultants Inc. Daniel J Mills & Daniel A Dumais. March 15, 2019.



Not to Scale

Figure 5
2028 No-Build Conditions
Weekday Morning Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

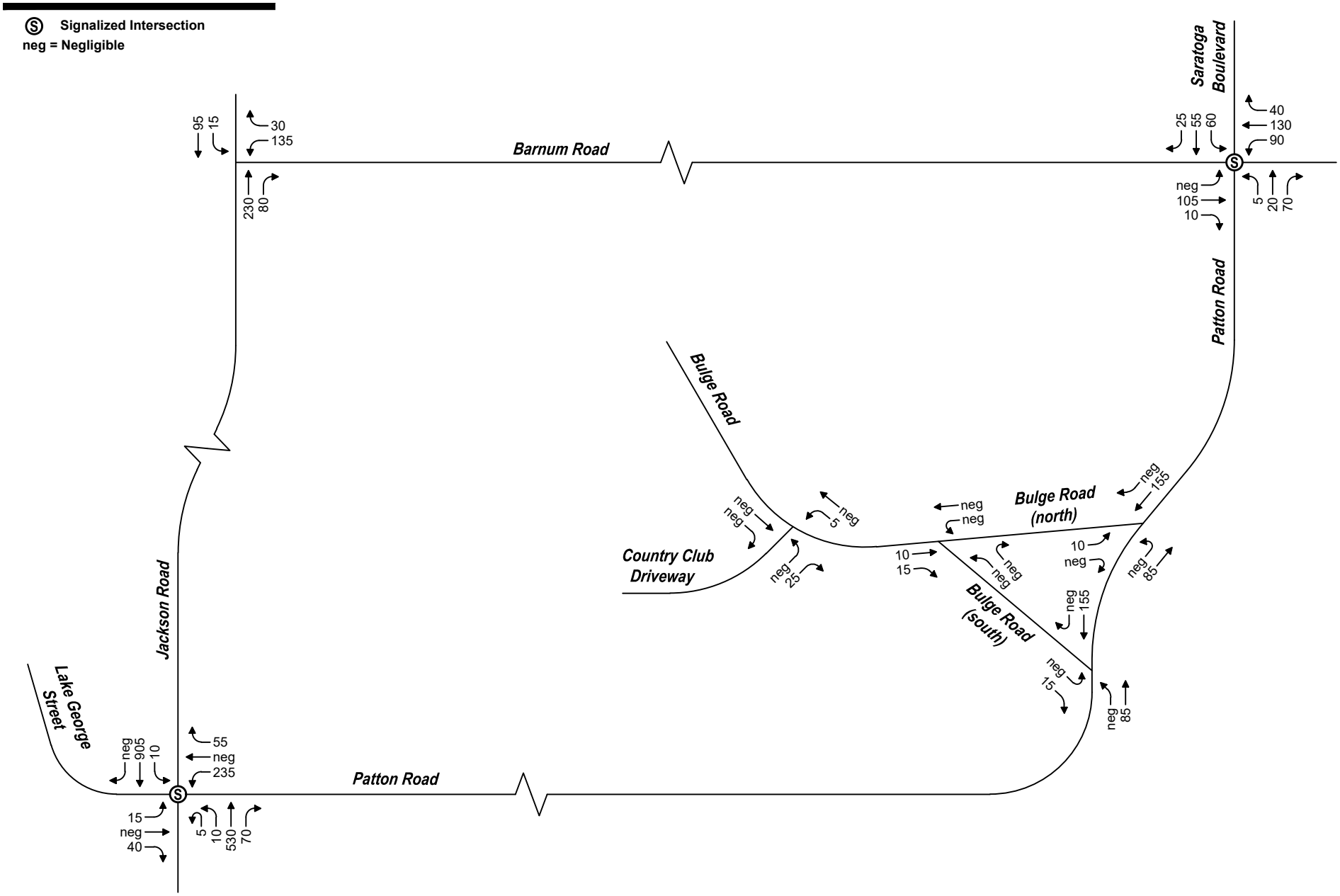


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Figure 6
2028 No-Build Conditions
Weekday Evening Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

Trip Generation

The rate at which any development generates traffic is dependent upon a number of factors such as size, location and concentration of surrounding developments. As previously stated, the proposed development consists of a 150,843 square foot manufacturing building. The number of vehicle-trips to be generated by the proposed Project was estimated based on trip generation rates published by the Institute of Transportation Engineers (ITE)[5]. ITE land use code 140 (manufacturing) was determined to be the most appropriate land use code for this development.

Table 3 summarizes the projected trip generation associated with the proposed Project based on the standardized ITE rates. The trip generation worksheet is included in the Appendix to this report.

Table 3 Trip Generation Summary

Time Period	Movement	Site-Generated Vehicle Trips [a]
Weekday Daily [b]	Enter	296
	Exit	296
	Total	592
Weekday Morning Peak Period [c]	Enter	72
	Exit	22
	Total	94
Weekday Evening Peak Period [c]	Enter	31
	Exit	70
	Total	101

a Based on ITE land use code 140 (manufacturing) for 150,843 sf
b vehicles per day
c vehicles per hour

As shown in Table 3, the Project is expected to generated approximately 592 new vehicle trips (296 entering/296 exiting) on a typical weekday, with 94 new vehicle trips (72 entering/22 exiting) during the weekday morning peak hour and 101 new vehicle trips (31 entering/70 exiting) during the weekday evening peak hour.

Mode Share

A transportation survey was completed by Devens residents and business employees as part of the 2015 Devens Traffic Monitoring Report. As summarized in the survey, nearly all Devens commuters travel to and from work via private vehicle, with approximately 98 percent commuting by vehicle (either by driving alone or in a carpool). Of the remaining two

5 Trip Generation Manual, 10th Edition; Institute of Transportation Engineers (ITE); Washington, D.C.; 2017.

percent of commuters, one percent commute by public transit and one percent commute by walking.

To provide a conservative analysis, no credit was taken for the approximately two percent of commuters who may use alternative mode of transportation beyond private vehicles to travel to and from the proposed Project.

Existing Land Use

As stated previously, the existing Site is currently vacant with the remnants of the former uses and street network are visible from when the Site was part of Fort Devens. However, the former uses have been torn down and no vehicle trips are generated by the existing Site. Therefore, no trip generation credit has been taken for former uses on-Site.

Trip Distribution and Assignment

The directional distribution of the vehicular traffic approaching and departing the Site is a function of population densities, the location of employment, existing travel patterns, and the efficiency of the existing roadway system. Trips made from and to the proposed development during the peak hours are expected to be predominantly home-to-work and work-to-home trips in the morning and evening peak hours, respectively. For this TIAS, the trip distribution for the Devens "gateway locations" identified in the 2015 Devens Traffic Monitoring Report were utilized. The 2010 U.S. Census Journey-to-Work data was also considered in the trip distribution and yielded similar results to the 2015 Devens Traffic Monitoring Report. The specific location of the Site within Devens was also taken into consideration when determining which gateway locations would be utilized.

