Traffic Impact Study

Amherst Residential Development

408 Northampton Road, Amherst, MA

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INTRODUCTION

McMahon Associates has reviewed the potential traffic impacts associated with the proposed Amherst Residential development located at 408 Northampton Road (Route 9/116) in Amherst, Massachusetts. The purpose of this study is to evaluate existing and projected traffic operational and safety conditions in the vicinity of the site and identify mitigating measures to offset potential project-related traffic impacts on the surrounding roadways, if necessary.

The assessment presented in this document is based on a review of current traffic volumes and crash data collected for the study area, and the anticipated traffic generating characteristics of the proposed development. This study examines existing and projected traffic operations (both with and without the proposed development) at key intersections in the vicinity of the project site. The study area was chosen based on a review of the surrounding roadway network. This study provides a detailed analysis of traffic operations during the weekday morning, weekday afternoon, and Saturday midday peak hours, when the combination of adjacent roadway volumes and potential traffic increases associated with the project would be greatest.

Based on the analysis presented in this study, the project-related traffic anticipated to be generated by the proposed development is expected to have a minimal effect on the operations of area roadways and intersections. The proposed 132 unit residential development is not expected to be substantially more detrimental to the study area roadways and intersections than the existing Amherst Motel. The report below documents these findings.

Project Description

The project site, shown in Figure 1, is located at 408 Northampton Road (Route 9/116) in Amherst, Massachusetts. The existing site is bound commercial buildings to the west, Northampton Road (Route 9/116) to the north, Greenleaves Drive to the east, and undeveloped land to the south. The existing project site is occupied by the Amherst Motel, which is comprised of a combination of motel rooms and furnished apartments.

The proposed project calls for the razing of existing structures on site and the construction of a new 132 unit residential development with 278 parking spaces. Access to the proposed project site is to be provided via one unsignalized driveway located on Northampton Road (Route 9/116) in approximately the same location as the existing driveway. The site driveway is proposed to provide right-in, right-out access to Northampton Road (Route 9/116). Presently, there is no delineation between the Amherst Motel driveway and the adjacent Domino’s Pizza driveway, so patrons of both land uses utilize both site driveways. As part of the proposed project, access between the Amherst Residential property and Domino’s Pizza property would be formally delineated, thereby separating the traffic destined to and coming from each land use into separate driveways.
Study Methodology

This study evaluates existing and projected traffic operations at study area intersections for the weekday morning, weekday afternoon, and Saturday midday peak hour traffic conditions when the combination of adjacent roadway volumes and potential traffic increases associated with the project would be greatest.

The study was conducted in three steps. The first step involved an inventory of existing traffic conditions in the vicinity of the site. As part of this inventory, traffic counts were collected at key intersections during the weekday morning, weekday afternoon, and Saturday midday peak periods. A field review was also conducted to identify the physical and operational characteristics of the study area roadways in the vicinity of the site, including lane usage, posted speed limits, and sight distance measurements. Crash data for the study area intersections were obtained from the Massachusetts Department of Transportation (MassDOT) to evaluate existing traffic safety within the study area.

The second step of the study builds upon data collected in the first phase and establishes the basis for evaluating the transportation impacts associated with the future conditions. In this step, the projected traffic demands of other future developments that could influence traffic volumes at the study area intersections were assessed. Existing 2017 traffic volumes were projected to the 2024 No Build (without project) condition and the 2024 Build (with project) condition.

The final step evaluated if measures were necessary to improve future traffic operations or minimize potential traffic impacts in order to provide efficient access to the project site.

Study Area Intersections

The area identified for detailed analysis in this study was determined based on a review of the surrounding roadway network serving the project site. The study area intersections include:

- Russell Street (Route 9/116) at Campus Plaza Road/Greenleaves Drive
- Northampton Road (Route 9/116) at Site Driveway
- Northampton Road (Route 9/116) at Greenleaves Drive
- Northampton Road (Route 9/116) at University Drive/Snell Street
EXISTING CONDITIONS

Effective evaluation of potential traffic impacts associated with the proposed development requires a thorough understanding of the existing traffic conditions on the roadways and intersections serving the project site. The assessment of existing conditions consists of an inventory of the roadway and intersection geometries and traffic control devices, collection of peak-period traffic volumes, and a review of recent crash history. A discussion of this information is presented below.

