Traffic Impact and Access Study

Abbyville Commons
Proposed 40B Residential Development

Norfolk, Massachusetts

Prepared for

DiPlacido Development Corp.

April 2017

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

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1.0 INTRODUCTION AND EXECUTIVE SUMMARY

This report describes the traffic analysis of the proposed Abbyville residential development project situated in Norfolk, Massachusetts proposed to consist of both rental apartment units and single family homes. The specific development this study examines in detail is proposed to consist of 48 townhouse apartment units. Access to the proposed development project will be to and from Lawrence Street approximately 1,200 feet west of its intersection with Park Street and just west of Bush Pond. It is approximately 2.2 miles southwest of the Norfolk town center and 6.8 miles west of Interstate 95 in Foxborough. The MBTA commuter rail runs just northwest of the project site. Figure 1 depicts the project location. The surrounding area of the proposed development is primarily residential in character with a significant amount of tree cover. The ownership housing component of this project consists of 148 single family houses. The traffic study for the single family houses is the focus of a separate report.

This report considers the potential impacts on the adjacent roadways and nearby intersections. Intersection capacity analyses were completed at each study intersection for the existing, future No-Build, and future Build conditions. An analysis of available or expected sight distances was also completed for the proposed site. While the focus of the impact analysis is the apartment portion of the site, the full-build development of the site including the single family housing component is also evaluated.

The analysis and evaluation in this report includes traffic volumes, safety data and review, and an analysis of the roadway/site access interface. The guidelines of the Massachusetts Department of Transportation (MassDOT), and the Institute of Transportation Engineers (ITE) were used for completing this traffic impact and access study. The report's content contains descriptions of existing characteristics of the abutting roadway network, current traffic conditions, estimated traffic impacts and access/egress characteristics of the development.

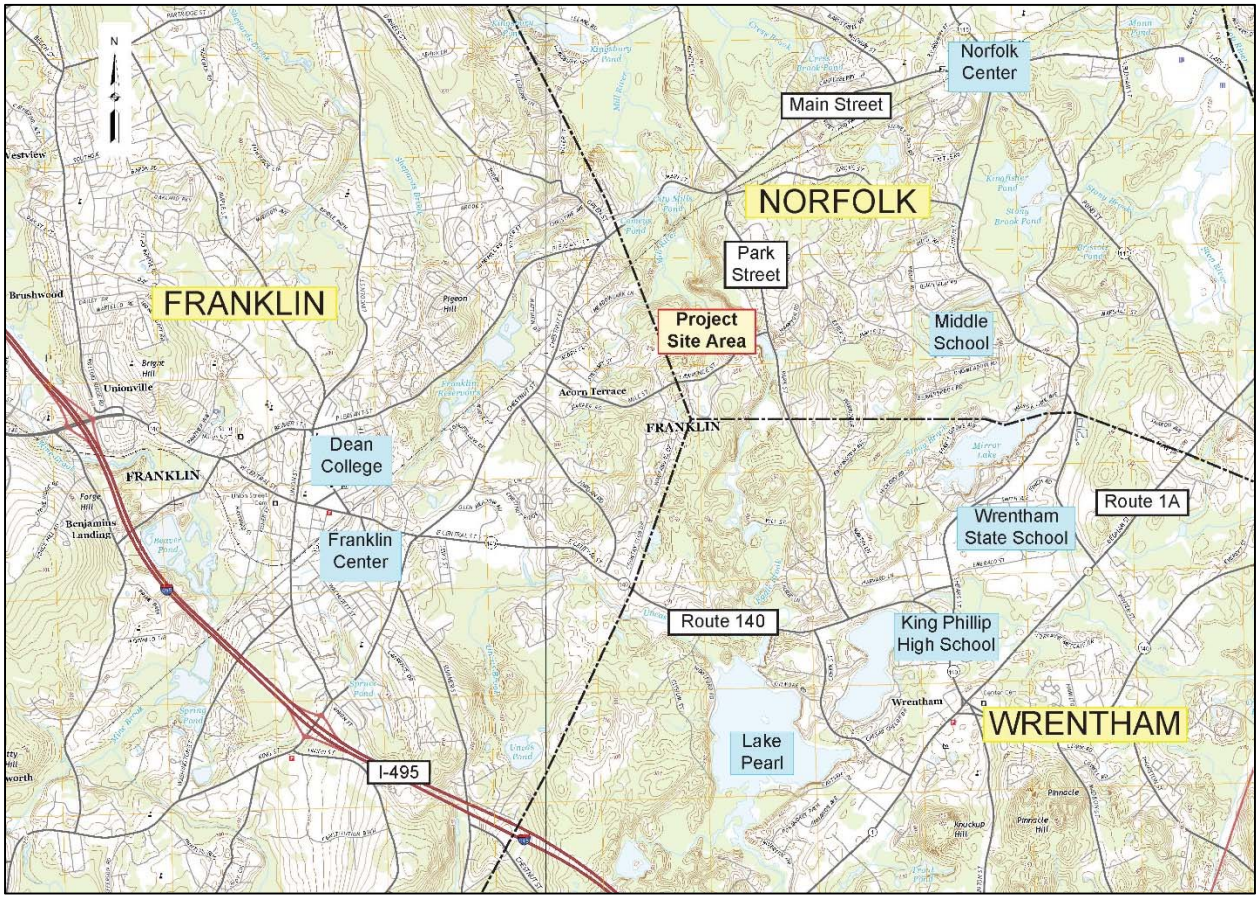
EXISTING CONDITIONS

The project is proposed to be on currently undeveloped land north of Lawrence Street in Norfolk. A portion of the site did have remnants of old mill buildings removed. The selection of the study area took into account the location and type of project and focused on the evaluation of the roadways and intersections in the vicinity of the site that are anticipated to be most impacted by the proposed development project. The following intersections were included in the study:

- Main Street at Park Street
- Park Street at Lawrence Street
- Park Street at Maple Street
- Lawrence Street at Brett's Farm Road

Park Street, Lawrence Street, Main Street, and Maple Street are two-lane, two-way roadways under the jurisdiction of the town of Norfolk. Park Street and Main Street are classified as "Urban Minor Arterial" roadways, and Lawrence Street and Maple Street are classified as "local" roadways. The roadways lie in an area that consists predominantly of single family houses. All of the intersections in the study area are unsignalized.

Figure 1. Overall Project Area



Traffic data were collected on September 9th and 10th, 2015 on Park Street and Lawrence Street. The data indicated that the weekday average daily traffic (ADT) volume on Park Street and Lawrence Street and indicated are approximately 2,925 and 865 vehicles per day (vpd), respectively. On Park Street, the AM and PM peak hour traffic volumes represent approximately 9.5% to 10.0% of daily traffic, while Lawrence Street AM and PM peak hour traffic volumes represent 6.5% and 9.0% of daily traffic, respectively. This base data was increased by a conservative 1.7% per year to the existing study year of 2017 for analysis purposes. The analysis showed that, based on the current data available, there is available roadway capacity to accommodate new traffic.

The evaluation of the intersections indicated that most of the approaches at the study intersections currently operate at Level of Service (LOS) 'A' or 'B'. Moderate to long delays and queue lengths currently exist on the Park Street approach at its intersection with Main Street. During the weekday peak hours, the Park Street approach presently operates at LOS 'E'.

FUTURE CONDITIONS

The future year 2024 was chosen for analysis based on MassDOT state guidelines. The evaluation of future conditions involves developing traffic forecasts based on a seven-year permitting and buildout timeframe, and comparing No-Build and Build conditions. The No-Build traffic volumes were determined by adding a general background growth rate of 1.0% to the existing traffic volumes, and by adding as appropriate expected trips from other specific development projects in or around the study area. Because the traffic data were collected in 2015, nine years of growth (seven-year time frame plus two years to bring counts to

the present year) were applied to the collected traffic volumes. For the purpose of this study, two Build analysis scenarios were included considering that the total development includes both apartment rental units and single family houses. One build scenario, Build – Single Family Houses, assumes that only the single family houses are constructed and fully occupied. The second scenario, Full-Build, assumes both the single family houses and apartment units of the adjacent section of the property are constructed and fully occupied.

The future Build traffic volumes were determined by adding the expected project trips to the No-Build traffic volumes. Traffic volume forecasts of the proposed development project were based on models published by the Institute of Transportation Engineers (ITE).

The apartment portion of the proposed development is expected to generate a total of 414 additional vehicle trips over the course of an average weekday with entering and exiting trips split evenly. The weekday morning and afternoon peak hours are expected to generate a total of 27 trips and 44 trips, respectively. The proposed development in the Full-Build condition, including the single family housing component, is expected to generate a total of 1,920 additional vehicle trips over the course of an average weekday, generating in the weekday morning and afternoon peak hours a total of 140 trips 194 trips, respectively.

The trips were distributed across the study network based on existing traffic patterns of the area with minor adjustments made based on residence-to-work data collected from U.S. Census surveys.

CONCLUSIONS

This report focuses on the impact of the proposed apartment unit development but the Full-Build analysis is also examined and compared. The analyses demonstrate that the roadways and intersections within the study area are able to accommodate the additional traffic associated with the proposed development project in either Build scenario. The following summarizes the traffic analyses:

- The existing roads serving the project experience low volumes and have the capacity to accommodate the added vehicles.
- There are no major safety issues currently exhibited at the study intersections based on review of historical crash experience.
- The apartment complex component with 48 units of the overall development is a relatively low generator of trips with 27 and 44 vehicles during the AM and PM peak hours, respectively and 414 trips throughout the course of a weekday.
- With full occupancy of the proposed development project under either Build scenario, motorists using the nearby neighborhood intersections and site drives will continue to experience relatively short delays during the weekday peak hours.
- The analysis showed that at either site drive, traffic can efficiently enter and exit the site. Level of Service is expected to be 'A' during the weekday morning and afternoon peak hours.
- Motorists will continue to experience long delays and 95th percentile queues on the Park Street approach to the intersection with Main Street as the Park Street approach changes from LOS 'E' to LOS 'F' during the morning peak hour and remains at LOS 'F' during the afternoon peak hour under each No-Build scenario. Capacity at the northbound approach is exceeded during the afternoon peak hour in the No-Build, Build, and Full-Build scenarios on account of the large proportion of traffic exiting left from Park Street.
- One intersection sight distance (ISD) in the study area at the proposed project site driveways was found to be less than the minimum required distance for the posted speed limit. For 85th-percenile speeds, the ISD's at two locations were found to be less than the minimum required distance.

- Drivers exiting the western site driveway (near Eagle Drive) have ISD and SSD constrained by vegetation within the right-of-way and a horizontal curve looking to the left. However, it is noted that the project proponent owns much of the lot at the horizontal curve location and it is anticipated that clearing the existing vegetation present at the curve will improve ISD and SSD.
- Vegetation within the right-of-way hinders ISD looking to the right exiting the eastern site driveway (near Cranberry Meadow Road). ISD could be improved by vegetation trimming (to remove blockages).