Table 4 and Figure 7 summarize the vehicular trip distribution pattern.

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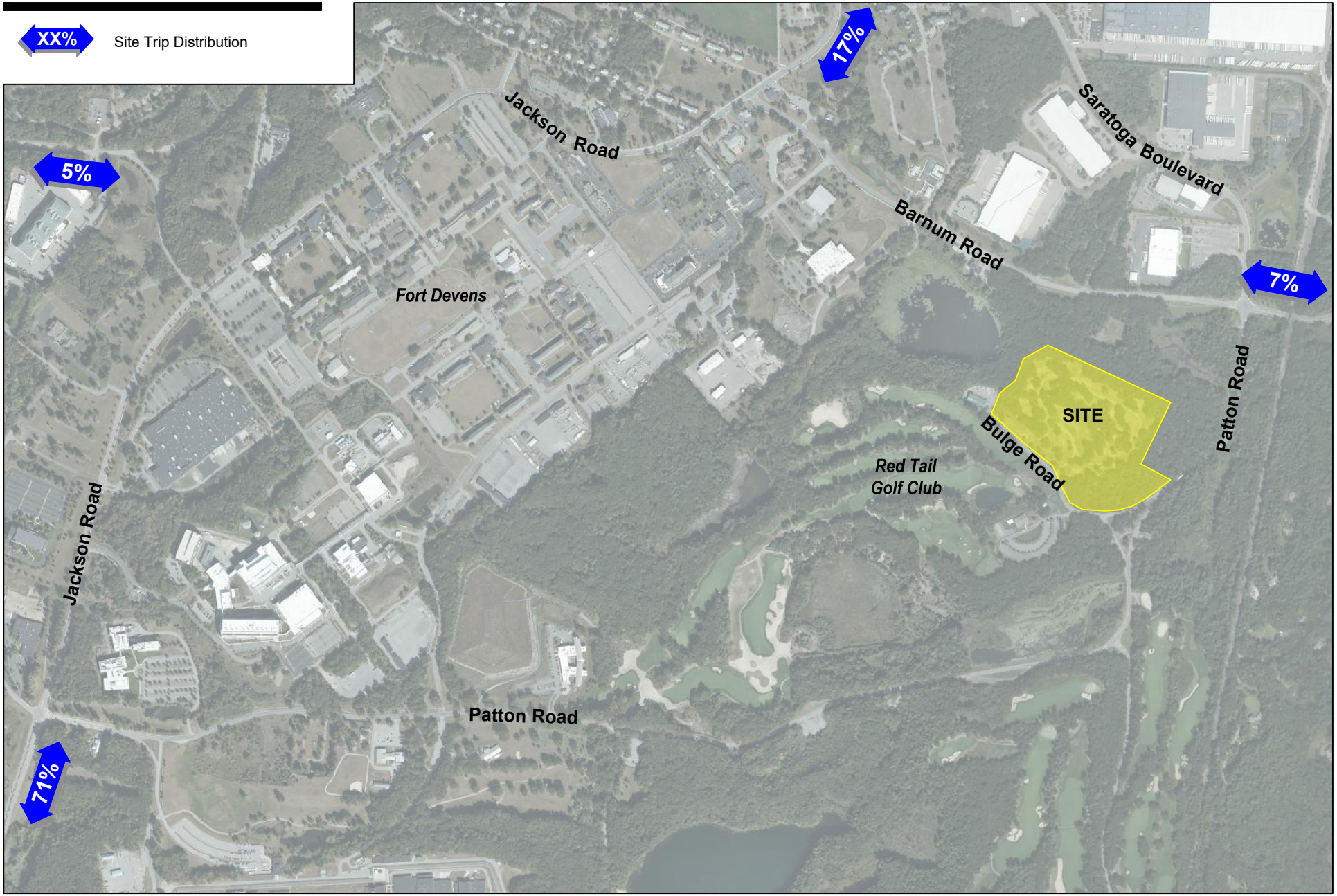

Figure 7
Trip Distribution

16 Bulge Road
Devens, Massachusetts

0 500 1000Feet

Table 4 Trip Distribution

Gateway Location	Direction (To/From)	Percent of New Site-Generated Traffic Assigned to Route
Shirley (Hospital Road)	Northwest	5%
Verbeck (Jackson Road)	North	17%
Barnum (Barnum Road)	East	7%
Jackson (Jackson Road)	West/South/East	71%
		100%

As shown in Table 4, the majority of traffic (71 percent) is projected to use Jackson Road to access Route 2.

The projected Site-generated traffic volumes, as shown in Table 3, were distributed on the study area roadways using the trip distribution shown in Table 4 and added to the 2028 No-Build peak hour traffic volumes to develop the 2028 Build peak hour traffic volumes. The site-generated volume networks for the weekday morning and weekday evening peak hours are provided in Figures 8 and 9, respectively, and the 2028 Build traffic volumes for the weekday morning and weekday evening peak hours are illustrated in Figures 10 and 11, respectively.