Roadway Network

The project site benefits from excellent access via the local and regional roadway systems. A brief description of the principal roadways serving the project site is presented below.

Northampton Road/Russell Street (Route 9/116)
Northampton Road/Russell Street (Route 9/116) generally extends in a northeast-southwest direction through the Town of Amherst and the Town of Hadley. For the purposes of the traffic impact study, Northampton Road/Russell Street (Route 9/116) will be referred to as an east-west roadway. The roadway is designated as Russell Street in Hadley, MA and Northampton Road in Amherst, MA, with the municipal border located immediately west of the project site. The roadway is classified as an urban principal arterial under MassDOT jurisdiction. In the vicinity of the project site, Northampton Road/Russell Street (Route 9/116) is a four-lane, two-way roadway providing access to adjacent commercial land uses. The posted speed limit in the eastbound direction of Northampton Road in the vicinity of the site is 35 miles per hour.

At the signalized intersection with Campus Plaza Road and Greenleaves Drive, Russell Street (Route 9/116) provides an exclusive left-turn lane, two through lanes, and an exclusive right-turn lane in both the eastbound and westbound directions. At the signalized intersection with University Drive and Snell Street, Northampton Road (Route 9/116) provides an exclusive left-turn lane, a through lane, and a shared through-right lane in the eastbound direction and a shared left-through lane and a shared through-right lane in the westbound direction.

Sidewalks are provided along both sides of the Northampton Road (Amherst) section of Route 9; however, there are no sidewalks provided along either side of the Russell Street (Hadley) section of the roadway in the vicinity of the project site. Signalized crosswalks are located across the northbound and westbound approaches to the intersection of Russell Street (Route 9/116) at Campus Plaza Road/Greenleaves Drive and across the southbound, northbound, and westbound approaches to the intersection of Northampton Road (Route 9/116) at University Drive/Snell Street.

The Pioneer Valley Transit Authority (PVTA) operates several bus routes through the study
area, including Bus Routes Blue 43 and 33, which travel in front of the project site providing access to Smith College, University of Massachusetts (UMass) Amherst, Amherst College, Puffers Pond, and various shopping areas. Bus stops are currently located on Route 9/116, adjacent to the Pride gasoline station in Hadley and east of Greenleaves Drive in Amherst, near the project site.

**University Drive**
University Drive generally extends in a north-south direction through the Town of Amherst. The roadway is classified as an urban minor arterial under local jurisdiction south of Amity Street. University Drive is a two-lane, two-way with an exclusive left-turn lane, through lane, and channelized right turn lane provided at the southbound approach to its intersection with Northampton Road (Route 9/116) and Snell Street. University Drive provides access to adjacent commercial land uses and serves as a connection to the UMass Amherst campus. A sidewalk is provided on the west side of the roadway and a shared use path accommodating both bicycles and pedestrians is provided on the east side of the roadway. Several PVTA bus routes travel in both the northbound and southbound directions of University Drive.

**Snell Street**
Snell Street generally extends in an east-west direction through the Town of Amherst; however, at its signalized intersection with Northampton Road (Route 9/116) and University Drive, the roadway is oriented in a north-south direction. Snell Street is a two-lane, two-way roadway that is classified as a local road under Town of Amherst jurisdiction. At the intersection of Snell Street at Northampton Road (Route 9/116) and University Drive, Snell Street provides an exclusive left-turn lane and a shared through-right lane in the northbound direction. Snell Street provides access to primarily residential land uses and a shared use path is provided on the north side of roadway in the vicinity of the study area.

**Greenleaves Drive**
Greenleaves Drive is a local road under local jurisdiction that provides access to the Greenleaves Retirement Community residences. Greenleaves Drive is a two-lane, two-way roadway with sidewalks provided intermittently along both sides of the roadway. The roadway has two access points to Northampton Road/Russell Street (Route 9/116); one at the signalized intersection with Campus Plaza Road and one unsignalized right-in, right-out roadway to the east of the proposed site driveway. At its intersection with Russell Street (Route 9/116) and Campus Plaza Road, Greenleaves Drive provides an exclusive left-turn lane and a shared through-right lane in the northbound direction.