RECOMMENDATIONS

While the analyses show that the proposed project can be accommodated on the study area network, several recommendations have been made to enhance the transportation system. The proposed actions are as follows:

- Any proposed landscaping and signage should be low enough and/or set back sufficiently so as not to create any sight distance constraints at the proposed site drives.
- Roadside vegetation within the right-of-way should be selectively cleared and trimmed and some terrain should be regraded to improve existing intersection sight distances.
    - Vegetation along the north side of Lawrence Street, between Eagle Drive and Brett's Farm Road and between the proposed eastern site drive and #25 Lawrence Street, should be trimmed and cut within the public right-of-way and, if the project is approved, the project property to improve sight distances.
    - Additional benefits would be gained by regrading the terrain alongside parts of Lawrence Street near the proposed site drives. The small hill just east of the proposed location of the western site drive is proposed to be partially flattened by the project proponent, taking care not to affect the property at #51 Lawrence Street. Other roadside regrading near the proposed site drives would also improve ISD.
    - With these actions implemented, minimum safety criteria for sight distance is expected to be exceeded. Figures 9 and 10 show the intersection sight triangles for the 85th-percentile travel speed; trimming and vegetation clearing are recommended within the right-of-way within and along these triangles.
- Repave Lawrence Street to be a consistent roadway width after installing the proposed water main.
- Advance warning signage should be considered for the eastbound approach to the intersection of Park Street and Main Street regardless of the proposed development project. Because of the sharp, wooded curve on Main Street east of Park Street, the signage could have LED lighting installed around the sign border(s), and solar panels could provide power for the lights.
- As a result of this project and considering the added traffic volumes and the existing crash rate at the intersection of Lawrence Street with Park Street, W2-2 advanced warning signage in the form of W2-2 signs should is recommended be installed along each approach of Park Street.

W2-2L
(Northbound approach)

W2-2R
(Southbound approach)

2.0 EXISTING TRAFFIC CONDITIONS

The following sections describe the existing transportation system in terms of physical and operational characteristics. The selection of the study area took into account the location and type of project and focused on the evaluation of the roadways and intersections in the vicinity of the site that are anticipated to be most impacted by the proposed development project.

2.1 Existing Roadway Network

The study focused on the roadway network in the vicinity of the project site that residents of the development will utilize, and included the following intersections:

- Main Street at Park Street
- Park Street at Lawrence Street
- Park Street at Maple Street
- Lawrence Street at Brett's Farm Road

As part of this study, a field reconnaissance was conducted to verify the physical and geometric layout of the study intersections and roadways and to observe traffic operations in the study area. A description of the study roadways serving the project is as follows:

2.1.1 Park Street

Park Street is classified as a minor arterial road under the jurisdiction of the Town of Norfolk and follows a north-south alignment between Main Street in the town of Norfolk and Route 140 in the town of Wrentham. Drivers are provided with one 11-foot-wide travel lane in each direction of travel. The posted speed limit on Park Street is 35 miles per hour (MPH) in both directions in the vicinity of the site. There is a gentle horizontal curve just south of the intersection of Park Street and Lawrence Street. Land use in the vicinity of the proposed development project is primarily residential.

At its intersection with Lawrence Street, Park Street operates "free" while Lawrence Street is STOP-controlled. The three-leg intersection consists of Park Street forming the northern and southern legs and Lawrence Street forming the western leg. The intersection lies in a semi-wooded setting, with residences to the east of the intersection and Bush Pond to the west flowing under a bridge on Lawrence Street. Along Park Street, the nearest intersections are formed by Bush Pond Road on the west side of Park Street 500 feet to the north and Hampton Road on the east side of Park Street 250 feet to the south. The intersection of Park Street and Bush Pond Road is uncontrolled, while the intersection of Park Street and Hampton Street is STOP-controlled on the westbound approach. Both intersections are three-legged.

At its intersection with Maple Street, Park Street operates "free" while Maple Street is STOP-controlled. At the three-leg intersection Park Street forms the northern and southern legs and Maple Street provides the eastern leg. The intersection lies in a semi-wooded setting, with residences to the east, west and south of the intersection.

Intersection of Park Street and Main Street, looking north.

Intersection of Park Street and Maple Street, looking north.

Park Street has its northern terminus at Main Street approximately 0.9 miles north of Lawrence Street. This is a three-legged intersection with Park Street forming the south approach and Main Street running east-west. There is one 13-foot-wide westbound lane on Main Street and one 11-foot-wide eastbound lane. The Park Street approach consists of one northbound lane. The intersection operates under STOP-control with Park Street traffic required to stop. A flashing yellow beacon exists for east-west traffic while a flashing red beacon is present for northbound traffic. It was observed during field reconnaissance that the northbound approach is wide enough to fit two adjacent vehicles at the road's terminus at Main Street. However, as this is only the case immediately at the mouth of the intersection, the Park Street approach is modeled in this study as having only one lane. There is a sidewalk on the southwest corner of the intersection. Drivers entering Park Street southbound have a speed limit of 20 mph as they proceed along a vertical curve providing grade-separation over MBTA railroad tracks as well as a concurrent horizontal curve.

Less than 200 feet south of this intersection Park Street has a three-legged intersection with Grove Street, which is a local roadway serving a residential neighborhood. Between the Grove Street and Main Street intersections, Park Street crosses over (via bridge) railroad tracks. At its narrowest point on the bridge, Park Street is approximately 33 feet wide.

2.1.2 Lawrence Street

Lawrence Street is a town-owned road classified as a local road. It is an approximately 21-foot-wide road accommodating two-way flow. The posted speed limit on Park Street is 30 miles per hour (MPH) in the vicinity of the site in both directions. There is a horizontal curve on Lawrence Street located alongside the project site.

Lawrence Street intersects Brett's Farm Road to form a three leg intersection approximately 32 feet east of the proposed western site drive. The three-leg intersection consists of Lawrence Street forming the eastern and western legs and Eagle Drive forming the southern leg. The intersection is uncontrolled.

The intersection nearest access to the proposed development is Cranberry Meadow Road and Lawrence Street just to the east of proposed site access. This is a three-legged intersection with Cranberry Meadow Road serving as the southern approach and Lawrence Street providing the eastern and western approaches. The intersection is uncontrolled but operates as STOP controlled on the minor approach.

Intersection of Park Street and Lawrence Street, looking north.

Intersection of Lawrence Street and Brett's Farm Road, looking east.

2.1.3 Main Street

Main Street is classified as a town-owned urban minor arterial/rural primary road with a speed limit of 35 miles per hour (MPH) in the vicinity of the study area. It connects Norfolk center to the east with Interstate 495 to the west. It intersects Chestnut Street 0.9 mile west of its intersection with Park Street at an uncontrolled Y-intersection. Chestnut Street provides access to the western end of Lawrence Street.

2.1.1 Maple Street

Maple Street is a town-owned local road serving a residential area with a speed limit of 30 miles per hour (MPH). It is rural in character, unstriped, and has a total paved width of approximately 21-22 feet.

2.2 Traffic Volumes

As part of this study, traffic volume data were obtained and used to form the basis of the traffic analysis. The data were collected on two separate days, September 9th and 10th, 2015 and consisted of weekday peak periods (7:00-9:00 AM and 4:00-6:00 PM) manual turning movement counts (TMC) at the study intersections noted previously. The count program also included 48-hour vehicle counts on Park Street (north of Lawrence Street) and Lawrence Street (east of Eagle Drive) using Automatic Traffic Recorders (ATR's). The complete TMC and ATR data collected as a part of this study are included in the Appendix.

Table 2.1 summarizes the ATR data that were collected as part of this study. Both roadways were found to have low volumes. As indicated, the weekday average daily traffic (ADT) volume on Park Street (north of Lawrence Street) and Lawrence Street (east of Eagle Drive) are approximately 2,925 and 865 vehicles per day (vpd), respectively. On Park Street the morning peak hour traffic volume represent approximately 9.5% of daily traffic while the afternoon peak hour represents approximately 9.9%. Lawrence Street peak hour traffic volumes represent approximately 6.5% and 9.0% of daily traffic in the morning and afternoon peak hours, respectively. Directional splits are high during peak hours; during the morning peak hour almost 60% of traffic on Park Street travels in the northbound direction while 61% of traffic in the afternoon peak hour travels in the southbound direction. On Lawrence Street during the afternoon peak hour as much as 71% of traffic flows in the westbound direction. These high directional splits are indicative of the study roadways lying within predominantly residential neighborhoods, where traffic patterns during the peak hours would be dominated by commuter traffic.

Table 2.1 - Summary of Observed ATR Traffic Data

Location	ADT Weekday	Volume, Weekday AM Peak Hour	Percent of Daily Volume	Volume, Weekday PM Peak Hour	Percent of Daily Volume
Park Street north of Lawrence Street	2,925	275	9.5%	290	9.9%
Lawrence Street east of Eagle Drive	865	55	6.5%	80	9.0%

Note: Data have been averaged over two days and rounded. September 2015 (ATR) data.