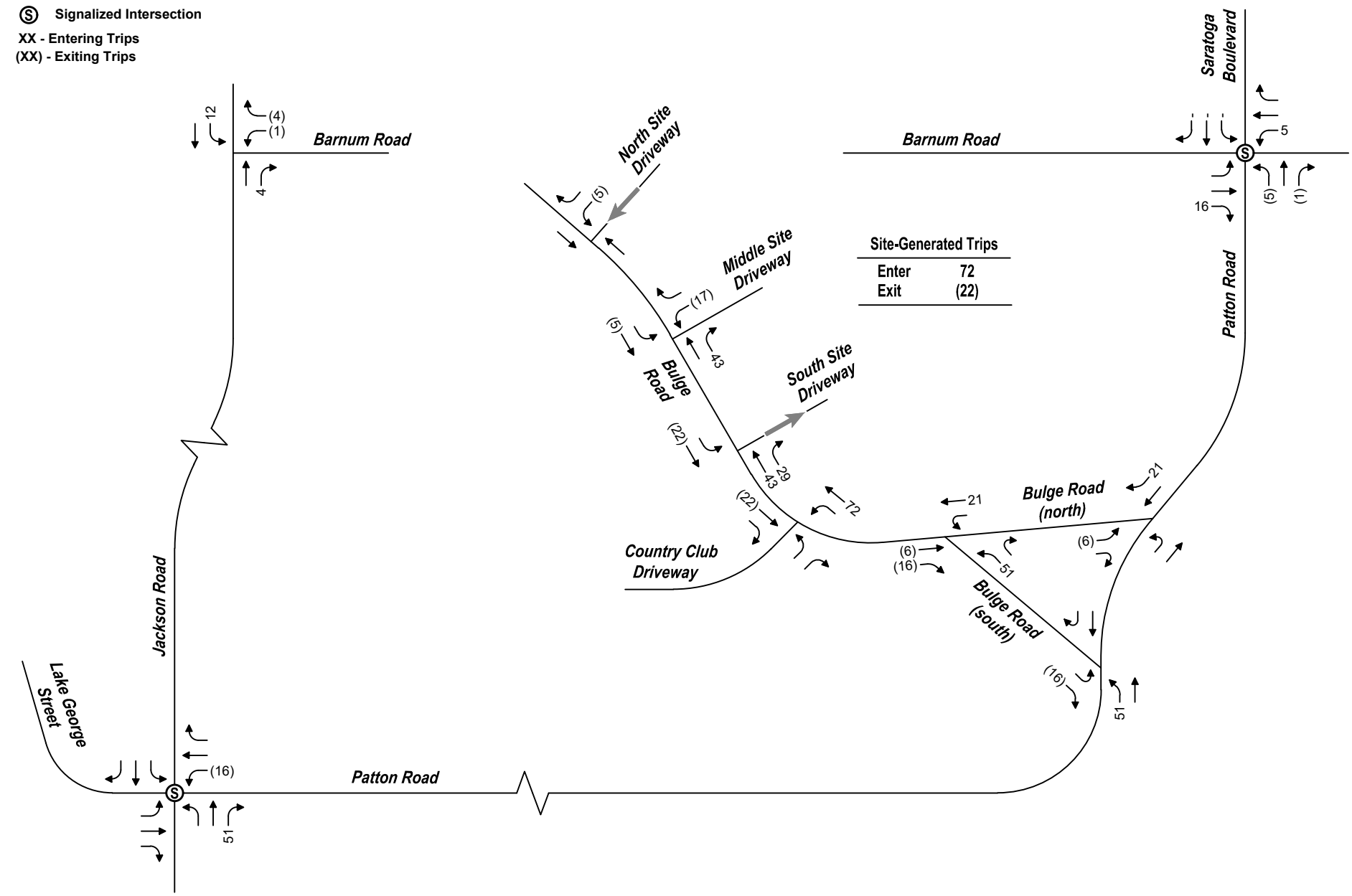

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Figure 8

Site-Generated Traffic Volumes
Weekday Morning Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

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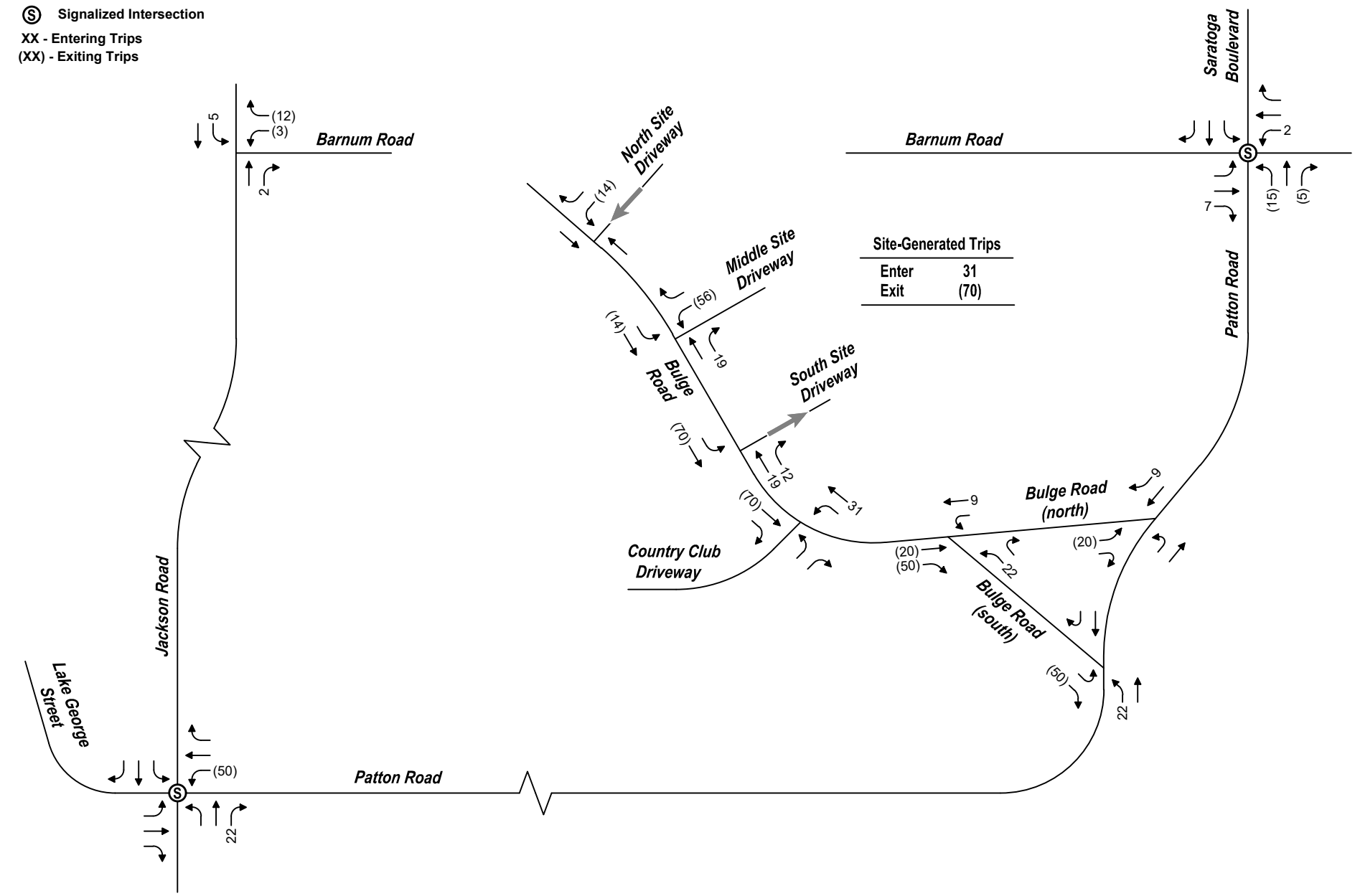

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Figure 9

Site-Generated Traffic Volumes
Weekday Evening Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