**Existing Traffic Volumes**

**Existing Peak Hour Traffic Volumes**
To assess peak hour traffic conditions, manual turning movement counts were conducted at the study area intersections during the weekday morning, weekday afternoon, and Saturday midday peak periods. Counts were conducted on Wednesday, April 5, 2017 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM and on Saturday, April 8, 2017 from 11:00 AM to 2:00
PM. The results of the turning movement counts are tabulated by 15-minute periods and are provided in Appendix A of this report. The four highest consecutive 15-minute intervals during each of these count periods constitute the peak hours that are the basis of the traffic analysis provided in this report. Based on the traffic counts, the weekday morning peak hour occurs between 8:00 AM and 9:00 AM, the weekday afternoon peak hour occurs between 4:30 PM and 5:30 PM, and the Saturday midday peak hour occurs between 1:00 PM and 2:00 PM on the study area roadways.

**Automatic Traffic Recorder**

Automatic traffic recorder (ATR) data was collected along Northampton Road (Route 9/116) for a 48-hour period from Wednesday, April 5, 2017 through Thursday, April 6, 2017. The ATRs collected traffic volume, speed, and vehicle classification data on Northampton Road (Route 9/116) to the west of the University Drive. The results of the ATR counts are summarized in Table 1 below and are provided in Appendix A of this report.

| Table 1: Northampton Road (Route 9/116) Automatic Traffic Recorder Data |
|---|---|---|
| | Eastbound | Westbound | Total |
| **Average Daily Traffic Volume** | 10,580 | 11,120 | 21,700 |
| **85th Percentile Speed (mph)** | 38 | 38 | n/a |
| **Heavy Vehicle Percentage** | 2.9% | 3.0% | n/a |

Along Northampton Road (Route 9/116), to the west of University Drive, the overall average daily traffic volume was approximately 21,700 vehicles recorded in both directions, with approximately 10,580 vehicles traveling eastbound and 11,120 vehicles traveling westbound. The 85th percentile speed for vehicles in both the eastbound and westbound direction was recorded to be 38 miles per hour. The heavy vehicle percentage along the roadway was calculated to be 2.9% in the eastbound direction and 3.0% in the westbound direction.

**Seasonal Variation**

According to data collected at MassDOT permanent count stations located on Interstate 91 and Route 5 in Northampton, MA, traffic volumes collected during the month of April are shown to be higher than traffic volumes for the average month. Therefore, to provide a conservative analysis, the volumes collected for this study were not seasonally adjusted to reflect the average month. The peak hourly traffic flows for the 2017 Existing condition are depicted in Figures 2, 3, and 4 for the weekday morning, weekday afternoon, and Saturday midday peak hours, respectively.
<table>
<thead>
<tr>
<th>Campus Plaza Road</th>
<th>Russell Street/Northampton Road (Route 9/116)</th>
<th>University Drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 30</td>
<td></td>
<td>8 486 30</td>
</tr>
<tr>
<td>28</td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>48 574 28</td>
<td></td>
<td>656 3</td>
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<td>13</td>
<td></td>
<td>656 2</td>
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<td>13</td>
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<td>13</td>
</tr>
<tr>
<td>31 150 383 94</td>
<td></td>
<td>105 199 7</td>
</tr>
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<td>13</td>
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<td>13</td>
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<td>13</td>
</tr>
</tbody>
</table>

**SITE**

2017 Existing Weekday Morning Peak Hour Traffic Volumes
Amherst Residential Development
Amherst, Massachusetts
Figure 3
2017 Existing Weekday Afternoon
Peak Hour Traffic Volumes
Amherst Residential Development
Amherst, Massachusetts
Crash Summary

Crash data for the study area intersections was obtained from MassDOT for the most recent five-year period available. This data includes complete yearly crash summaries for 2010, 2011, 2012, 2013, and 2014. A summary of the crash data is presented in Appendix B.

The MassDOT Crash Rate Worksheet was used to determine whether the crash frequencies at the study area intersections were unusually high given the travel demands at each location. The MassDOT Crash Rate Worksheet calculates a crash rate expressed in crashes per million entering vehicles. The calculated rate was then compared to the average rate for signalized and unsignalized intersections statewide and within the particular MassDOT District. For signalized intersections, the statewide average crash rate is 0.77 crashes per million entering vehicles and the MassDOT District 2 crash rate is 0.82 crashes per million entering vehicles. For unsignalized intersections, the statewide average crash rate is 0.58 crashes per million entering vehicles and the MassDOT District 2 crash rate is 0.70 crashes per million entering vehicles.