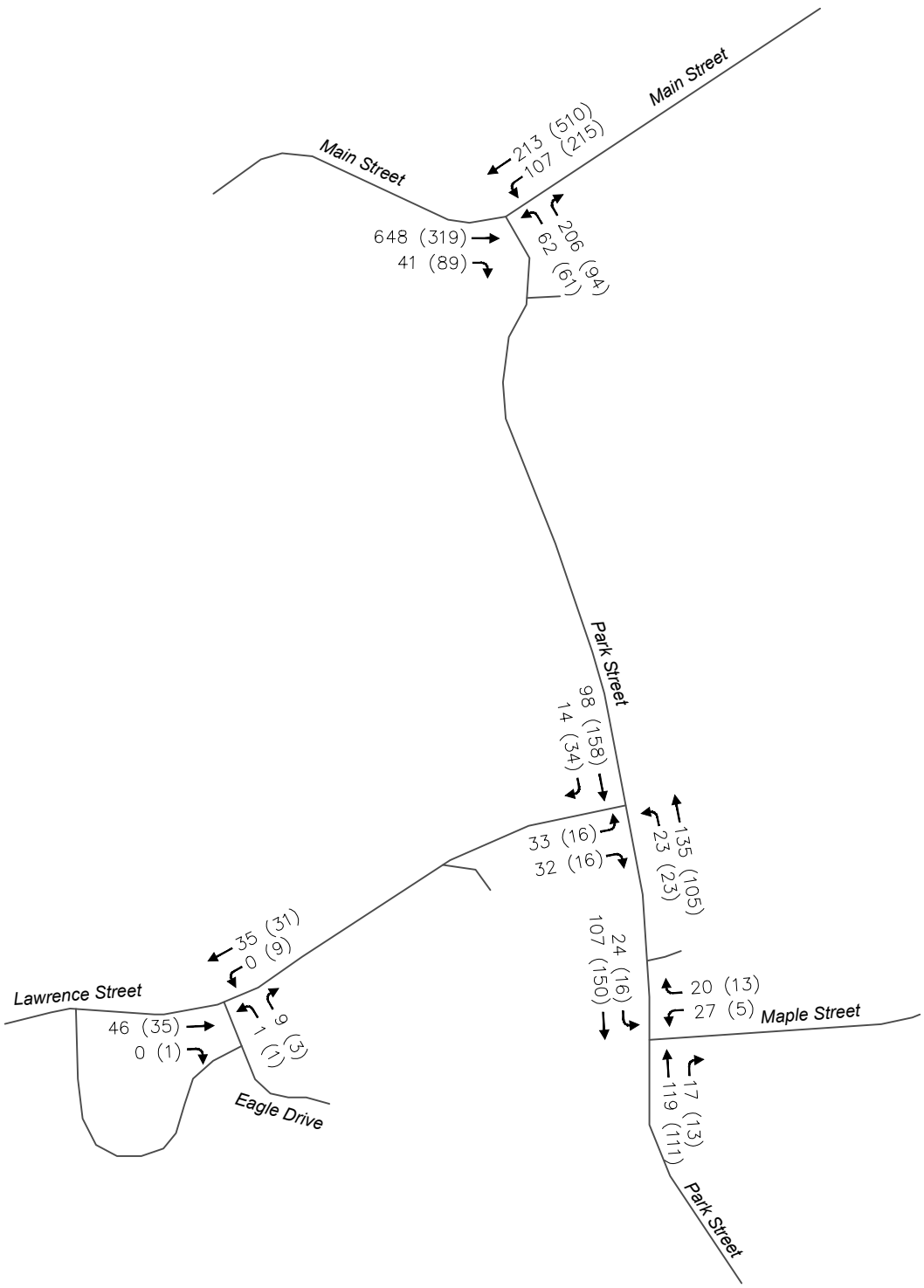
In developing the estimated average or typical volume conditions for analysis purposes, a review of permanent traffic count station data maintained by the Massachusetts Department of Transportation (MassDOT) was completed. This review determined the seasonal variation of traffic flow on roadways in the general region and serves as the basis of any appropriate seasonal adjustments. Data from the MassDOT permanent count stations 3321 (on I-495 in Milford south of Route 85), 6125 (on I-495 in Franklin north of Route 140), and Station 307 on Route 9 in Westborough were used. The seasonal variation of the local stations indicated that September average daily traffic volumes tended to be about two to three percent above of annual daily volumes; thus no seasonal adjustment factor was applied.

Figure 2 illustrates the 2017 existing weekday morning and afternoon peak hour traffic volumes. These volumes were created by using a conservative average of the above-1.0% annual growth rate that occurred at count stations 3321 and 6125 (an average of approximately 1.7%) to project forward the volumes initially collected in 2015. For reasons explained in the No-Build Traffic Volumes section, a general approach is to assume a maximum growth rate of 1.0% per year. The Appendix contains information on the use of background growth rates.

2.3 Crash Experience

Recent crash history for the study intersections for the most recent four-year period available (2011-2014) were reviewed as part of this study. Crash data presented in this report were obtained from the MassDOT Crash Record System (CRS). Out of the four study intersections in close proximity to the proposed site location, only the intersections at Park Street and Main Street and Park Street and Lawrence Street had reported crashes from 2011-2014. Table 2.2 summarizes the recent crash data.

As part of this safety review, the “crash rate”, measured in crashes per million entering vehicles (MEV) for the study intersections was also determined. The standard MassDOT Crash Rate Worksheet was used to determine the crash rate at each location. The calculation of the crash rate relates the number of accidents at a location to the amount of traffic that passes through the location. It is a more comprehensive measure for identifying potentially hazardous locations compared to simple averages as it takes into account volume, although crash rates can skew higher due to low volumes. The calculated rate is compared to the MassDOT District-wide averages. Intersections experiencing crash rates greater than the above averages are potentially experiencing an unusually high number or higher than expected number of crashes relative to traffic volumes at that particular location and may warrant further investigation or improvements. MassDOT District 5, which includes the Town of Norfolk, has an average crash rate of 0.58 crashes per MEV for unsignalized intersections.



LEGEND

AM (PM) Peak Hour Volumes

Figure 2

2017 Existing Weekday Peak Hour Traffic Volumes

Lawrence Street

Norfolk, MA

GREEN INTERNATIONAL AFFILIATES, INC.

CIVIL AND STRUCTURAL ENGINEERS

Table 2.2 - Summary of Reported Crash Data

	Park Street at Main Street				*Park Street at Lawrence Street*			
	2011	2012	2013	2014	2011	2012	2013	2014
Severity								
Property Damage	1		1	2			1	1
Injury		1						
Fatality								
Unknown								
Collision Type								
Rear End		1		1			1	
Angle	1		1	1				
Side Swipe								
Head On								
Single Vehicle								
Collision with Ped								
Collision with Bike								
Other/Unknown								1
Time of Day								
6:01 AM – 10:00 AM	1							
10:01 AM – 4:00 PM		1	1	2			1	
4:01 PM – 7:00 PM								
7:01 PM – 6:00 AM								1
Roadway Conditions								
Dry		1	1				1	1
Wet				2				
Snow/Ice	1							
Other/Unknown								
Season								
Dec-Feb	1							1
Mar-May				1				
June-Aug		1	1					
Sept-Nov				1			1	
Light Conditions								
Daylight	1	1	1	2			1	
Dawn/Dusk								
Dark (Unlit)								
Dark (Lit)								1
Unknown								
Totals	***1***	***1***	***1***	***2***	***0***	***0***	***1***	***1***
Annual Average Crashes	1.25				0.50			
Intersection Crash Rate	***0.26***				***0.46***			
MassDOT District 5 Average Crash Rate	0.58				0.58			

Green determined the crash rate for the intersection of Park Street/Main Street to be 0.26 crashes per million entering vehicles. This is lower than the MassDOT average of 0.58 for unsignalized intersections in District 5. The rate of 0.26 indicates that the crash frequency is well below what the expected average rate would generate. The existing overhead beacon installed years ago may contribute to this below-average rate. However, there is a visibility constraint related to traffic approaching the intersection from the west as

motorists travel up a grade and through a horizontal curve. There is a secondary existing pole-mounted beacon facing eastbound traffic located on the inside of the curve.

Green determined the crash rate for the intersection of Park Street/Lawrence Street to be 0.46 crashes per million entering vehicles. This is lower than the MassDOT average of 0.58 for unsignalized intersections in District 5. There were only two reported crashes at this intersection in three years. Both crashes involved property damage only. Based on the low number of crashes, no reported injuries and the good visibility at this intersection it can be concluded that there is not a safety deficiency at this intersection.

2.4 Existing Public Transportation Network

As part of this study, the presence of nearby public transit systems was identified to better understand the potential interaction among multiple modes of travel as well the impact that commuters driving to transit stations will have on the roadway network. Based on the review there is no fixed route public transportation serving the project area. There are regional commuter rail stations located in the towns of Franklin and Norfolk. While a number of Norfolk residents use the commuter rail to travel to/from their workplace, residents of the proposed development would have to drive to the station(s) given the distances. Because the assumed trip distributions for residents of the proposed development incorporated local traffic patterns, it is assumed that trip patterns to/from the regional rail stations was incorporated into the trip assignment of peak hour traffic.

3.0 PROBABLE IMPACTS OF THE PROJECT

The impact of the proposed residential development project on the roadway network within the study area was evaluated and the results are described in this section. This study used the year 2024 for the future analysis year, which represents a seven-year permitting and build-out timeframe from the present condition and is consistent with current MassDOT guidelines for traffic studies.

3.1 No-Build Traffic Volumes

A year 2024 No-Build traffic volume network was developed by identifying potential area-wide background traffic volume growth and known specific nearby development projects that could contribute to traffic flow on the 2024 study network.

3.1.1 Background Traffic Growth

Traffic growth and historical traffic count trends for the project's analysis area have been reviewed. Based upon review of local count stations (the same as those used for seasonal data), an annual growth rate of one percent (1%) per year for seven years was used to forecast future roadway volumes. Although average annual growth rates on these roadways may be above one percent, these large limited-access roadways also collect and may reflect an increase in long-distance traffic; regional traffic volumes are generally not expected to increase at more than one percent per year. Also, these rates would presumably account for some of the more remote growth in the region as well as potential nearby smaller residential and business growth that could result in added traffic through the study area. The count station data can be found in the Appendix.

3.1.2 Specific Development Projects

In addition to the application of the general background growth rate, traffic generated by other specific development projects was also taken into consideration. Through research Green reviewed several development projects in the vicinity of the project. Some developments are not expected to contribute a significant amount if any site trips to use Lawrence Street, Main Street, or Park Street, and any of these trips are assumed to be included in our background growth rate. Site-specific estimates developed for these projects were added to the No-Build networks. These specific development projects included:

Table 3.1 - Summary of Specific Development Projects

Project	Location		Type	Size	Expected impact on Study Area	Status
Pondville Estate	Norfolk	Dedham Street	Mixed Used Development	220 Townhouses, 150 apartments, 180 assisted living housing units, 16,000 sq. ft. retail and 16,000 sq. ft. office space	No	Is Proposed
Boyde's Crossing		Main Street	Residential Development	40 Condominium Units	Yes	Is Proposed
Eagle Brook Village	Wrentham	Route 140, near Franklin Border	Mixed Used Development		Yes	Phase1 Completed, occupied 2014
Park Place		Off Park Street	Residential Development		Yes	Is Proposed
Rose Gate		Madison Street near Route 1, I 495& Plainvile	Apartment Complex	200 units	No	Is Proposed
Planet Chrysler Jeep Dodge Dealership	Franklin	400 East Central Street	Commercial Expansion		No, more likely to use Chestnut	Under Construction
Bowling Alley		300 East Central Street	Mixed-Commercial Development	121,000 sq. ft.	No	Is Proposed
Acorn Hill Estate		Acorn Place	Residential Subdivision	5 Single Family Houses	No	Is Proposed

3.1.3 No-Build Traffic Volumes

Based on the above noted research, the year 2024 No-Build peak hour traffic volume projections were developed by adding seven (7) years' background traffic growth of one percent annually plus the site specific volumes projected to result from the proposed Boyde's Crossing, Eagle Brook Village, and Park Place developments. The projected year 2024 No-Build traffic volumes projected for the weekday morning and afternoon peak hours at the study intersections are shown in Figure 3.

3.2 Proposed Project Description

This proposed 40B residential development project evaluated in this study is situated in Norfolk, Massachusetts is proposed to consist of 48 townhouse apartments. The apartments are proposed to be low-rise, garden-style apartments. It is part of a larger overall development that also includes 148 single family houses that are expected to be advanced through the 40B program as well. Access to the apartments is proposed to occur at a site drive located along Lawrence Street approximately 500 feet west of Eagle Drive; a second project site drive is proposed to be approximately opposite of Cranberry Meadow Road. The site is approximately 2.2 miles southwest of the Norfolk town center, 3.6 miles east of Interstate 495 in Franklin,

and 6.8 miles west of Interstate 95 in Foxborough. The MBTA commuter rail line runs northwest of the project site. The surrounding area of the proposed development is primarily residential in character with a significant amount of tree cover.