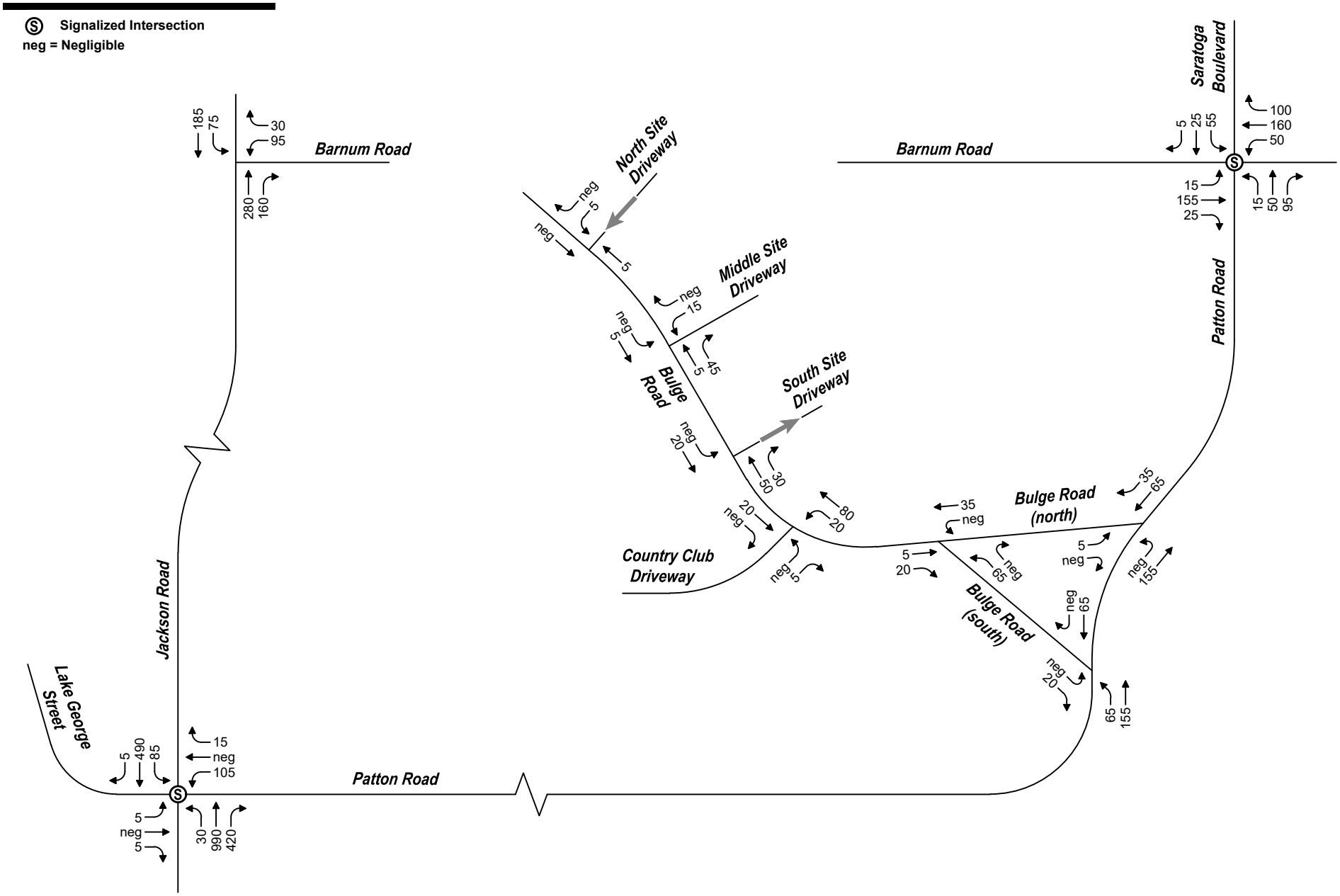

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Figure 10
2028 Build Conditions
Weekday Morning Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

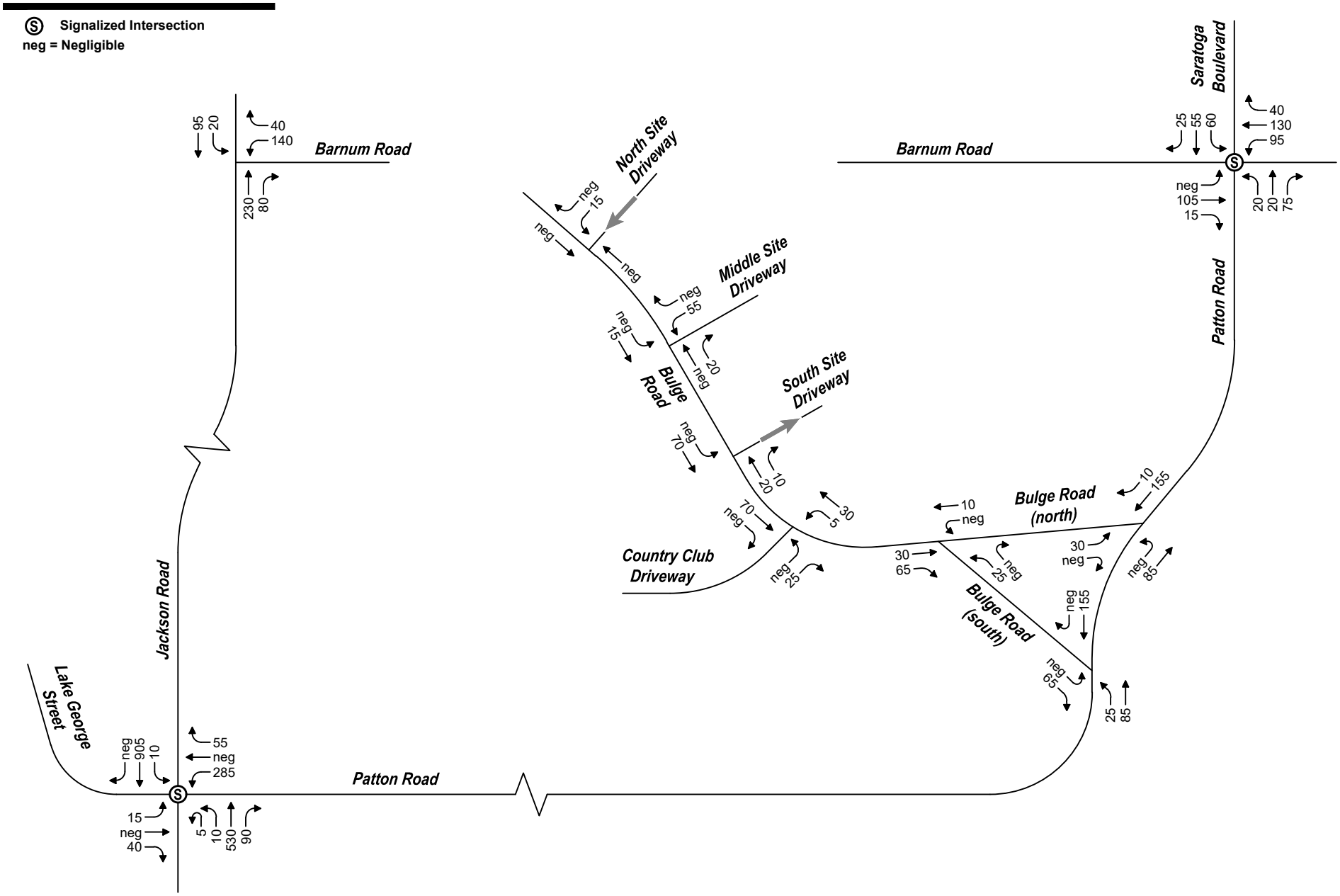

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Figure 11
2028 Build Conditions
Weekday Evening Peak Hour Traffic Volumes
16 Bulge Road
Devens, Massachusetts

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 2021 Existing conditions and the projected 2028 No Build Conditions and Build Conditions traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them.