The intersection of Russell Street (Route 9/116) at Campus Plaza Road and Greenleaves Drive is shown to have experienced a total of 29 crashes over the five-year period from 2010 to 2014. The resulting crash rate of 0.59 crashes per million entering vehicles is below both statewide and District 2 averages for a signalized intersection. Figure 5, below, presents the documented crashes by crash type at the intersection of Russell Street (Route 9/116) at Campus Plaza Road and Greenleaves Drive.

Figure 5: Russell Street (Route 9/116) at Campus Plaza Road and Greenleaves Drive Crash Types (2010-2014)

As shown in Figure 5, more than half of the crashes (17 of 29) reported were rear-end collisions. There were also eight angle collisions, three sideswipe crashes, and one head-on collision reported at the intersection from 2010 to 2014. Of the reported crashes, 23 of the 29 crashes resulted in property damage only. One fatal crash was reported at this location on April 14, 2012 at 2:20 AM. The crash was classified as a head-on collision between a westbound passenger car and an eastbound motorcycle and passenger car. The crash occurred
approximately 140 feet west of the intersection of Russell Street (Route 9/116) at Campus Plaza Road and Greenleaves Drive.

The intersection of Northampton Road (Route 9/116) at University Drive and Snell Street is shown to have experienced a total of 36 crashes over the five-year period from 2010 to 2014. The resulting crash rate of 0.71 crashes per million entering vehicles is below both statewide and District 2 averages for a signalized intersection. Figure 6, below, presents the documented crashes by crash type at the intersection of Northampton Road (Route 9/116) at University Drive and Snell Street.

Figure 6: Northampton Road (Route 9/116) at University Drive and Snell Street
Crash Types (2010-2014)

As shown in Figure 6, the intersection of Northampton Road (Route 9/116) at University Drive and Snell Street experienced 17 rear-end collisions, 15 angle collisions, three sideswipe crashes, and one crash categorized as other from 2010 to 2014. Of the reported crashes, 20 of the 36 crashes resulted in personal injury. There were no fatal crashes reported at this location.

The intersection of Northampton Road (Route 9/116) at Site Driveway is shown to have experienced one crash over the five-year period studied. The one crash was a rear-end collision resulting in property damage only. The resulting crash rate of 0.04 crashes per million entering vehicles is well below both statewide and District 2 averages for a signalized intersection. There were no fatal crashes reported at this location.

The intersection of Northampton Road (Route 9/116) at Greenleaves Drive is shown to have experienced two crashes between 2010 and 2014. One crash was a rear-end collision resulting in property damage only and the other was an angle collision resulting in a non-fatal injury. The resulting crash rate of 0.09 crashes per million entering vehicles is well below both statewide and District 2 averages for a signalized intersection. There were no fatal crashes reported at this location.
FUTURE CONDITIONS

To determine future traffic demands on the study area roadways, the 2017 Existing traffic volumes were projected to the future-year 2024, by which time the proposed development is expected to be fully constructed and occupied. Independent of the proposed project, traffic volumes on the roadways in 2024 are assumed to include all existing traffic, as well as new traffic resulting from general growth in the study area and from other planned development projects. The potential background traffic growth unrelated to the proposed project was considered in the development of the 2024 No Build (without project) peak hour traffic volume networks. The anticipated traffic increases associated with the proposed development were then added to the 2024 No Build volumes to reflect the 2024 Build (with project) traffic condition. A more detailed description of the development of the 2024 No Build and 2024 Build traffic volume networks is presented below.

Future Roadway Improvements

Planned roadway improvement projects can affect area travel patterns and future traffic operations. To develop a clearer understanding of future area roadway operations, the Town of Amherst, the Town of Hadley, and the MassDOT project website were consulted. Based on these consultations, there are several planned roadway improvement projects in the vicinity of the study area; however none of the projects are expected to directly impact future-year, 2024 traffic operations at the study area intersections.

The Route 9 Corridor Improvement Project is currently in the alternatives analysis phase of design, and is comprised of two separate projects intended to increase safety for all modes of transportation and provide congestion relief along the roadway. One facet of the corridor improvement project involves the widening of Russell Street (Route 9/116) in Hadley, MA from Middle Street to South Maple Street. The roadway widening is proposed to occur west of the Amherst Residential study area and is not expected to impact operations at any of the study area intersections. The second component of the Route 9 Corridor Improvement Project is the modifications to Bus Route B43, which is proposed to operate as a mixed-flow Bus Rapid Transit system. The route that currently runs past the project site is proposed to be rerouted, removing buses from the eastbound left-turn approach from Northampton Road (Route 9/116) to University Drive and redirecting them north on Route 116, west of the project study area. In order to present a conservative analysis, traffic volume was not removed from the study area intersections to represent the proposed changes to Bus Route B43.