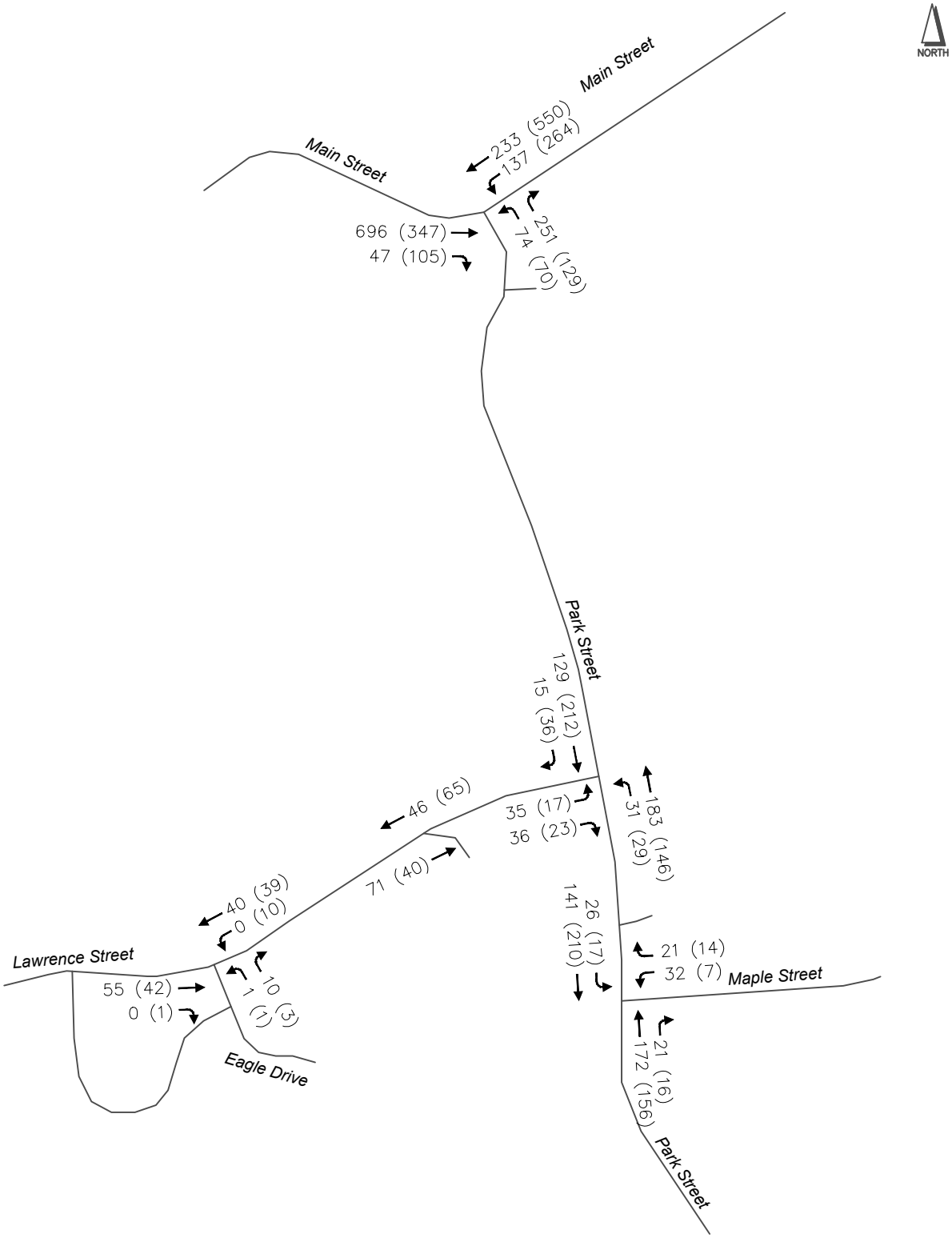
In this section, the traffic forecasts related to the development are described. An estimate of traffic to be generated by the proposed development project was completed and assigned to roadways/intersections within the study area to develop the Build traffic condition, based upon the year 2024 No-Build traffic volume network.

3.3 Site Trip Generation

In order to estimate the number of trips that could be generated by the proposed development, statistics published by the Institute of Transportation Engineers (ITE) in *Trip Generation*[1] for similar land uses were examined. The ITE trip generation statistics represent compilations of data from studies/projects throughout the United States collected over the past 40+ years on trip generation characteristics for different types of land uses. The data have been compiled to provide transportation analysts with guidelines in forecasting daily and peak hour volumes for the specified use.

Based on a review of the ITE database and the residential-related models, LUC 221 –Low-Rise Apartments was selected as the most similar to the proposed development project. Based on 100 garden or low-rise townhouse apartments proposed for this project, the total estimated trips generated by the project were estimated and are presented in Table 3.2. Detailed trip generation calculations for the proposed development are included in the Appendix.

[1] Institute of Transportation Engineers, Trip Generation, 9th Edition, Washington, D.C., 2012.



LEGEND

AM (PM) Peak Hour Volumes

Figure 3
2024 Weekday Peak Hour Traffic Volumes
No-Build Scenario
Lawrence Street
Norfolk, MA

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Table 3.2 - Summary of Estimated Site Trip Generation

Apartment Component Only

TIME	ENTERING	EXITING	TOTAL
Weekday Daily	207	207	414
AM Peak Hour	5	22	27
PM Peak Hour	29	15	44

Source: ITE Trip Generation, 9th Edition, 2012; LUC 221

Total Site Including Single Family Housing

TIME	ENTERING	EXITING	TOTAL
Weekday Daily	960	960	1920
AM Peak Hour	34	106	140
PM Peak Hour	194	71	194

Source: ITE Trip Generation, 9th Edition, 2012; LUC 210

The apartment units, based on the LUC 221 model, are expected to generate a total of 414 additional vehicle trips on the surrounding roadway network over the course of an average weekday. The weekday morning peak hour is expected to generate a total of 27 trips, and the weekday afternoon peak hour is expected to generate 44 trips.

The proposed development is expected to generate a total of 1,920 additional vehicle trips in the Full-Build condition over the course of an average weekday. The weekday morning peak hour is expected to generate a total of 140 trips, and the weekday afternoon peak hour is expected to generate 194 added total trips. Full-build construction and occupation will result in about four times the generated volume that would result from construction of just the apartment complex.

3.4 Site Trip Distribution/Assignment

Once the number of trips estimated to be generated by the development were determined, the trips were assigned to the site driveways and study area roadways based on trip distribution patterns determined for the project. An analysis of directional distribution of generated trips to and from the site was completed.

For this specific analysis, the trip distributions pattern was determined based on existing traffic patterns. The predominant land use along Park Street, Maple Street, Lawrence Street, and the side streets along Park Street is single family residential units. Park Street itself lies close enough to numbered routes such as 140 and 1A that it is unlikely to be used much by through traffic aside from residences immediately north and south of it. Hence, it can be assumed that traffic patterns on Park Street are representative areas of residence-to-work and work-to-residence trip distributions in the area. Figure 4 shows the trip distribution percentages within the study area for the proposed apartment project. Trip distribution percentages for the adjacent proposed single family housing project can be found in the Appendix.

The apartment complex portion of the site is proposed to be served by one site drive. Hence, trips generated by the apartment complex are assigned only to the site drive proposed near Eagle Drive. A second site drive further east approximately opposite of Cranberry Meadow Road is proposed that would be used by many of the residents of the single family housing portion of the project. However, it is assumed that residents of

the single family houses in the western part of the site will use the western site drive along with the apartment complex tenants.

3.5 Build Traffic Volumes

Trips were estimated for the proposed development for two future build conditions. The first condition, the proposed Apartments, assumes only the apartment portion of the project is constructed and fully occupied. The second condition, Full-Build, assumes that both the single family housing and apartment portions of the site are constructed and fully occupied. For both conditions, the site-generated trips were assigned to the site driveways and the study area roadways using the trip distribution percentages discussed above. Peak hour site traffic volumes were then added to study area traffic volumes plus the background growth adjustment and the trips generated by the specific developments in the vicinity of the project site. This resulted in the 2024 Full-Build and 2024 Build – Apartment Build condition traffic networks. The number of new trips and the total roadway volumes during the weekday peak hours generated by the 2024 Build – Apartments scenario are shown in Figures 5 and 6, respectively. The number of new trips and the predicted total roadway volumes in the Full-Build scenario are presented in Figures 7 and 8, respectively. Further details on volume assignments are included in the Appendix.