Level-of-Service and Delay Criteria

The evaluation criteria used to analyze area intersections in this traffic study are based on the Highway Capacity Manual (HCM).[6] The term 'level of service' (LOS) is used to denote the different operating conditions that occur on a given roadway segment under various traffic volume loads. It is a qualitative measure that considers a number of factors including roadway geometry, speed, travel delay, and freedom to maneuver. 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. Level of service is derived *directly* from the delay calculation.

Delay is a complex measure that depends upon a number of variables such as quality of signal progression, cycle length, allocation of green time, and volume-to-capacity (v/c) ratio. Of all the factors cited, v/c ratios have the least effect on delay. Thus, for any given v/c ratio, a range of delay values (and, therefore, levels of service) may result. Conversely, for a given

6 Highway Capacity Manual, 6th Edition, Transportation Research Board, Washington, D.C., 2016.

level of service, the v/c ratio may lie anywhere within a broad range. Comparison of intersection capacity results therefore requires that in addition to the LOS, the other measures of effectiveness must also be considered.

The level-of-service designations, which are based on delay, are reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection and the LOS designation is for overall conditions at the intersection. For unsignalized intersections, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. Thus, the LOS designation is for the critical movement exiting the side street and is typically the left turn out of the side street or site driveway.

Level-of-Service Analysis

Levels-of-service analyses were conducted for the 2021 Existing, 2028 No Build, and 2028 Build conditions for the signalized and unsignalized study-area intersections.

Signalized Intersection Capacity Analyses

Table 5 presents a summary of the capacity analyses for the signalized intersections in the study area. The capacity analyses worksheets are included in the Appendix to this report.

Table 5 Signalized Intersection Capacity Analysis

Location / Movement	2021 Existing Conditions					2028 No-Build Conditions [f]					2028 Build Conditions				
	v/c [a]	Del [b]	LOS [c]	50 Q [d]	95 Q [e]	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Jackson Road at Patton Road / Lake George Street															
Weekday Morning															
EB L/T/R	0.06	15	B	3	11	0.05	15	B	2	13	0.04	15	B	2	12
WB L	0.40	25	C	32	59	0.49	30	C	35	65	0.53	31	C	39	73
WB T/R	0.02	0	A	0	0	0.05	0	A	0	0	0.04	0	A	0	0
NB L/T	0.57	10	A	157	#365	0.87	23	C	322	#673	0.89	25	C	335	#695
NB R	0.28	2	A	0	29	0.34	2	A	0	32	0.39	2	A	0	35
SB L/T/R	0.42	7	A	76	168	>1.20	>120	F	~330	#372	>1.20	>120	F	~342	#408
Overall		**8**	**A**				**54**	**D**				**68**	**E**		
Weekday Evening															
EB L/T/R	0.21	9	A	7	16	0.15	9	A	5	29	0.14	9	A	5	29
WB L	0.74	34	C	65	#151	0.82	44	D	84	#186	0.93	59	E	108	#240
WB T/R	0.12	7	A	0	19	0.14	7	A	1	24	0.13	7	A	1	24
NB L/T	0.49	11	B	91	138	0.57	12	B	132	219	0.60	13	B	134	225
NB R	0.08	3	A	0	12	0.09	2	A	0	15	0.11	2	A	0	17
SB L/T/R	0.71	16	B	157	251	0.95	34	C	327	#591	0.98	40	D	327	#591
Overall		**16**	**B**				**26**	**C**				**32**	**C**		
Barnum Road at Patton Road / Saratoga Boulevard															
Weekday Morning															
EB L	0.04	14	B	2	19	0.04	13	B	2	19	0.04	14	B	2	19
EB T/R	0.20	13	B	21	101	0.20	13	B	20	108	0.23	13	B	22	118
WB L	0.10	14	B	5	39	0.10	14	B	6	41	0.12	14	B	6	45
WB T/R	0.34	12	B	27	147	0.36	13	B	30	161	0.36	13	B	30	161
NB L/T/R	0.41	11	B	8	71	0.43	12	B	9	77	0.45	13	B	11	85
SB L/T	0.45	23	C	14	68	0.40	23	C	12	76	0.39	22	C	12	75
SB R	0.02	0	A	0	0	0.01	0	A	0	0	0.01	0	A	0	0
Overall		**14**	**B**				**14**	**B**				**14**	**B**		
Weekday Evening															
EB L	0.00	15	B	0	3	0.00	14	B	0	4	0.00	14	B	0	4
EB T/R	0.23	15	B	17	69	0.15	13	B	14	79	0.16	13	B	14	81
WB L	0.25	17	B	13	72	0.19	15	B	11	72	0.20	15	B	12	75
WB T/R	0.30	14	B	19	102	0.24	13	B	19	108	0.24	13	B	19	108
NB L/T/R	0.26	8	A	4	37	0.26	9	A	3	43	0.33	10	A	6	53
SB L/T	0.58	23	C	27	71	0.43	20	C	17	89	0.44	20	C	17	89
SB R	0.10	1	A	0	0	0.07	0	A	0	0	0.07	0	A	0	0
Overall		**15**	**B**				**13**	**B**				**13**	**B**		

a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, in feet.
f Any improvements between Existing and No Build Conditions are due to future analyses using a peak hour factor of 0.92, as outlined in MassDOT TIA guidelines.
~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.

As shown in Table 5, the intersection of Jackson Road at Patton Road / Lake George Street is expected to operate at overall LOS B or better under the 2021 Existing Conditions. Under the 2028 No Build Conditions, this intersection is expected to degrade to overall LOS D during the weekday morning peak hour and LOS C during the weekday evening peak hour due to traffic growth along Jackson Road. Specifically, the southbound approach on Jackson Road during the weekday morning peak hour is expected to degrade to LOS F with delays greater than 120 seconds. With the additional Site-generated traffic under the 2028 Build Conditions, the intersection is expected to degrade from overall LOS D to overall LOS E during the weekday morning peak hour and maintain overall LOS C during the weekday evening peak hour. A discussion of recommended signal timing adjustments at this intersection to improve operations under the 2028 Build Conditions is provided in the following chapter.

The intersection of Barnum Road at Patton Road / Saratoga Boulevard is expected to operate at overall LOS B under the 2021 Existing, 2028 No Build, and 2028 Build Conditions for both peak hours. The additional Site-generated traffic is expected to have a negligible impact at this intersection.

Unsignalized Intersection Capacity Analyses

Table 6 presents a summary of the capacity analyses for the unsignalized intersections in the study area. The capacity analyses worksheets are included in the Appendix to this report.

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.