Another roadway improvement project that is proposed to occur in the vicinity of the Amherst Residential development study area is the reconstruction of Northampton Road (Route 9/116) from University Drive to South Pleasant Street. The project, currently in the preliminary design phase, is intended to create a “Complete Streets” corridor, providing safe and accessible accommodations for pedestrians and bicyclists. The preferred concept for the project includes the construction of a multi-use shared path of the north side of Northampton Road (Route 9/116) and a sidewalk on the south side of the roadway, east of the Amherst Residential
development study area, and is not expected to impact operations at any of the study area intersections.

**Background Traffic Growth**

Traffic growth is primarily a function of changes in motor vehicle use and expected land development in the region. To predict a rate at which traffic on the roadways in the vicinity of the site can be expected to grow during the seven-year forecast period (2017 to 2024), both historic traffic growth and planned area developments were examined.

**Historic Traffic Growth**

According to data collected by MassDOT at permanent count stations located on Interstate 91 and Route 5 in Northampton, MA, traffic has been growing at an average rate of approximately one percent per year. Therefore, in order to provide a conservative analysis, a one and a half percent growth rate was used to represent traffic growth near the proposed project site. The one and a half percent growth rate, compounded annually, was utilized to capture growth associated with general changes in the population and other developments that are not known at this time that would be expected to increase traffic volumes on the study area roadways and intersections.

**Site-Specific Growth**

Based on conversations with the Town of Amherst and the Town of Hadley, several developments were identified in North Amherst and Downtown Amherst that are currently going through the permitting or construction process. However, no permitted developments were identified that would be expected to generate a significant amount of additional traffic at the study area intersections during the seven-year traffic projection period. The Amherst Town Planner also noted that 30 units of housing and two medical marijuana dispensaries, one of which has been approved, are being considered for development on University Drive. Traffic associated with the 30 units of housing were added to the study area roadways based on existing travel patterns. As noted in the traffic impact assessment for the approved medical marijuana facility, there is negligible amounts of traffic expected to be generated by that development. Potential traffic volumes associated with the medical marijuana facilities on University Drive and any unknown projects are accounted for in the one and a half percent background growth rate. The traffic volumes associated with the additional developments are summarized in the traffic projection model in Appendix C.

**2024 No Build Traffic Volumes**

The 2017 Existing peak hour traffic volumes were grown by one percent per year over the seven-year study horizon (2017 to 2024) to establish the 2024 No Build traffic volumes. The resulting 2024 No Build weekday morning, weekday afternoon, and Saturday midday peak hour traffic volume networks are illustrated in Figures 7, 8, and 9, respectively, and are documented in the traffic projection model presented in Appendix C of this report.
SMCMAHON TRANSPORTATION ENGINEERS & PLANNERS

2024 No Build Weekday Morning Peak Hour Traffic Volumes
Amherst Residential Development
Amherst, Massachusetts
**Site-Generated Traffic**

The Institute of Transportation Engineers (ITE) is a national research organization of transportation professionals. Their publication, *Trip Generation Manual, 9th Edition* provides traffic generation information for various land uses compiled from studies conducted by members nationwide. Vehicle trip estimates for the proposed Amherst Residential project were developed based on data presented in this publication for Land Use Code 220 (Apartment). This reference establishes vehicle trip rates (in this case expressed in trips per dwelling unit) based on actual traffic counts conducted at similar existing facilities. Table 2 presents the total projected future vehicle trips associated with the proposed Amherst Residential development.

**Table 2: Total Project Trips**

<table>
<thead>
<tr>
<th>Description</th>
<th>Weekday AM Peak Hour</th>
<th>Weekday PM Peak Hour</th>
<th>Saturday Midday Peak Hour (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartment (1)</td>
<td>In 14 Out 54 Total 68</td>
<td>In 59 Out 31 Total 90</td>
<td>In 34 Out 35 Total 69</td>
</tr>
</tbody>
</table>

(1) ITE Land Use Code 220 (Apartment), based on 132 dwelling units.