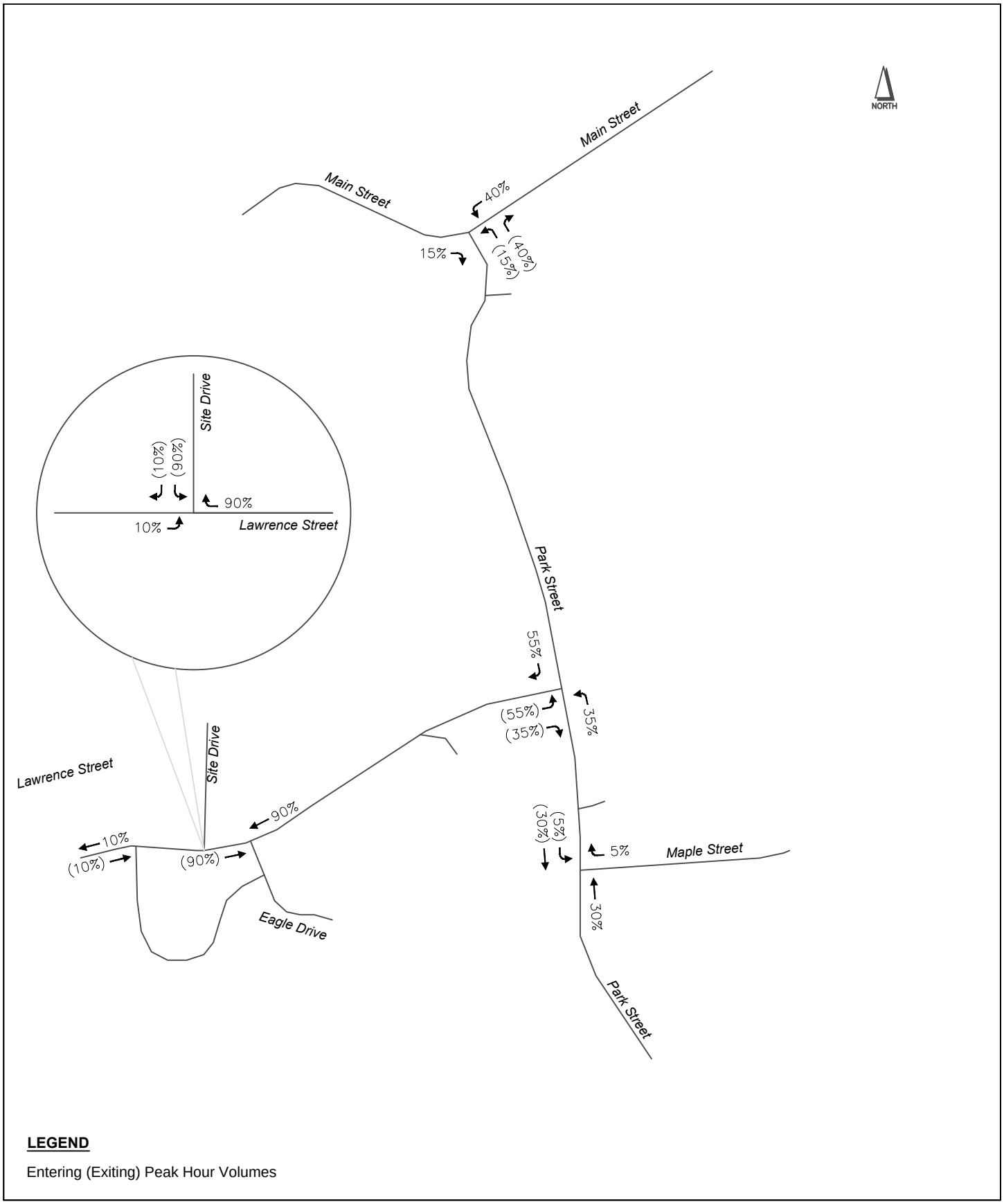

Figure 4
Estimated Trip Distribution
Apartments
Lawrence Street
Norfolk, MA

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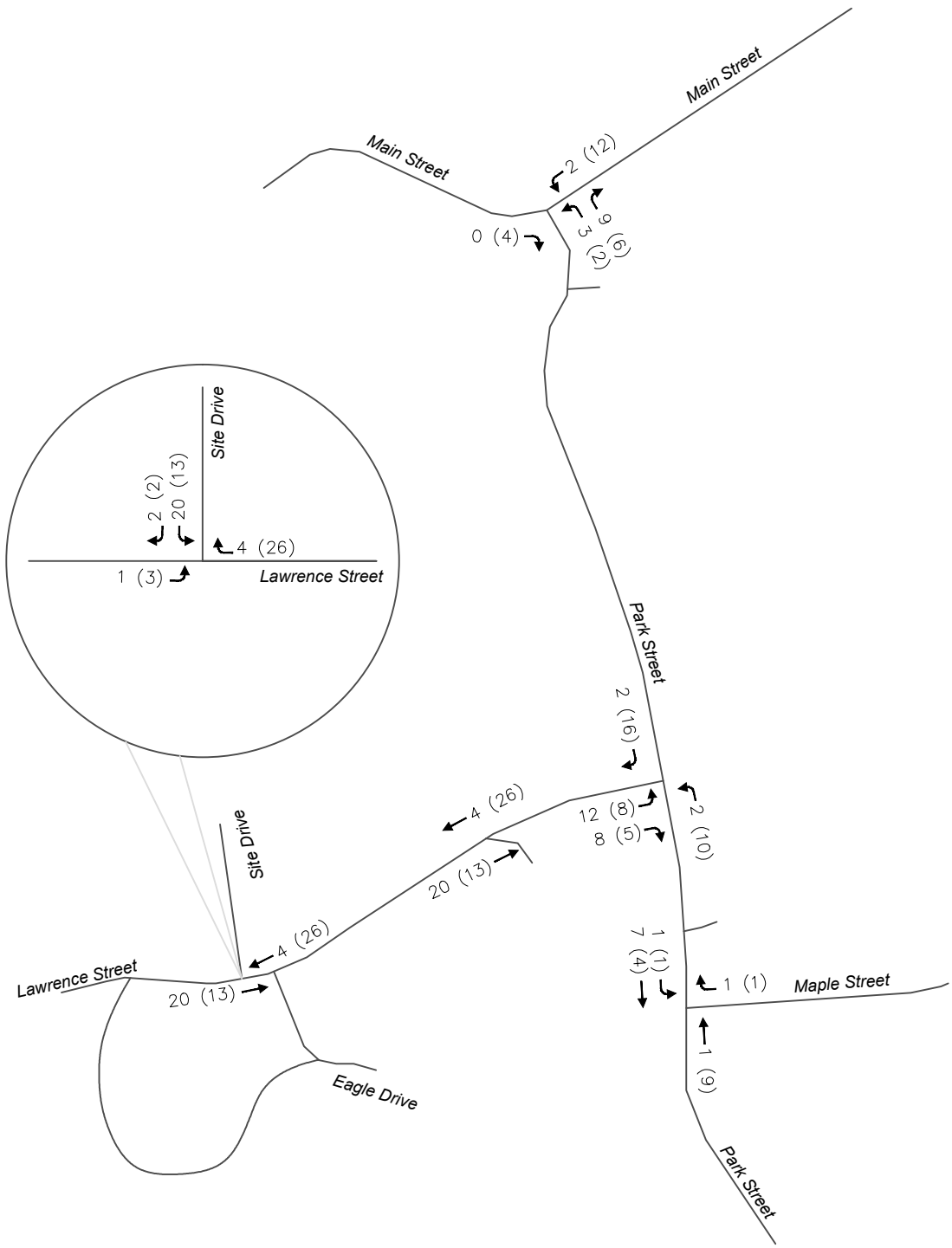

LEGEND

AM (PM) Peak Hour Volumes

Figure 5
Estimated Site-Generated Trips
Apartments
Lawrence Street
Norfolk, MA

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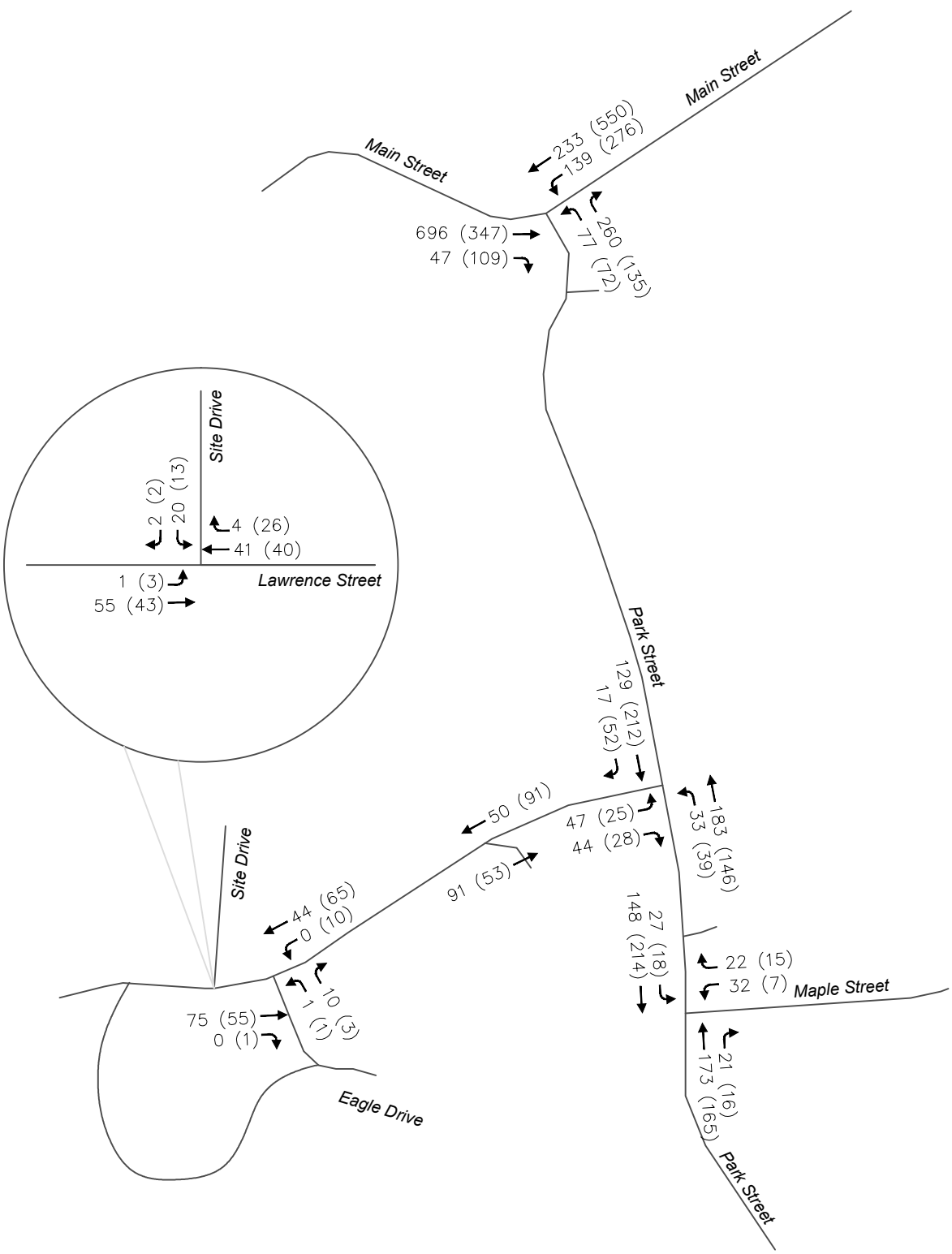

LEGEND

AM (PM) Peak Hour Volumes

Figure 6
2024 Weekday Peak Hour Traffic Volumes
Build - Apartments
Lawrence Street
Norfolk, MA

