PARE PROJECT NO. 11098.00
REPORT

TRAFFIC IMPACT ANALYSIS FOR THE ESSEX NORTH SHORE AGRICULTURAL TECHNICAL HIGH SCHOOL DANVERS, MASSACHUSETTS

SUBMITTED TO:
DESIGN PARTNERSHIP OF CAMBRIDGE
HOOD BUSINESS PARK
500 RUTHERFORD AVENUE
CHARLESTOWN, MA 02129

SUBMITTED BY:
PARE CORPORATION
8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865

January 24, 2012

PARE CORPORATION

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Introduction

The following represents the traffic study completed for the construction of the Essex North Shore Agricultural Technical High School (ENSATHS) on Maple Street (Route 62) in Danvers, Massachusetts. The construction includes a new campus including academic and vocational facilities, commercial grade workshops, barns and offices, storage facilities, and administration offices. The new facility will merge the existing Essex County Agricultural and Technical High School (Essex Aggie) in Danvers, Massachusetts, the existing North Shore Technical High School in Middleton, Massachusetts, as well as service a number of students from the existing Peabody High School in Peabody, Massachusetts. The proposed school is anticipated to have 1,440 students and 200 faculty.

The new school is proposed on existing Essex County Agricultural and Technical High School property located on the north side of Maple Street (Route 62) between Manning Avenue and Preston Street in Danvers, Massachusetts. The existing Essex Aggie campus is located approximately 960 feet east of the proposed site on the south side of Maple Street (Route 62). The proposed ENSATHS will have three (3) curb cuts on Maple Street providing access to the campus buildings, the ancillary recreation fields, and parking areas. Parking areas will be located both east and west of the proposed campus buildings to provide parking for teachers and students. Buses are expected to drop off on the south side of the school and pick up on both the north and south sides of the school building.

Presented within are existing conditions in the vicinity of the project site, a safety analysis of the study area, an analysis of the traffic based on existing, future 2016 no-build and future 2016 build conditions, and proposed mitigation measures, where required. A locus map of the study area is provided in Figure 1 and a conceptual plan for the site is provided in Figure 2.

Data Collection

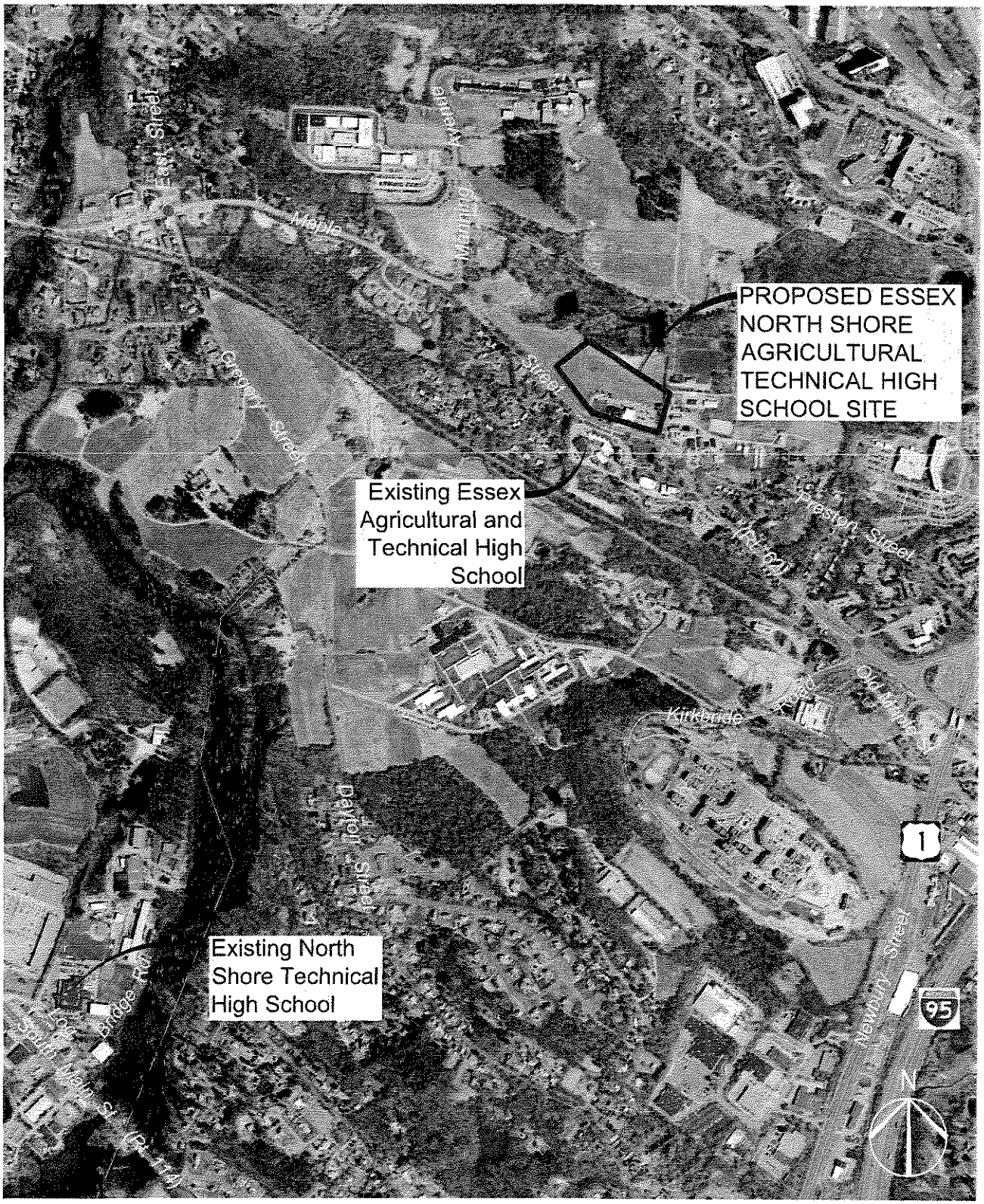
Manual turning movement counts were completed on Tuesday, September 14, 2011 from 7:00 a.m. to 9:00 a.m. and 2:00 p.m. to 6:00 p.m. at the following intersections:

- Maple Street (Route 62) and East Street/Gregory Street (Middleton, MA)
- Maple Street (Route 62) and Manning Avenue (Middleton, MA)
- Maple Street (Route 62) and Preston Street (Danvers, MA)
- Maple Street (Route 62) and Old Maple Street/Massachusetts State Police Driveway (Danvers, MA)

In addition, a 48-hour automatic traffic recorder (ATR) count was performed on Maple Street (Route 62) in the vicinity of the existing Essex Aggie entrance on September 14-15, 2011. Copies of all count data are provided in Appendix A.

Crash data for the roadway network in the vicinity of the project site was requested from the Police Departments in the Towns of Danvers and Middleton for the most recent three year period. MassDOT crash data for the years 2007-2009 has been reviewed and is included. Data received from the Town of Danvers was compared to the MassDOT data, and crashes not previously included were added. To date, nothing has been received from the Town of Middleton.

Signal plans for the signalized study intersections were obtained from the Towns of Middleton and MassDOT. Information contained on these plans was used in the analysis of the intersections.



● = STUDY INTERSECTIONS

SCALE: 1"= 1200'

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Figure 1

LOCUS MAP

ESSEX NORTH SHORE AGRICULTURAL TECHNICAL HIGH SCHOOL

Danvers, Massachusetts

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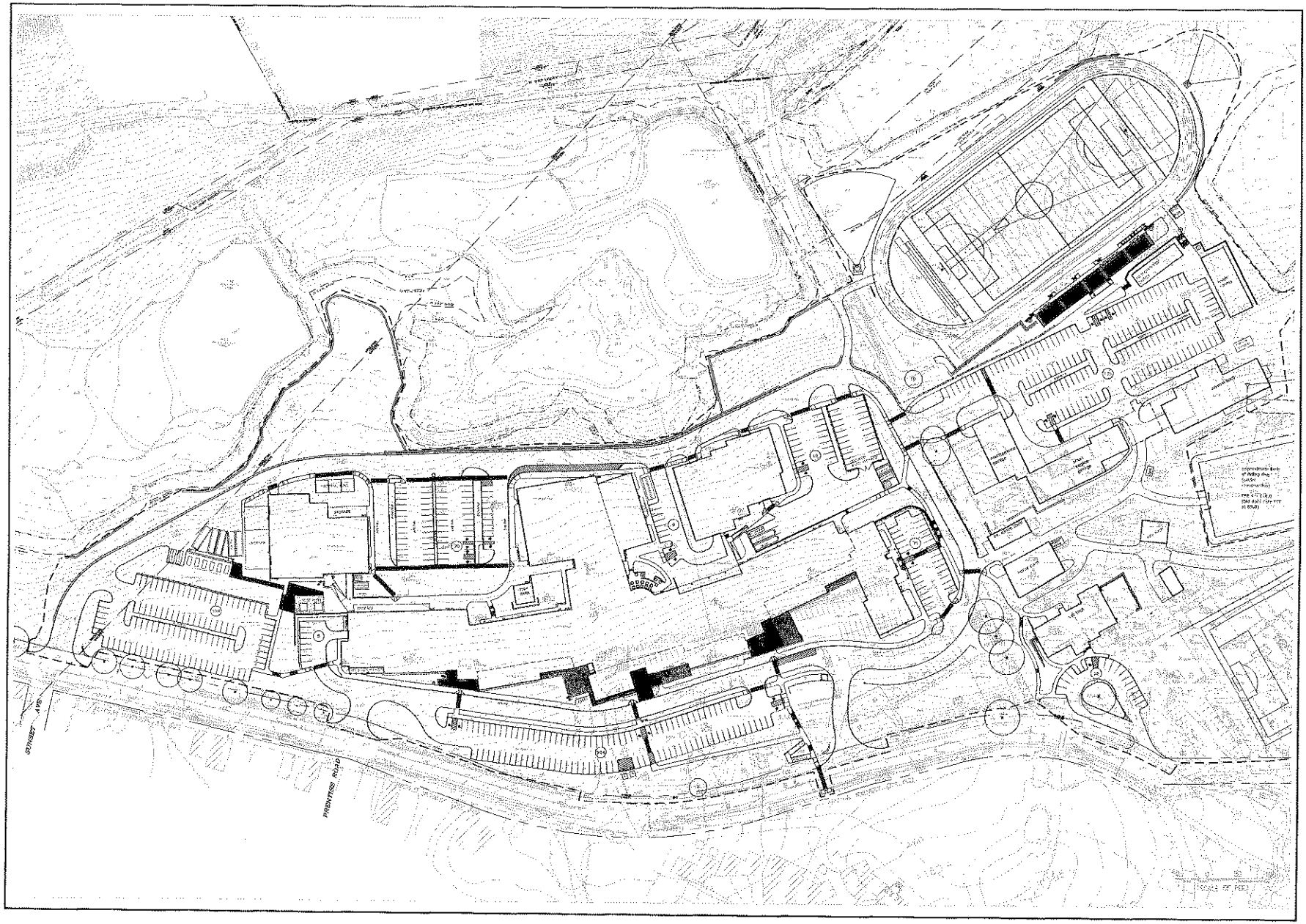