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 6 Unsignalized Intersection Capacity Analysis

Location / Movement	2021 Existing Conditions					2028 No-Build Conditions [f]					2028 Build Conditions				
	D [a]	v/c [b]	Del [c]	LOS [d]	95 Q [e]	D	v/c	Del	LOS	95 Q	D	v/c	Del	LOS	95 Q
Jackson Road at Barnum Road															
Weekday Morning															
WB L	80	0.26	18	C	25	95	0.26	17	C	25	95	0.27	18	C	28
WB R	25	0.04	10	B	3	25	0.04	10	B	3	30	0.05	10	B	3
SB L	60	0.08	9	A	8	65	0.07	9	A	5	75	0.08	9	A	5
Weekday Evening															
WB L	120	0.20	12	B	18	135	0.24	13	B	23	140	0.26	13	B	25
WB R	30	0.04	10	A	3	30	0.04	10	A	3	40	0.06	10	A	5
SB L	15	0.01	8	A	0	15	0.01	8	A	0	20	0.02	8	A	3
Patton Road at Bulge Road (south)															
Weekday Morning															
EB L/R	5	0.01	9	A	0	5	0.01	9	A	0	20	0.02	9	A	3
NB L	15	0.01	7	A	0	15	0.01	7	A	0	65	0.05	7	A	3
Weekday Evening															
EB L/R	15	0.03	9	A	3	15	0.02	9	A	3	65	0.08	9	A	8
NB L	2	0.00	8	A	0	2	0.00	8	A	0	25	0.02	8	A	3
Patton Road at Bulge Road (north)															
Weekday Morning															
EB L/R	neg	n/a	n/a	A	n/a	neg	n/a	n/a	A	n/a	5	0.01	10	B	0
NB L	1	0.00	7	A	0	1	0.00	7	A	0	1	0.00	7	A	0
Weekday Evening															
EB L/R	10	0.04	11	B	3	10	0.02	10	B	0	30	0.05	10	B	3
NB L	neg	n/a	n/a	A	n/a	neg	n/a	n/a	A	n/a	neg	n/a	n/a	A	n/a
Bulge Road at Bulge Road															
Weekday Morning															
WB L	1	0.00	7	A	0	1	0.00	7	A	0	1	0.00	7	A	0
NB L/R [g]	15	0.02	9	A	3	15	0.02	9	A	0	65	0.07	9	A	5
Weekday Evening															
WB L	neg	n/a	n/a	A	n/a	neg	n/a	n/a	A	n/a	neg	n/a	n/a	A	n/a
NB L/R [g]	2	0.00	9	A	0	2	0.00	9	A	0	25	0.03	9	A	3
Bulge Road at Country Club Driveway															
Weekday Morning															
EB L/R	5	0.02	8	A	3	5	0.01	8	A	0	5	0.01	8	A	0
NB L	20	0.02	7	A	0	20	0.01	7	A	0	20	0.01	7	A	0
Weekday Evening															
EB L/R	25	0.04	9	A	3	25	0.03	8	A	3	25	0.03	9	A	3
NB L	5	0.01	7	A	0	5	0.00	7	A	0	5	0.00	7	A	0

a Demand
b Volume to capacity ratio.
c Average total delay, in seconds per vehicle.
d Level-of-service.
e 95th percentile queue, in feet.
f Any improvements between Existing and No Build Conditions are due to future analyses using a peak hour factor of 0.92, as outlined in MassDOT TIA guidelines.
g Approach analyzed under STOP control instead of YIELD control to present a conservative analysis.

Table 6 Unsignalized Intersection Capacity Analysis (continued)

Location / Movement	2021 Existing Conditions D [a]	v/c [b]	Del [c]	LOS [d]	95 Q [e]	2028 No-Build Conditions D	v/c	Del	LOS	95 Q	2028 Build Conditions D	v/c	Del	LOS	95 Q
Bulge Road at South Site Driveway															
Weekday Morning	*Intersection Does Not Exist Under 2021 Existing Conditions*					*Intersection Does Not Exist Under 2028 No Build Conditions*									
SB L											neg	n/a	n/a	A	n/a
Weekday Evening															
SB L											neg	n/a	n/a	A	n/a
Bulge Road at Middle Site Driveway															
Weekday Morning	*Intersection Does Not Exist Under 2021 Existing Conditions*					*Intersection Does Not Exist Under 2028 No Build Conditions*									
WB L/R											15	0.02	9	A	3
SB L											Neg	n/a	n/a	A	n/a
Weekday Evening															
WB L/R											55	0.06	9	A	5
SB L											neg	n/a	n/a	A	n/a
Bulge Road at North Site Driveway															
Weekday Morning	*Intersection Does Not Exist Under 2021 Existing Conditions*					*Intersection Does Not Exist Under 2028 No Build Conditions*									
WB L/R											5	0.01	9	A	0
Weekday Evening															
WB L/R											15	0.02	9	A	0

a Demand
b Volume to capacity ratio.
c Average total delay, in seconds per vehicle.
d Level-of-service.
e 95th percentile queue, in feet.

As shown in Table 6, all of the approaches at the unsignalized study area intersections during the peak hours currently operate at LOS B or better under the 2021 Existing Conditions, and all of the unsignalized approaches are expected to continue to operate at LOS B or better under the 2028 No Build and 2028 Build Conditions. The only exception to this is the Barnum Road westbound left-turn movement at Jackson Road, which operates at LOS C during the weekday morning peak hour under all existing and future conditions.

A comparison of the operations under the 2028 No Build Conditions and the 2028 Build Conditions shows that the proposed Project is expected to result in negligible impacts to the unsignalized intersections in the study area. The proposed Site driveway approaches are all expected to operate at LOS A with queues of less than one vehicle length.

Sight Distance Evaluation

VHB conducted a sight distance analysis, conforming to guidelines of the American Association of State Highway and Transportation Officials (AASHTO)[8], at the proposed driveway locations on Bulge Road. Sight distance is generally divided into two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD).

Stopping Sight Distance (SSD) is the distance required for a vehicle approaching an intersection from either direction to perceive, react and come to a complete stop before colliding with an object in the road, in this case the exiting vehicle from a driveway. In this respect, SSD can be considered as the minimum visibility criterion for the safe operation of an unsignalized intersection.

Intersection Sight Distance (ISD) is based on the time required for perception, reaction and completion of the desired critical exiting maneuver once the driver on a minor street or driveway approach decided to execute the maneuver. Calculation for the critical ISD includes the time to (1) turn left, and to clear the half of the intersection without conflicting with the vehicles approaching from the left; and (2) accelerate to the operating speed of the roadway without causing approaching vehicles to unduly reduce their speed. In this context, ISD can be considered as a desirable visibility criterion for the safe operation of an unsignalized intersection. Essentially, while SSD is the minimum distance needed to avoid collisions, ISD is the minimum distance needed so that mainline motorists will not have to substantially reduce their speed due to turning vehicles. To maintain the safe operation of an unsignalized intersection, ISD only needs to be equal to the stopping sight distance, though it is desirable to meet ISD requirements by themselves.