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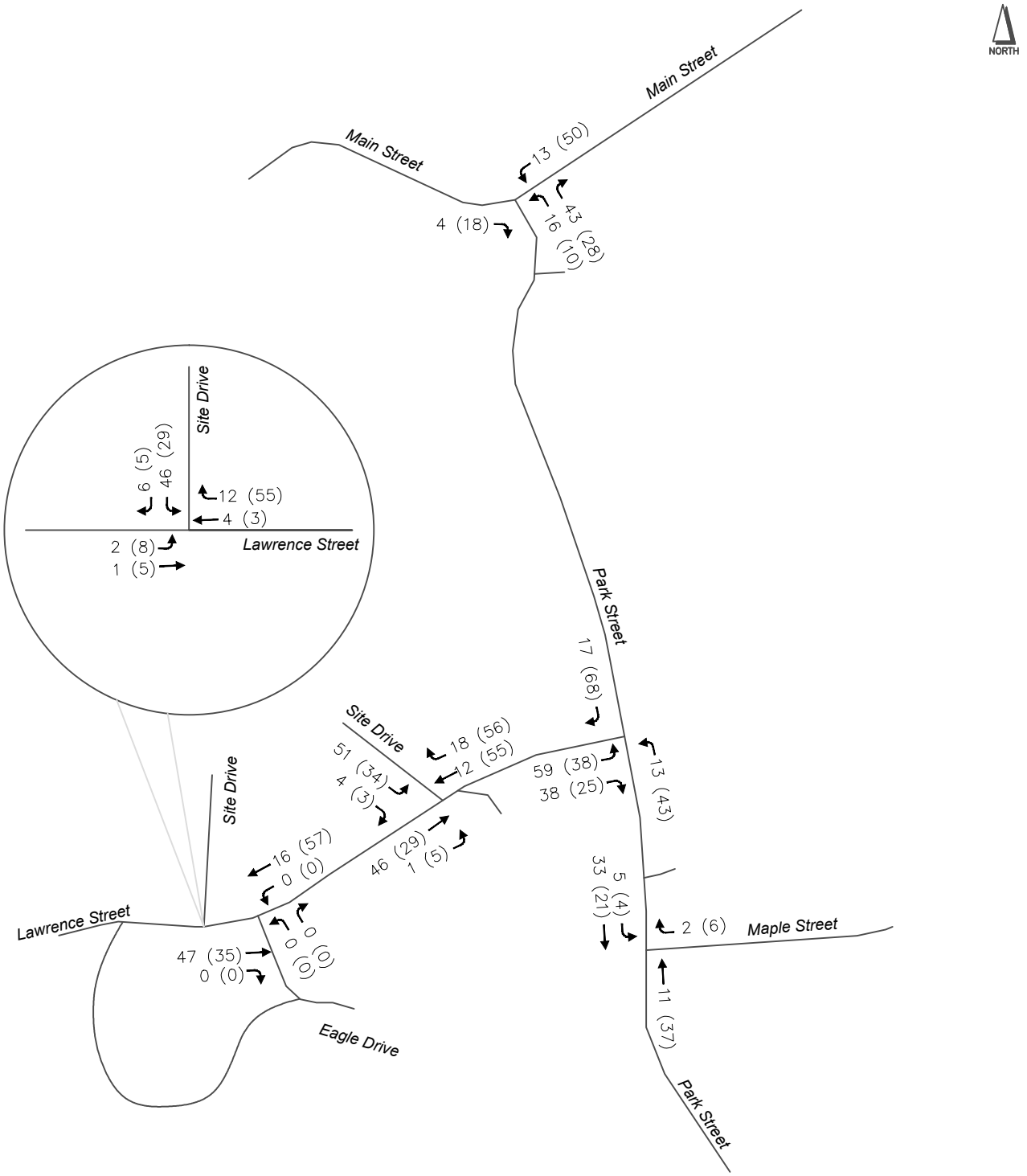

LEGEND

AM (PM) Peak Hour Volumes

Figure 7
Estimated Site-Generated Trips
Full-Build Scenario
Lawrence Street
Norfolk, MA

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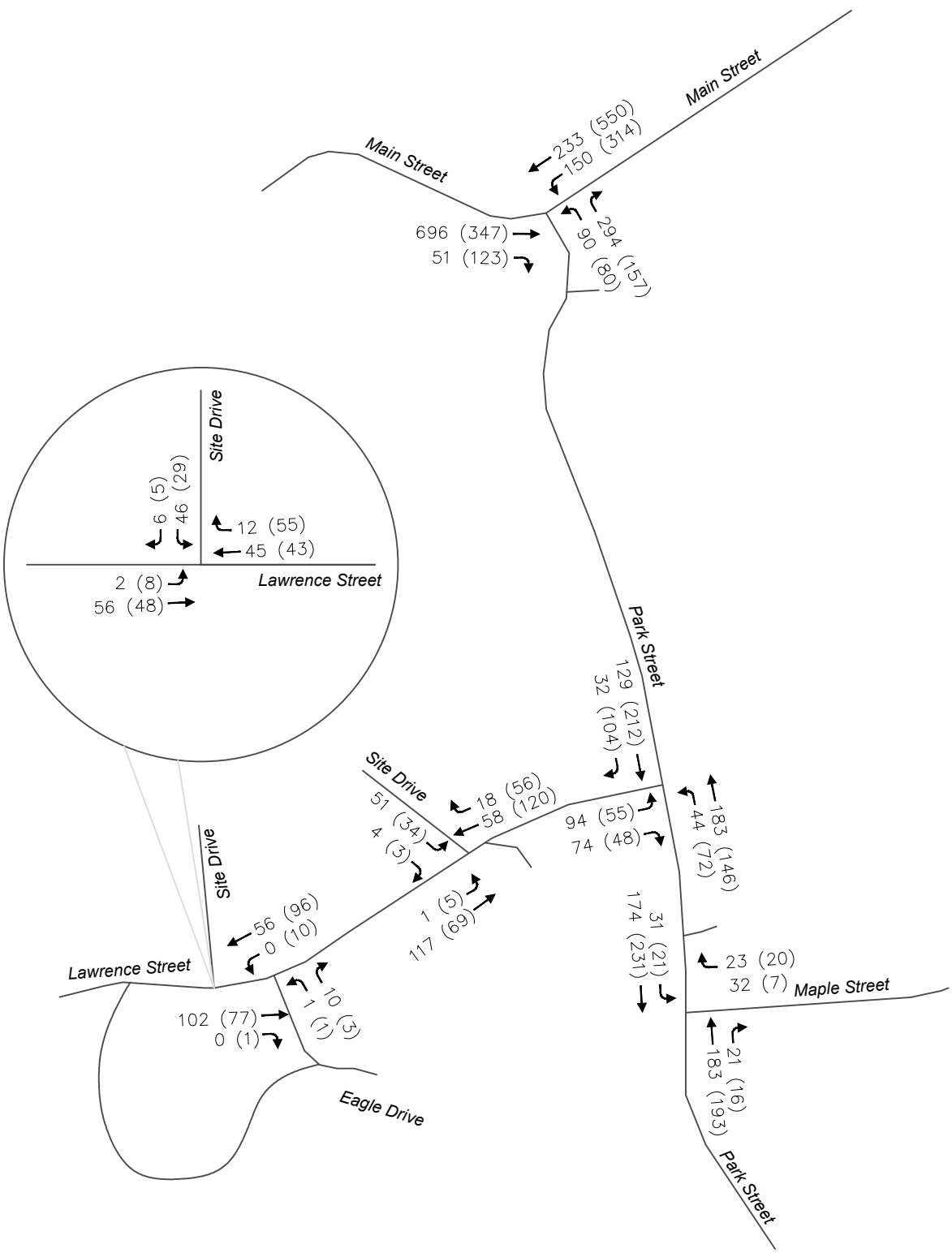

LEGEND

AM (PM) Peak Hour Volumes

Figure 8
2024 Weekday Peak Hour Traffic Volumes
Full-Build Scenario
Lawrence Street
Norfolk, MA

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4.0 ANALYSIS

Previous sections of this report described the current conditions of the study intersections and the development of the 2024 No-Build and 2024 Build traffic volume networks, including the site-generated trip forecasts. Included in this section is an examination of the volume changes, intersection capacity analyses for the study intersections and an analysis of available sight distances.

4.1 Traffic Volume Increases

Traffic impacts to the surrounding roadway network are not expected to cause new operational issues. None of the study intersections are expected to experience a significant change in Level of Service relative to the No-Build conditions during either the morning or afternoon peak hours. With construction of the apartment component, roadway volumes on Park Street and Main Street are predicted to increase less than 25 drivers during either peak hour (Table 4.1). With the full construction and occupation of the site, roadway volumes on Main Street are expected to remain small corresponding to two to seven percent, while volumes on Park Street are expected to increase by a moderate amount with less than 60 drivers south of Maple Street and about 76-106 drivers north of Lawrence Street during the peak hours. The intersection capacity analysis has shown that the abutting roads have the capacity to accommodate added vehicles due to the project and that traffic operations are not substantially altered as a result of full site construction.

Table 4.1 - Summary of Estimated Roadway Traffic Increases

Apartment Component Only

	AM Peak Hour			PM Peak Hour		
	No-Build	Build	No. Increase	No-Build	Build	No. Increase
Park Street						
South of Maple Street	366	374	8	389	402	13
North of Lawrence Street	362	376	14	411	435	24
Main Street						
East of Park Street	1317	1328	11	1290	1308	18
West of Park Street	1050	1053	3	1072	1078	6

Full Site Construction

	AM Peak Hour			PM Peak Hour		
	No-Build	Full-Build	No. Increase	No-Build	Full-Build	No. Increase
Park Street						
South of Maple Street	366	410	44	389	447	58
North of Lawrence Street	362	438	76	411	517	106
Main Street						
East of Park Street	1317	1373	56	1290	1368	78
West of Park Street	1050	1070	20	1072	1100	28

4.2 Intersection Capacity Analysis

The three study intersections were examined with regard to flow rates, capacity and delay characteristics to determine the Level of Service (LOS), using the methodology defined in the Highway Capacity Manual (HCM)[2] for the existing and future (No-Build and Build) traffic conditions. Level of Service is an indicator of operating conditions which occur on a given roadway feature while accommodating varying levels of traffic volumes. It is a qualitative measure that accounts for a number of operational factors including roadway geometry, speed, traffic composition, peak hour factors, travel delay, freedom to maneuver and driver expectation. When all of these measures are assessed and a Level of Service is assigned to a roadway or intersection, it is equivalent to presenting an "index" to the operational qualities of the section under study. Level of Service is classified into six levels that are designated 'A' through 'F' based on the control delay ranges they fall under. Additionally, a movement with a volume-to-capacity (v/c) ratio of over 1.00 also has a LOS of 'F', regardless of delay. These are presented in Table 4.2 for both signalized and unsignalized intersections.

In practice, any given roadway/intersection may operate at a wide LOS range depending upon time of day, day of week or period of year. It should be noted that for unsignalized intersections, the Level of Service is not computed for the intersection as a whole. Instead, the level of service is determined by the computed or measured control delay for each individual critical movement (typically the side street movements).

Table 4.2 - Level of Service Criteria for Unsignalized Intersections

LEVEL OF SERVICE	UNSIGNALIZED INTERSECTIONS CONTROL DELAY RANGE (SEC)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50 or v/c > 1.00

The study intersections were evaluated using the Synchro 9 computer software to complete the analysis for the unsignalized study intersections. Using existing roadway features and the intersection controls, traffic operations at the study intersections were evaluated for existing as well as predicted 2024 conditions. Analysis results are presented in Table 4.3 and Table 4.4 for the morning and afternoon weekday peak hours, respectively.

The Level of Service analysis indicated the following:

- Most of the approaches at the study intersections operate well during the peak hours in each scenario, operating at LOS 'A' or 'B' and having 95th-percentile queues less than 20 feet (less than one vehicle-length)
- The proposed apartment unit project does not result in any significant changes from the 2024 No-Build condition and no new significant deficiencies are created as a result of the project.
- The proposed site drives are expected to operate with minimal delays to vehicles entering or exiting the site in both Build conditions.

[2] Transportation Research Board, of the National Academies, Highway Capacity Manual 2010, Washington, D.C., 2010.

- The Main Street/Park Street intersection exhibits long delays for vehicles exiting Park Street in the Build conditions, in particular for those turning left onto Main Street. However, the condition exists today and will not significantly change between the No-Build or either of the Build scenarios. It is noted that the Park Street approach is constrained in terms of modification due to the nearby bridge over the MBTA railroad.
- The analysis has shown that the abutting roads have the capacity to accommodate added vehicles due to the project.