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ESSEX NORTH SHORE AGRICULTURAL & TECHNICAL HIGH SCHOOL

HATHORNE MA

Drawn By: JP, TC, DM, + MA
Checked By: JP & TC
Scale: As Noted
Date: January 23, 2019
Professional Seal

A field review of the area was conducted, with geometric measurements and other field observations recorded at the significant intersections in the vicinity of the project site that provide access. The information obtained was used in the analysis of the study area intersections.

The Town of Danvers Planning Department was contacted to determine additional projects within the Town whose trip generation should be included as background growth in the completion of this study. Two proposed projects were identified within the project vicinity. This first project is a 120-bed nursing home facility located at 15 Kirkbride Drive in the Town of Danvers. This is located at the east extent of the project area adjacent to the Maple Street (Route 62) and Old Maple Street intersection. The second is construction of 90 affordable housing units and parking spaces located at 121 Conifer Hill Drive in the Town of Danvers. Conifer Drive intersects Maple Street (Route 62) approximately one mile east of the project location. Traffic impact studies from both projects were obtained from the Town of Danvers Planning Department. The trip generation associated with each of the developments was then added to the background growth in the future scenario of this project.

The Town of Danvers Department of Public Works was also contacted to verify that Maple Street (Route 62) was town maintained at the proposed site. The response received indicated that Maple Street (Route 62) is Town owned and maintained from the Middleton Town Line to Hazen Avenue. Maple Street (Route 62) from Hazen Avenue southeast to US 1 is under MassDOT jurisdiction. MassDOT District 4 has indicated that no Permit to Access State Highway is required for the project.

An additional traffic impact analysis study was provided to PARE by Design Partnership for informational purposes only. This study was completed by Nitsch Engineering in May 2007 for the redevelopment of the existing North Shore Community College (NSCC) main campus in Danvers, Massachusetts. Data collected for this traffic study included much of the same area as this ENSATHS study, and was therefore used for verification of assumptions regarding the volume of traffic generated by the NSCC Essex Aggie Campus and the directional distributions at the existing Essex Aggie driveways.

Existing Roadway Conditions

The study area is defined as the significant roadways and intersections in the vicinity of the project site that may be impacted by the traffic due to the construction of the proposed ENSATHS. Four intersections are included in the study area, including two signalized intersections and two unsignalized intersections. The two signalized intersections are Maple Street (Route 62) with Gregory Street and East Street in Middleton, Massachusetts and Maple Street (Route 62) with Old Maple Street and the Massachusetts State Police Driveway in Danvers, Massachusetts. The two unsignalized intersections include Maple Street (Route 62) with Manning Avenue in Middleton and Maple Street (Route 62) with Preston Street in Danvers.