(2) Directional distribution estimated to be equal between entering and exiting trips.

As shown in Table 2, the peak hour trip generation of the proposed Amherst Residential development is estimated to be approximately 68 new vehicle trips (14 entering vehicles and 54 exiting vehicles) during the weekday morning peak hour, an increase of approximately 90 new vehicles trips (59 entering vehicles and 31 exiting vehicles) during the weekday afternoon peak hour, and an increase of approximately 69 new vehicle trips (34 entering and 35 exiting) during the Saturday midday peak hour.

Due to the existing configuration of the shared driveways serving both the Amherst Motel and Domino’s Pizza, the vehicle trips specifically traveling to and from the Amherst Motel were not isolated during data collection. Therefore, in order to present a conservative analysis, the existing Amherst Motel trips have not been removed from the study area intersections.

**Project Trip Distribution and Assignment**

The traffic expected to be generated by the proposed development was distributed onto the study area roadways and intersections based on the existing travel patterns of the adjacent roadways and US 2010 Census Journey-to Work data for the Town of Amherst. New vehicle trips expected to access the project site were assigned to the study area intersections based on the most convenient means of access. The resulting arrival and departure patterns are presented in Figure 10 and the Journey to Work data is provided in Appendix D. During different times of day, vehicles may utilize alternative routes to access the proposed project site when traveling to the west or traveling from the east.
2024 Build Peak Hour Traffic Volumes

To establish the 2024 Build peak hour traffic volumes, the project-related traffic was assigned to the surrounding roadway network based on the project distribution patterns depicted in Figure 10. These project trips were then added to the 2024 No Build peak hour traffic volumes to reflect the 2024 Build peak hour traffic volumes. The resulting 2024 Build weekday morning, weekday afternoon, and Saturday midday peak hour traffic volumes are presented in Figures 11, 12 and 13, respectively.
<table>
<thead>
<tr>
<th>Campus Plaza Road</th>
<th>Site Driveway</th>
<th>Russell Street/Northampton Road (Route 9/116)</th>
<th>Greenleaves Drive</th>
<th>Snell Street</th>
</tr>
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Figure 11
2024 Build Weekday Morning
Peak Hour Traffic Volumes
Amherst Residential Development
Amherst, Massachusetts
Figure 13
2024 Build Weekday Afternoon
Peak Hour Traffic Volumes
Amherst Residential Development
Amherst, Massachusetts
TRAFFIC OPERATIONS ANALYSIS

In previous sections of this report, the quantity of traffic on the study area roadways was described. The following section describes the quality of traffic flow at the study area intersections for the given travel demands. As a basis for this assessment, intersection capacity analyses were conducted using Synchro capacity analysis software for the study area intersections under the 2017 Existing, 2024 No Build, and 2024 Build peak hour traffic conditions. This analysis is based on Synchro methodologies and procedures contained in the 2010 Highway Capacity Manual (HCM), which are summarized in Appendix E of this report. A discussion of the evaluation criteria and a summary of the results of the capacity analyses are presented below.

Level-of-Service Criteria

Operating levels of service (LOS) are reported on a scale of A to F with A representing the best conditions (with little or no delay) and F representing the worst operating conditions (long delays).

Capacity Analysis Results

Intersection capacity analyses were conducted for the study area intersections to evaluate the 2017 Existing, 2024 No Build and 2024 Build peak hour traffic conditions. Based on the traffic counts, the weekday morning peak hour of the adjacent street traffic occurs between 8:00 AM and 9:00 AM, the weekday afternoon peak hour of the adjacent street traffic occurs between 4:30 PM and 5:30 PM, and the Saturday midday peak hour of the adjacent street traffic occurs between 1:00 PM and 2:00 PM.

The detailed capacity analysis results for the 2017 Existing, 2024 No Build, and 2024 Build conditions are presented in Appendix F, Appendix G, and Appendix H, respectively. The overall results of the intersection capacity analysis for the signalized study area intersection are presented in Table 3 below. A more detailed summary of the capacity analysis for each intersection is provided in Appendix I.
Table 3: Signalized Peak Hour Intersection Capacity Analysis Results