In summary, the analysis has shown that the proposed development project will facilitate motorists to enter and exit the site in a safe and effective manner, with manageable delays for entering and for exiting motorists. Further capacity analysis may be warranted at the intersection of Main Street at Park Street irrespective of the proposed development.

Table 4.3 - Summary of Intersection Capacity Analysis - Weekday AM Peak Hour

	2015 Existing Conditions				2024 No-Build Conditions				2024 Build – Apartment Conditions				2024 Full-Build Conditions			
	v/c	Delay	LOS	95th % Queue (ft.)	v/c	Delay	LOS	95th % Queue (ft.)	v/c	Delay	LOS	95th % Queue (ft.)	v/c	Delay	LOS	95th % Queue (ft.)
Main Street at Park Street																
Main Street WB	0.12	9.9	A	10	0.17	10.4	B	15	0.17	10.4	B	15	0.19	10.5	B	18
Park Street NB	0.80	47.9	E	170	>1	>80	F	343	>1	>80	F	378	>1	>80	F	518
Park Street at Lawrence Street																
Lawrence Street EB	0.08	10.1	B	8	0.10	10.7	B	10	0.13	11	B	13	0.27	12.5	B	28
Park Street NB	0.01	7.6	A	3	0.02	7.7	A	3	0.02	7.7	A	3	0.03	7.7	A	3
Park Street at Maple Street																
Maple Street WB	0.07	10.4	B	8	0.10	11.4	B	8	0.10	11.5	B	10	0.11	11.9	B	10
Park Street SB	0.02	7.7	A	3	0.02	7.9	A	3	0.02	7.9	A	3	0.03	7.9	A	3
Lawrence Street at Eagle Drive																
Lawrence Street WB	-	0	A	0	-	0	A	0	-	0	A	0	-	0	A	0
Eagle Drive NB	0.01	8.8	A	0	0.01	8.9	A	0	0.01	9	A	0	0.01	9.2	A	0
Lawrence Street at Western Site Drive																
Lawrence Street EB	-	-	-	-	-	-	-	-	0.00	7.3	A	0	0.00	7.3	A	0
Western Site Drive SB	-	-	-	-	-	-	-	-	0.02	9.2	A	3	0.06	9.3	A	5
Lawrence Street at Eastern Site Drive																
Lawrence Street EB	-	-	-	-	-	-	-	-	-	0	A	0	0.00	7.4	A	0
Eastern Site Drive SB	-	-	-	-	-	-	-	-	-	0	A	-	0.07	9.9	A	5

* No volumes were recorded during the peak hour

Table 4.4 - Summary of Intersection Capacity Analysis - Weekday PM Peak Hour

	2015 Existing Conditions				2024 No-Build Conditions				2024 Build Apartment Conditions				2024 Full-Build Conditions			
	v/c	Delay	LOS	95th % Queue (ft.)	v/c	Delay	LOS	95th % Queue (ft.)	v/c	Delay	LOS	95th % Queue (ft.)	v/c	Delay	LOS	95th % Queue (ft.)
Main Street at Park Street																
Main Street WB	0.19	8.9	A	18	0.25	9.4	A	25	0.26	9.5	A	28	0.30	9.2	A	33
Park Street NB	0.69	48.8	E	113	>1	>80	F	263	>1	>80	F	300	>1	>80	F	443
Park Street at Lawrence Street																
Lawrence Street EB	0.04	10.2	B	3	0.06	11.1	B	5	0.09	11.3	B	8	0.20	13.4	B	20
Park Street NB	0.01	7.7	A	3	0.02	7.9	A	3	0.03	7.9	A	3	0.06	8.2	A	5
Park Street at Maple Street																
Maple Street WB	0.02	9.4	A	3	0.03	10	B	3	0.03	10.1	B	3	0.04	10.3	B	3
Park Street SB	0.01	7.5	A	0	0.01	7.6	A	0	0.01	7.6	A	0	0.01	7.7	A	3
Lawrence Street at Eagle Drive																
Lawrence Street WB	0.00	7.4	A	0	0.00	7.3	A	0	0.00	7.4	A	0	0.00	7.4	A	0
Eagle Drive NB	0.00	8.7	A	0	0.00	9	A	0	0.00	9.1	A	0	0.00	9.4	A	0
Lawrence Street at Western Site Drive																
Lawrence Street EB	-	-	-	-	-	-	-	-	0.00	7.4	A	0	0.00	7.4	A	0
Western Site Drive SB	-	-	-	-	-	-	-	-	0.08	9.1	A	3	0.04	9.4	A	3
Lawrence Street at Eastern Site Drive																
Lawrence Street EB	-	-	-	-	-	-	-	-	-	0	A	0	0.00	7.6	A	0
Eastern Site Drive SB	-	-	-	-	-	-	-	-	-	0	A	-	0.05	10.1	B	5

* No volumes were recorded during the peak hour

4.3 Sight Distance Analysis

Adequate sight distance is an important safety consideration at intersections. Sight distances were reviewed at each of the two proposed site drive locations. Stopping sight distance (SSD) is the distance required for an approaching driver (with an eye height of 3.5 feet) to perceive and stop in time to avoid a collision with an object 2 feet high in the roadway. The values are based on a perception and reaction time of 2.5 seconds and braking distance required under wet, level pavements. Corner or intersection sight distance (ISD) is based upon the time required to perceive, react, and complete desired exiting maneuver from a driveway once the driver decides to execute the maneuver. Adjustments for the grade of the roadway are applied to both SSD and ISD if appropriate. SSD is considered the most critical of the two and relates specifically to safety.

Values for ISD represent the time to (1) turn left or right, in addition to accelerating to the operating speed of the roadway, without causing approaching vehicles to reduce speed by more than 10 miles per hour (mph), and (2) upon turning left, to clear the near half of the intersection without conflicting with the vehicles approaching from the left. ISD is more related to operations and to some degree, the convenience or inconvenience of oncoming motorists. The minimum criteria are defined by the American Association of State and Highway and Transportation Officials (AASHTO)[3]. As indicated by AASHTO, if the available ISD meets or exceeds the minimum SSD criteria, then there is adequate safe sight distance available for motorists to avoid collisions. A criterion for calculating minimum required sight distances can be established based on operating speed, the speed at or under which most motorists (85th-percentile) actually travel along a particular portion of roadway.

The posted speed limit on Lawrence Street is 30 mph in the vicinity of the project site. Mean average speeds on Lawrence Street between Cranberry Meadow Road and Eagle Drive were observed to be 30-31 mph, but 85th-percentile travel speeds on Lawrence Street were observed to be 36 mph in each travel direction. A travel speed of 35 mph and the posted speed of 30 mph were used in the sight distance analysis for the proposed site driveway intersections with Lawrence Street.

The SSD and ISD at the proposed site driveway locations were measured in the field and compared to minimum and desirable distances; Table 4.5 summarizes the results of the evaluation. Although most of the sight distances within the study area exceed the minimum required distances as calculated per AASHTO standards, several existing sight distances in the study area at the proposed project site driveways were found to be less than the minimum required distance.

The intersection of the west site driveway (near Brett's Farm Road) at Lawrence Street meets SSD, but ISD is blocked by vegetation along the northern side of Lawrence Street. Vegetation within the right-of-way obscures ISD looking to the left and right exiting from the proposed sight driveway. ISD is also limited looking east (to the left) exiting this proposed site driveway by the horizontal curve present on Lawrence Street. However, it is noted that the builder owns the land at the horizontal curve location and it is anticipated that clearing the vegetation present at the curve will improve ISD.

Vegetation within the right-of-way hinders ISD looking west (to the right) exiting the east site driveway (near Cranberry Meadow Road) at its intersection with Lawrence Street, although minimum ISD at this location is met for the posted travel speed. ISD could be improved by vegetation trimming (to remove blockages). Construction of these proposed site driveways would entail vegetation clearing and roadside regrading, so

[3] American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets, Washington, D.C., 2011.

it is anticipated that the minimum required ISDs at the proposed site drives would all be met after construction.

Table 4.5 - Summary of Sight Distance Analysis

LOCATION	STOPPING SIGHT DISTANCE (FT.)			INTERSECTION SIGHT DISTANCE (FT.)				
	MEASURED	MINIMUM REQUIRED		MEASURED	MINIMUM REQUIRED		DESIRABLE	
Proposed Site Drive at Lawrence St, west of Brett's Farm Rd.		*Speed (MPH)*			*Speed (MPH)*		*Speed (MPH)*	
		30	*36*		*30*	*36*	*30*	*36*
Lawrence St, Approaching from East	500	205 [a]	265 [a]	225	205 [a]	265 [a]	335	400
Lawrence St, Approaching from West	425	190 [b]	250 [b]	250	190 [b]	250 [b]	335	400
Proposed Site Drive at Lawrence St, at Cranberry Meadow Rd.		*Speed (MPH)*			*Speed (MPH)*		*Speed (MPH)*	
		30	*36*		*30*	*36*	*30*	*36*
Lawrence St, Approaching from East	440	185 [c]	235 [c]	460	185 [c]	235 [c]	335	400
Lawrence St, Approaching from West	350	225 [d]	300 [d]	150	225 [d]	300 [d]	335	400

Notes: a – Calculated assuming a downslope along Lawrence Street of 1.5 percent
b – Calculated assuming an upslope along Lawrence Street of 3.2 percent
c – Calculated assuming an upslope along Lawrence Street of 8.1 percent
d – Calculated assuming a downslope along Lawrence Street of 8.6 percent

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The previous sections of this traffic report described the analysis procedures, assumptions and results of this traffic study. The analyses demonstrate that the roadways and intersections within the study area are able to accommodate the additional traffic associated with the proposed development project. The following summarizes the traffic analysis:

- The existing roads serving the project experience low volumes and have the capacity to accommodate the added vehicles.
- There are no major safety issues currently exhibited at the study intersections based on review of historical crash experience.
- The apartment complex component with 48 units of the overall development is a relatively low generator of trips with 27 and 44 vehicles during the AM and PM peak hours, respectively and 414 trips throughout the course of a weekday.
- With full occupancy of the proposed development project under either Build scenario, motorists using the nearby neighborhood intersections and site drives will continue to experience relatively short delays during the weekday peak hours.
- The analysis showed that at either site drive, traffic can efficiently enter and exit the site. Level of Service is expected to be 'A' during the weekday morning and afternoon peak hours.
- Motorists will continue to experience long delays and 95th percentile queues on the Park Street approach to the intersection with Main Street as the Park Street approach changes from LOS 'E' to LOS 'F' during the morning peak hour and remains at LOS 'F' during the afternoon peak hour under each No-Build scenario. Capacity at the northbound approach is exceeded during the afternoon peak hour in the No-Build, Build, and Full-Build scenarios on account of the large proportion of traffic exiting left from Park Street.
- One intersection sight distance (ISD) in the study area at the proposed project site driveways was found to be less than the minimum required distance for the posted speed limit. For 85th-percenile speeds, the ISD's at two locations were found to be less than the minimum required distance.
- Drivers exiting the western site driveway (near Eagle Drive) have ISD and SSD constrained by vegetation within the right-of-way and a horizontal curve looking to the left. However, it is noted that the project proponent owns much of the lot at the horizontal curve location and it is anticipated that clearing the existing vegetation present at the curve will improve ISD and SSD.
- Vegetation within the right-of-way hinders ISD looking to the right exiting the eastern site driveway (near Cranberry Meadow Road). ISD could be improved by vegetation trimming (to remove blockages).