To calculate the required SSD and ISD at the Site driveways along Bulge Road, the 85th percentile speed along Bulge Road measured by the ATR count described previously was utilized. The 85th percentile speed along Bulge Road was observed to be approximately 26 mph northbound and 23 mph southbound.

Table 7 summarizes the sight distance analyses for each proposed Site driveway. It should be noted that the proposed southern Site driveway will be one-way away from Bulge Road and therefore no vehicles will be exiting the driveway. All sight distance worksheets are included in the Appendix to this report.

8 A Policy on the Geometric Design of Highways and Streets, 7th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2018.

Table 7 Sight Distance Summary

	Stopping Sight Distance (ft)			Intersection Sight Distance (ft)		
Location	**Traveling**	**Required**	**Measured**	**Looking**	**Desired [a]**	**Measured**
Bulge Road at Southern Site Driveway	Northbound [b]	155	200	Left	N/A	N/A
	Southbound	150	350	Right	N/A	N/A
Bulge Road at Middle Site Driveway	Northbound	160	380	Left	290	520
	Southbound	140	400 [c]	Right	290	400 [c]
Bulge Road at Northern Site Driveway	Northbound	160	450	Left	440	480
	Southbound	140	100 [c]	Right	440	100 [c]

Note: Based on guidelines established in A Policy on the Geometric Design of Highways and Streets, 7th Edition, AASHTO, 2018 for an 85th percentile speed of 26 mph northbound and 23 mph southbound.

a Desired intersection sight distance based on the north and south driveway predominately serving heavy vehicles and the middle driveway predominately serving passenger vehicles.

b N/A - Driveway is entrance only from Bulge Road

c Sight distance available to the end of Bulge Road at the Country Club maintenance facility.

As shown in Table 7, at the southern Site driveway, the available SSD on Bulge Road exceeds the AASHTO requirements. Since this driveway is entrance only (one-way away from Bulge Road) ISD is not applicable.

At the middle Site driveway, the available SSD on Bulge Road and the ISD looking left and right from the driveway meet or exceed the AASTHTO requirements. Since this driveway serves the parking lot, the desired intersection sight distances were calculated based on the driveway predominately serving passenger vehicles.

At the northern Site driveway, the available SSD on Bulge Road northbound and the ISD looking left from the driveway meet or exceed the AASHTO requirements. The available SSD on Bulge Road southbound and the ISD looking right from the driveway are available until the end of Bulge Road, which is approximately 100 feet north of the northern Site driveway. Since this driveway only serves the loading dock, the desired intersection sight distances were calculated based on the driveway predominately serving heavy vehicles.

5

Mitigation

The preceding analysis of the 2021 Existing Conditions and projected future traffic demands in the 2028 No-Build and Build Conditions indicate that traffic volumes during the peak hour periods will have minimal impact to traffic operations at the study area intersections. As such, no off-Site geometric improvements are proposed as part of this Project. However, to offset minor impacts at the intersection of Jackson Road at Patton Road / Lake George Street, the Proponent is recommending signal timing adjustments that would improve traffic operations at the intersection.

In order to further reduce and minimize the impact of the Project on the local roadway network, the Proponent is also committed to the following measures listed below:

- Design the site driveways in a manner that allows for the safe and efficient movement of motor vehicles into and out of the Site off of Bulge Road.
- Implement a series of Transportation Demand Management strategies that will reduce single occupant vehicles arriving and departing from the Site and encourage use of area transit and pedestrian/bicycle resources in the area.
- Conduct a post-occupancy monitoring of traffic conditions to identify differences between the forecasted traffic generation of the development and any critical off-Site locations.

The proposed measures are identified below in greater detail.

Site Access

The Site is located at 16 Bulge Road and is surrounded by undeveloped land and the Red Tail Golf Course. The Site is currently undeveloped, and the remnants of the former uses and street network are visible from when the Site was part of Fort Devens. The Site is accessed from Bulge Road, which in turn connects to Patton Road southeast of the Site.

Proposed Site Access

Under proposed conditions, access to the Site will be via three curb-cuts on Bulge Road north of the driveway for the Red Tail Golf Club. The southern driveway will be one-way into the Site and will provide entering access to both the parking lot in front of the building and the loading/receiving docks behind the building. The middle driveway will be full access into and out of the Site and will provide direct access to the parking lot for employees and visitors. The northern driveway will be one-way out of the Site and will provide egress from the loading/receiving docks located behind the building.

Internal to the Site, the parking lot will be located between the proposed building and Bulge Road and will contain approximately 299 parking spaces for employees and visitors. An access roadway will wrap around the property to serve the loading/receiving docks located behind the building and will connect to Bulge Road from the southern and northern driveways. The access driveway will be one-way counterclockwise around the Site with vehicles entering from the southern driveway to access the loading/receiving docks and then exiting via the northern driveway. An access point will be provided between the access driveway and the parking lot allowing vehicles to enter the parking lot from the southern driveway.

A sidewalk will be constructed along the Site frontage on Bulge Road between the southern and middle driveways to facilitate pedestrians accessing the Site. Internal to the Site, a walkway will be provided through the parking lot connecting the sidewalk along Bulge Road with the front doors of the proposed building. In addition, a stone dust recreational path for employee use will circle the back half of the Site with crosswalks provided across the loading dock access road.

Loading

All loading and receiving for the proposed building will take place at the loading/receiving docks located in the rear of the building. The loading/receiving docks will be accessed from the one-way southern driveway entering the Site and the one-way northern driveway exiting the Site. The loading/receiving docks will be located on the opposite side of the building from the parking lot and the front doors for the building, which will minimize the interactions between loading/receiving operations and passenger vehicles, pedestrians, and bicyclists.

Five loading doors will be provided at the loading/receiving dock and a concrete loading dock pad approximately 75 feet in width will be provided. Sufficient turning room will be

provided for trucks maneuvering into and out of the loading/receiving docks. The dumpsters for the Site will also be located in the rear of the building near the loading/receiving docks.

Off-Site Mitigation

While the Project will have minimal impacts at the study area intersections, the signalized intersection of Jackson Road at Patton Road / Lake George Street is expected to experience a drop in overall level of service from LOS D to LOS E during the weekday morning peak hour with the Project in place. Therefore, the Proponent is recommending signal timing adjustments to improve operations.

Based on analysis of potential timing changes, VHB determined that increasing the cycle length from 60 seconds to 80 seconds during the weekday morning and weekday evening peak hours would improve overall operations at the intersection during both peak hours. Table 8 presents a summary of the capacity analyses for the intersection with the modified signal timings and the capacity analyses worksheets are included in the Appendix to this report.