<table>
<thead>
<tr>
<th>Location</th>
<th>2017 Existing</th>
<th>2024 No Build</th>
<th>2024 Build</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak Hour</td>
<td>LOS(1)</td>
<td>Delay(2)</td>
</tr>
<tr>
<td>Russell Street (Route 9/116) at</td>
<td>AM C</td>
<td>22.2</td>
<td>0.61</td>
</tr>
<tr>
<td>Campus Plaza Road and</td>
<td>PM C</td>
<td>32.6</td>
<td>0.83</td>
</tr>
<tr>
<td>Greenleaves Drive</td>
<td>SAT D</td>
<td>38.4</td>
<td>&gt;1.00</td>
</tr>
<tr>
<td>Northampton Road (Route 9/116) at</td>
<td>AM C</td>
<td>26.9</td>
<td>0.63</td>
</tr>
<tr>
<td>University Drive and</td>
<td>PM D</td>
<td>36.2</td>
<td>0.90</td>
</tr>
<tr>
<td>Snell Street</td>
<td>SAT D</td>
<td>35.2</td>
<td>&gt;1.00</td>
</tr>
</tbody>
</table>

(1) Level-of-Service  
(2) Average delay in seconds per vehicle  
(3) Volume to capacity ratio

Russell Street (Route 9/116) at Campus Plaza Road/Greenleaves Drive
The capacity analysis indicates that the signalized intersection of Russell Street (Route 9/116) and Campus Plaza Road/Greenleaves Drive currently operates at overall level-of-service (LOS) C during the weekday morning and weekday afternoon peak hours and at overall LOS D during the Saturday midday peak hour. Under the 2024 No Build and 2024 Build conditions, the intersection is shown to continue to operate at overall LOS C during the weekday morning and weekday afternoon peak hours and at LOS D during the Saturday midday peak hour. As documented in Appendix I, the level-of-service for each of the movements at the intersection is expected to be maintained between the 2024 No Build and 2024 Build conditions.

Northampton Road (Route 9/116) at University Drive/Snell Street
The signalized intersection of Northampton Road (Route 9/116) at University Drive and Snell Street currently operates at overall LOS C during the weekday morning peak hour, at overall LOS D during the weekday afternoon and Saturday midday peak hours. Under the 2024 No Build and 2024 Build conditions, the intersection is shown to continue to operate at overall LOS C during the weekday morning peak hour and at LOS D during the weekday afternoon and Saturday midday peak hours. As documented in Appendix I, the level-of-service for each intersection movement is expected to be maintained between the 2024 No Build and 2024 Build conditions, expect for the northbound left-turn movement during the weekday morning peak hour which experiences a slight increase in delay (less than one second) from LOS C to LOS D.

Table 4 summarizes the level-of-service results for the critical movements at each of the unsignalized study area intersections during the weekday morning, weekday afternoon, and Saturday midday peak hours. A more detailed summary of the capacity analysis is provided in Appendix I. The results of the capacity analysis conducted at the unsignalized study area intersections are discussed below.
Table 4: Unsignalized Peak Hour Intersection Capacity Analysis Results

<table>
<thead>
<tr>
<th>Location</th>
<th>Peak Hour</th>
<th>2017 Existing</th>
<th>2024 No Build</th>
<th>2024 Build</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LOS(1)</td>
<td>Delay(2)</td>
<td>V/C(3)</td>
</tr>
<tr>
<td>Northampton Road (Route 9/116) at AM</td>
<td>B</td>
<td>10.8</td>
<td>0.01</td>
<td>B</td>
</tr>
<tr>
<td>Domino’s Driveway and PM</td>
<td>NB R</td>
<td>B</td>
<td>12.7</td>
<td>0.03</td>
</tr>
<tr>
<td>Project Site Driveway</td>
<td>SAT</td>
<td>B</td>
<td>13.1</td>
<td>0.04</td>
</tr>
<tr>
<td>Northampton Road (Route 9/116) at AM</td>
<td>B</td>
<td>10.9</td>
<td>0.04</td>
<td>B</td>
</tr>
<tr>
<td>Greenleaves Drive PM</td>
<td>NB R</td>
<td>B</td>
<td>13.3</td>
<td>0.09</td>
</tr>
<tr>
<td>SAT</td>
<td>B</td>
<td>13.4</td>
<td>0.08</td>
<td>B</td>
</tr>
</tbody>
</table>

(1) Level-of-Service  
(2) Average delay in seconds per vehicle  
(3) Volume to capacity ratio

As shown in Table 4, the critical northbound right-turn movement at each of the unsignalized study area intersections is expected to operate at LOS B during the weekday morning, weekday afternoon and Saturday midday peak hours during the 2017 Existing, 2024 No Build, and 2024 Build conditions. As part of the proposed project, access between the Domino’s property and the Amherst Residential development will be delineated. The 2017 Existing and 2024 No Build conditions analyses represent both driveways and the 2024 Build condition represents the proposed project site driveway. As documented in the detailed capacity analysis summary presented in Appendix I, traffic operations along Northampton Road (Route 9/116) at the unsignalized intersections are not expected to be impacted by the proposed project. All of the approaches to the intersections are expected to operate well below capacity.