5.2 Recommendations

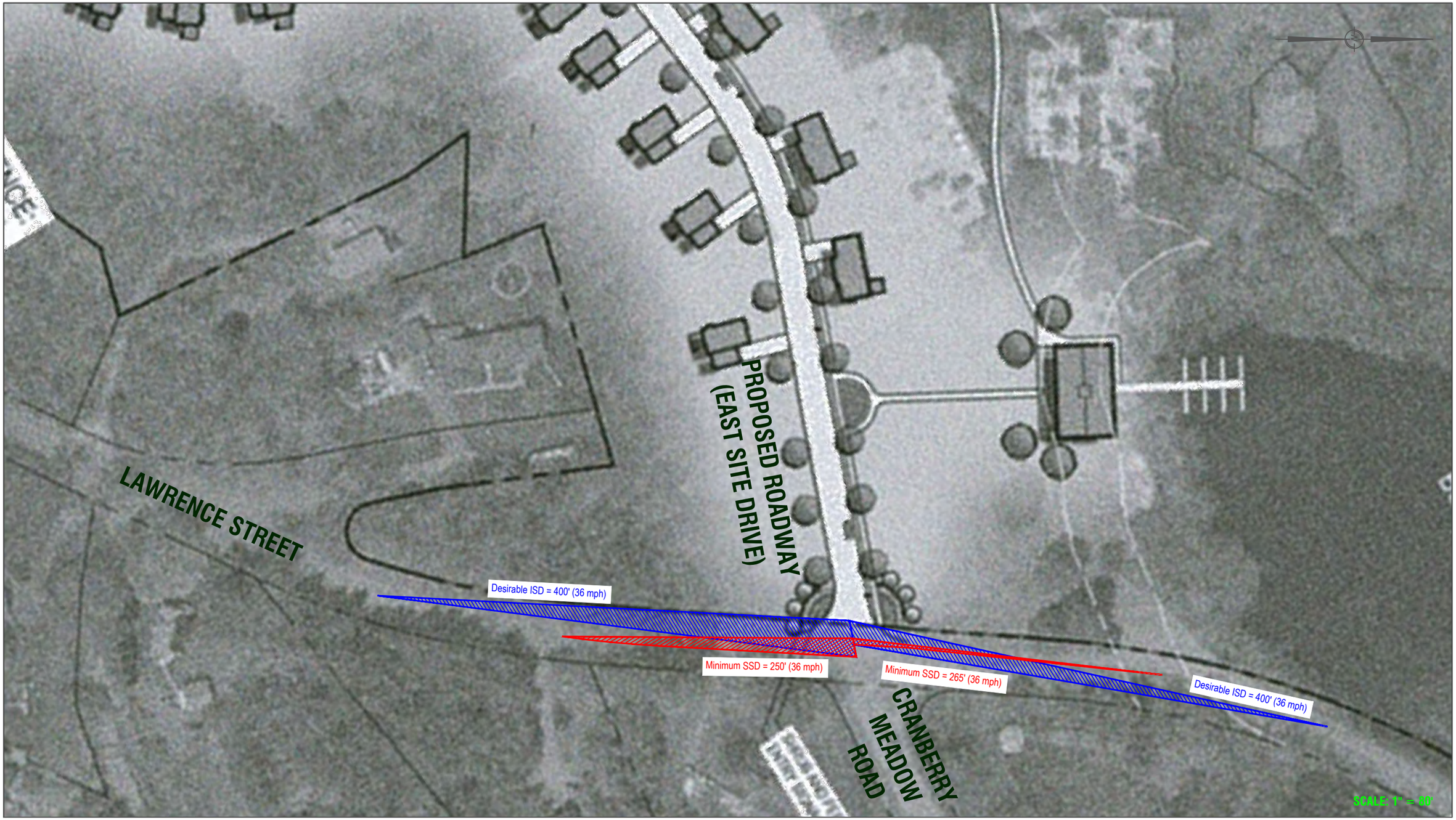
While the analyses show that the proposed project can be accommodated on the study area network, several recommendations have been made to enhance the transportation system. The proposed actions are as follows:

- Any proposed landscaping and signage should be low enough and/or set back sufficiently so as not to create any sight distance constraints at the proposed site drives.

- Roadside vegetation within the right-of-way should be selectively cleared and trimmed and some terrain should be regraded to improve existing intersection sight distances.
    - Vegetation along the north side of Lawrence Street, between Eagle Drive and Brett's Farm Road and between the proposed eastern site drive and #25 Lawrence Street, should be trimmed and cut within the public right-of-way and, if the project is approved, the project property to improve sight distances.
    - Additional benefits would be gained by regrading the terrain alongside parts of Lawrence Street near the proposed site drives. The small hill just east of the proposed location of the western site drive is proposed to be partially flattened by the project proponent, taking care not to affect the property at #51 Lawrence Street. Other roadside regrading near the proposed site drives would also improve ISD.
    - With these actions implemented, minimum safety criteria for sight distance is expected to be exceeded. Figures 9 and 10 show the intersection sight triangles for the 85th-percentile travel speed; trimming and vegetation clearing are recommended within the right-of-way within and along these triangles.
- Repave Lawrence Street to be a consistent roadway width after installing the proposed water main.
- Advance warning signage should be considered for the eastbound approach to the intersection of Park Street and Main Street regardless of the proposed development project. Because of the sharp, wooded curve on Main Street east of Park Street, the signage could have LED lighting installed around the sign border(s), and solar panels could provide power for the lights.
- As a result of this project and considering the added traffic volumes and the existing crash rate at the intersection of Lawrence Street with Park Street, W2-2 advanced warning signage in the form of W2-2 signs should is recommended be installed along each approach of Park Street.

W2-2L
(Northbound approach)

W2-2R
(Southbound approach)



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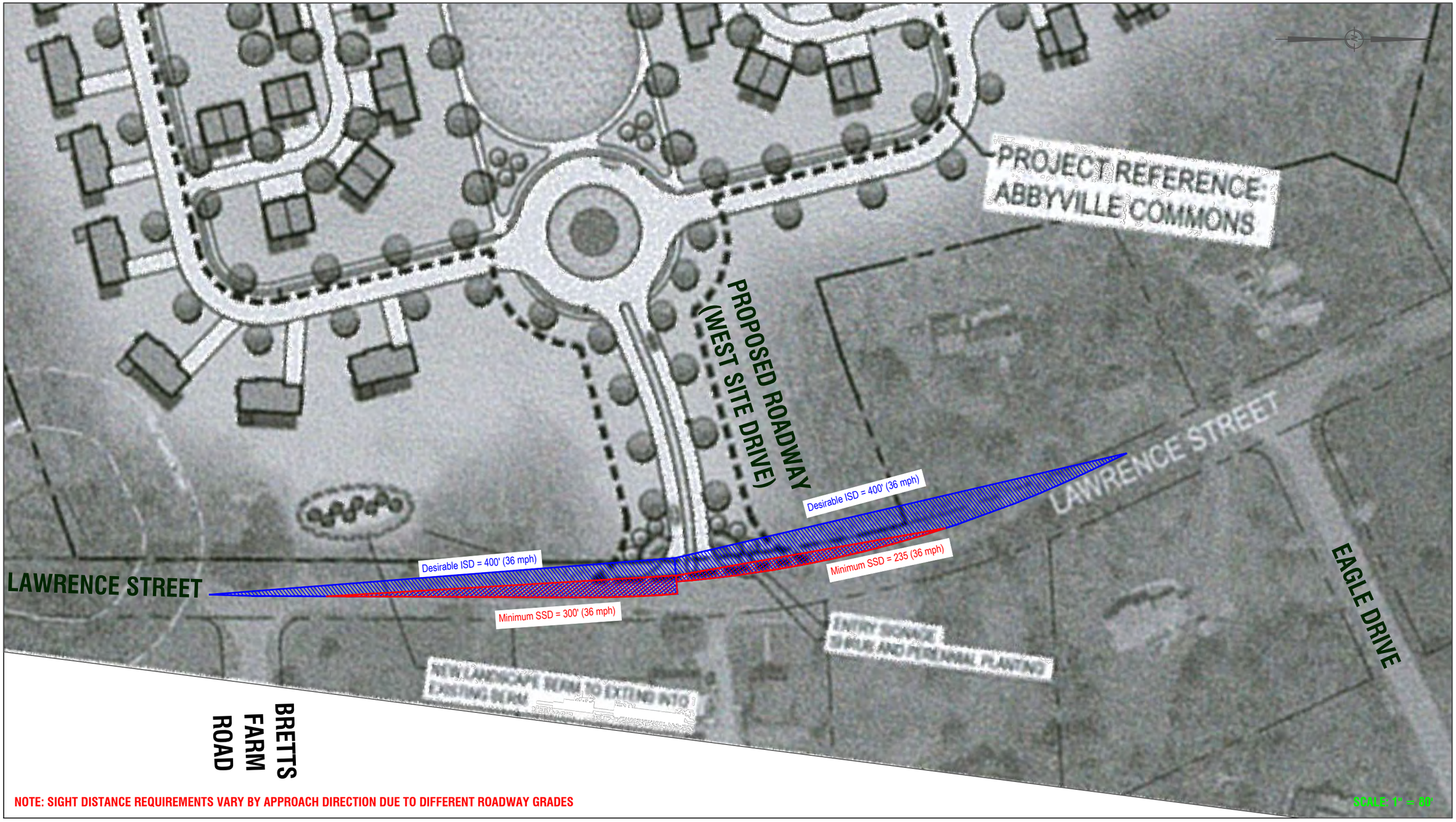
Vegetation trimming s□all be performed wit□in t□e desirable □SD triangles wit□in t□e rig□t-of-way and property owned by t□e pro□ect proponent

Figure □
□ecommended Vegetation Trimming East Site Dri□e Sig□t Triangles Based on 36 mp□ Tra□el Speed
Abby□ille □ommons and T□e Preser□e at Abby□ille
Norfolk, MA



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Vegetation trimming s□all be performed wit□in t□e desirable □SD triangles wit□in t□e rig□t-of-way and property owned by t□e pro□ect proponent

Figure 10
□ecommended Vegetation Trimming East Site Dri□e Sig□t Triangles Based on 36 mp□ Tra□el Speed
Abby□ille □ommons and T□e Preser□e at Abby□ille
Norfolk, MA

Appendix

- Traffic Volume Data
- MassDOT Season Adjustment Factors and Historical Growth
- Crash Rate Calculations
- Transit Schedules and Fares
- Trip Generation Calculations
- Residence to Work Data
- Trip Distribution for Adjacent Single Family Housing Project
- Intersection Capacity Analysis Worksheets