Table 8 Signalized Intersection Capacity Analysis with Proposed Improvements

Location / Movement	2028 No-Build Conditions					2028 Build Conditions					2028 Build Conditions with Proposed Improvements				
	v/c [a]	Del [b]	LOS [c]	50 Q [d]	95 Q [e]	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Jackson Road at Patton Road / Lake George Street															
Weekday Morning															
EB L/T/R	0.05	15	B	2	13	0.04	15	B	2	12	0.05	21	C	3	16
WB L	0.49	30	C	35	65	0.53	31	C	39	73	0.61	44	D	55	99
WB T/R	0.05	0	A	0	0	0.04	0	A	0	0	0.05	0	A	0	0
NB L/T	0.87	23	C	322	#673	0.89	25	C	335	#695	0.82	18	B	374	#799
NB R	0.34	2	A	0	32	0.39	2	A	0	35	0.37	2	A	0	31
SB L/T/R	>1.20	>120	F	~330	#372	>1.20	>120	F	~342	#408	0.96	44	D	~321	#576
Overall		**54**	**D**				**68**	**E**				**23**	**C**		
Weekday Evening															
EB L/T/R	0.15	9	A	5	29	0.14	9	A	5	29	0.13	11	B	6	33
WB L	0.82	44	D	84	#186	0.93	59	E	108	#240	0.87	53	D	144	#283
WB T/R	0.14	7	A	1	24	0.13	7	A	1	24	0.13	7	A	1	28
NB L/T	0.57	12	B	132	219	0.60	13	B	134	225	0.57	14	B	177	272
NB R	0.09	2	A	0	15	0.11	2	A	0	17	0.11	2	A	0	19
SB L/T/R	0.95	34	C	327	#591	0.98	40	D	327	#591	0.94	34	C	429	#722
Overall		**26**	**C**				**32**	**C**				**28**	**C**		

a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, in feet.
~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.

As shown in Table 8, the proposed signal timing modifications would improve the overall LOS during the weekday morning peak hour from LOS E to LOS C and would specifically improve the Jackson Road southbound approach from LOS F to LOS D. During the weekday evening peak hour, the Patton Road westbound left-turn movement and the Jackson Road

southbound approach would both return to the LOS experienced under the 2028 No Build Conditions. The Proponent will coordinate with MassDevelopment on the implementation of these modifications.

Transportation Demand Management

The goal of a 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. 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 non-single person vehicle modes of motorized 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. 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 include all the incentives and disincentives that increase the likelihood for people to change their existing travel behavior.

TDM Program

Section 3.02(2)(o) of the Devens Enterprise Commission Rules and Regulations requires all applicants to agree to participate in the Devens Transportation Management Initiative (TMI). Accordingly, the Proponent is proposing to implement a TDM program on the Site that is consistent with the Devens TMI. In order to promote the TDM program on the Site, the Proponent will encourage its tenants to implement a number of measures that will contribute toward the reduction of vehicular traffic to and from the site. These measures include:

- Designate an employee to be the on-site TDM coordinator
- Implement a Guaranteed Ride Home Program (in case of emergencies for those who use alternative transportation or participate in ridesharing)
- Participate in the Employee Relocation Commuter Assistance Program (educating employees on transportation options)

- Provide Ridesharing/Ridematching Services (to promote carpooling and reduce single-occupancy vehicle trips)
- Offer flexible work hours/compressed work weeks (to reduce AM and PM peak traffic)
- Devens Shuttle Bus Circulator (providing access to Devens services and local commuting options)
- Designate parking spaces as preferred parking for any ridesharing services (car/van vanpools)
- Designate parking spaces as preferred parking for any hybrid or zero/low-emission vehicles
- Provide bicycle racks and shower/changing facilities
- Provide Hybrid/Electrical vehicle plug-in/recharge stations

The accompanying site plans for this Project outline where the designated preferential parking and hybrid/zero/low-emission vehicle parking will be located proximate to the proposed building. The Proponent is committed to achieving a significant and measurable impact on reducing typical peak hour traffic generation for the development, with the goal of achieving a 15 percent reduction as the Devens TMI suggests.

Transportation Monitoring Program

Traffic Monitoring Program

The Proponent is committed to complete an annual traffic monitoring program (TMP) to occur six months after full occupancy of the Project. The data collected as part of the TMP will be distributed to the Devens Enterprise Commission (DEC) staff and MassDevelopment within two months of completing the monitoring effort. The TMP will include ATR counts for a 24-hour period on a typical weekday along all driveways serving the Site.

In addition, TMCs will be conducted on a typical weekday from 7:00 AM to 9:00 AM and 3:30 PM to 6:00 PM at the following locations:

- Patton Road at Bulge Road (south)
- Patton Road at Bulge Road (north)
- Bulge Road at Site Driveways (3)

The primary purpose of the TMP will be to validate the assumptions in this traffic study for the Project (traffic generation and distribution). Because the intersections listed above are not typically included in the Devens Traffic Monitoring Program, which is conducted every five years, these monitoring counts will serve as a supplemental evaluation to identify any significant differences with the future traffic projections.

TDM Monitoring Program

In addition to the traffic monitoring program, the Proponent is also committed to monitor the participation in, and effectiveness of, the proposed TDM program on Site. The Proponent

will work with an appointed on-site TDM coordinator to provide a summary of the participation rate and the estimated reduction in Site-generated traffic associated with the TDM measures in place. These findings will be reported to DEC Staff six months after occupancy of the Project.

6

Conclusion

This traffic study presented a detailed traffic assessment to evaluate the traffic impacts associated with the proposed development at 16 Bulge Road in Devens, Massachusetts. The existing Site is currently vacant with the remnants of the former uses and street network visible from when the Site was part of Fort Devens. Under proposed conditions, the Site will be occupied by a two-story manufacturing building of 150,843 sf and will be supported by approximately 299 parking spaces. Access to the proposed Project will be via three curb-cuts on Bulge Road. The southern driveway will be one-way into the Site and will provide entering access to both the parking lot in front of the building and the loading/receiving docks behind the building. The middle driveway will be full access into and out of the Site and will provide direct access to the parking lot for employees and visitors. The northern driveway will be one-way out of the Site and will provide egress from the loading/receiving docks located behind the building.

The proposed project is expected to generate approximately 592 new vehicle trips (296 entering/296 exiting) on a typical weekday, with 94 new vehicle trips (72 entering/22 exiting) during the weekday morning peak hour and 101 new vehicle trips (31 entering/70 exiting) during the weekday evening peak hour.

Capacity analyses were conducted for each of the study area intersections under 2021 Existing conditions, 2028 No-Build conditions (without the proposed redevelopment), and 2028 Build conditions (with the proposed redevelopment). Based on the results of these analyses and the anticipated Site-generated traffic, the Proponent will implement the following measures:

› Site Access Improvements

- Transportation Demand Management Program
- Traffic Monitoring Program
- Signal timing adjustments at the intersection of Jackson Road at Patton Road / Lake George Street

Overall, VHB concludes that the proposed Project with the mitigation measures in place will have minimal impacts to traffic operations on the local roadway network.