Site Access/Circulation

Under the proposed plan, access to the project site would be provided via one unsignalized driveway on Northampton Road (Route 9/116). The driveway would operate as a right-in, right-out driveway. There is currently no delineation between the Amherst Motel driveway and the adjacent Domino’s Pizza driveway, and patrons are able to travel between both site properties. As part of the proposed project, access between the Amherst Residential property and Domino’s Pizza property would be delineated, thereby separating the traffic destined to and coming from each land use. Pedestrian access to and from the project site is provided via a proposed sidewalk located to the east of the proposed site driveway. The on-site sidewalk is proposed to connect the existing sidewalk on the southern side of Northampton Road (Route 9/116) to the proposed residential building. The site configuration is expected to allow residents and emergency vehicles to access the site in a safe and efficient manner.
Sight Distance

A field review of the available sight distances was conducted for the proposed site driveway. The posted speed limit along Northampton Road is 35 miles per hour adjacent to the site and was utilized as part of the sight distance review.

The American Association of State Highway and Transportation Officials (AASHTO) publication, *A Policy on Geometric Design, 2011 Edition*, defines the minimum sight distances required at intersections. The minimum sight distance is based on the required stopping sight distance (SSD) for vehicles traveling along the main road and vehicles entering the main road from the minor street. According to AASHTO, “If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient time to anticipate and avoid collisions.” Table 5 presents the field measured available sight distance from the project site drive and the required SSD.

<table>
<thead>
<tr>
<th>Direction</th>
<th>Speed (mph)</th>
<th>SSD Required (ft)</th>
<th>Available Sight Distance (ft)</th>
<th>Meets Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-Turn Looking Left (West)</td>
<td>35</td>
<td>250</td>
<td>&gt;500</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(1) AASHTO stopping sight distance (see AASHTO Table 3-1).

As shown in Table 5, the sight distance looking to the left (west) for a vehicle exiting the site driveway and turning right onto Northampton Road (Route 9/116) is greater than 500 feet, which exceeds the required SSD for vehicles traveling at 35 miles per hour. The proposed site driveway on Northampton Road (Route 9/116) is shown to meet the minimum sight distance requirements to provide safe access to and from the project site.
CONCLUSION

The Amherst Residential project is proposed to be located at 408 Northampton Road (Route 9/116) in Amherst, Massachusetts. The proposed project calls for the razing of existing structures on site and the construction of a new 132 unit apartment building with 278 parking spaces. Access to the proposed project site is to be provided via one unsignalized driveway located on Northampton Road (Route 9/116) in the same location as the existing driveway. The site driveway is proposed to provide right-in, right-out access to Northampton Road (Route 9/116), and access between the proposed site and the existing Domino’s property would be separated.

The Amherst Residential development is expected to generate approximately 68 new vehicle trips (14 entering vehicles and 54 exiting vehicles) during the weekday morning peak hour, an increase of approximately 90 new vehicles trips (59 entering vehicles and 31 exiting vehicles) during the weekday afternoon peak hour, and an increase of approximately 69 new vehicle trips (34 entering and 35 exiting) during the Saturday midday peak hour.

The capacity analysis indicates that the proposed Amherst Residential development will not have a significant impact on the operations of the surrounding roadways or intersections. The overall operations of the signalized intersections are not expected to change with the proposed project in place. The movements turning onto Northampton Road (Route 9/116) at the unsignalized intersections, including the project site driveway, are expected to operate at LOS B during the weekday morning, weekday afternoon, and Saturday midday peak hours under the 2024 Build conditions.

Based on the analysis results presented in this report, the proposed 132 unit residential development is not expected to be substantially more detrimental to the study area roadways and intersections than the existing Amherst Motel. The proposed Amherst Residential development is expected to have a limited impact on the overall operations of the study area roadways.