Maple Street (Route 62)

Maple Street is two-way, two-lane roadway running primarily in the east and west direction through the entire study area. Land use along Maple Street (Route 62) within the study area consists primarily of residential neighborhoods with some commercial and institutional establishments. Maple Street (Route 62) primarily consists of one 13-foot lane in each direction with varying width shoulders of 3 feet to 5 feet on both sides. Sidewalk is located along the southern side of Maple Street along the frontage of Essex Aggie and for the majority of the study area with an exception

towards the intersection with Gregory Street. The predominate posted speed limit on Maple Street is 35 miles per hour. However, the speed limit is posted at 30 miles per hour from just east of Sunset Avenue to just east of Preston Street within the vicinity of the existing Essex Aggie and 40 miles per hour near the intersection with Old Maple Street. Maple Street (Route 62) in the vicinity of the existing Essex Aggie and the proposed ENSATHS is a Town owned and maintained roadway and is classified as an Urban Minor Arterial. Maple Street (Route 62) is under MassDOT control from the Hazen Avenue intersection to the east.

Two signalized crosswalks are located on Maple Street (Route 62) at the existing Essex Aggie. One is located approximately 150 feet west of Preston Street and the other is located approximately 650 feet east of Prentiss Street. Both signalized crosswalks are controlled by pushbutton sensors.

Maple Street (Route 62) and East Street/Gregory Street
The intersection of Maple Street (Route 62) with East Street and Gregory Street is a four-legged signalized intersection located in the Town of Middleton. Maple Street (Route 62) forms the east and west legs of the intersection while East Street forms the north leg of the intersection and Gregory Streett forms the south leg. This section of Maple Street (Route 62) is a Town owned and maintained roadway. Commercial establishments are located on the northwest, southwest, and southeast corners of the intersection while the northeast corner is a vacant lot. The intersection is controlled by a six phase signal. The westbound approach has a protected leading left turn phase, with westbound and eastbound through phases running simultaneously. The northbound and southbound movements have no protected turn phases, with the northbound and southbound through phases running simultaneously. Pedestrian push buttons are located on each corner of the intersection, controlling an exclusive pedestrian phase. Crosswalks are located across the north, south, and east legs of the intersection and sidewalks are located on each corner. It was noted during the field visit that lights in several of the pedestrian signal heads were not functioning. The pedestrian push button on the southeast corner was also broken and did not function.

The south leg of the intersection, on Gregory Street, has one 14-foot travel lane and 8-foot parking lane on each side of the approach. Right turns on red are prohibited at the intersection, and the posted limit on Gregory Street south of the intersection is 35 miles per hour. Gregory Street is classified as an Urban Minor Arterial.

The north leg of the intersection, on East Street, has one northbound lane and two southbound lanes. The southbound lanes consist of a 14-foot shared left turn and through lane, a 22-foot designated right turn lane, and a 2-foot shoulder. The right turn lane forms approximately 60 feet north of the intersection. The northbound lane on this approach is approximately 15 feet wide with a 2-foot shoulder. The posted speed limit on East Street north of the intersection is 35 miles per hour. East Street is a local roadway classified as an Urban Minor Arterial.

The east leg of the intersection on Maple Street (Route 62) has one lane in each direction with a 10-foot wide yellow painted gore separating directional traffic. The westbound lane on this approach is 12 feet wide with a 3-foot shoulder, while the eastbound lane is 18-feet wide with a 3-foot shoulder. Maple Street (Route 62) has a posted speed limit of 35 miles per hour east of the intersection.

The west leg of the intersection on Maple Street (Route 62) consists of two eastbound lanes and one westbound lane. The eastbound lanes consists of an 11-foot wide left turn lane and a 17 foot wide shared through and right turn lane, with an 8-foot wide parking lane adjacent to the travel lane. The westbound lane is 17 feet wide at the intersection and with a 3-foot shoulder. The

posted speed limit for the west leg of Maple Street (Route 62) is 35 miles per hour in the westbound direction and 40 miles per hour in the eastbound direction.

Maple Street (Route 62) and Manning Avenue
The intersection of Maple Street (Route 62) with Manning Avenue is a three-legged unsignalized intersection. Maple Street (Route 62) forms the east and west legs of the intersection while Manning Avenue forms the north leg. Maple Street (Route 62) at this location is a Town owned and maintained roadway. The existing Essex Aggie is locate east of this intersection with residential neighborhoods located to the west. The Essex County Sherriff's Headquarters and Correctional Facility is located just north of the intersection on Manning Avenue. The eastbound and westbound approaches of Maple Street (Route 62) operate freely at the intersection, while the southbound approach on Manning Avenue is controlled by a stop sign. A 6-foot sidewalk runs along the south side of Maple Street (Route 62) and is separated from the roadway by a 4-foot grass buffer.

The east leg of Maple Street (Route 62) consists of one 13-foot westbound lane and one 12-foot eastbound lane with a 3-foot shoulder in each direction. Directional traffic on this approach is separated by an 11-foot wide yellow striped gore area.

The west leg of Maple Street (Route 62) consists of two eastbound lanes and one westbound lane. The eastbound lanes include an 11-foot designated left turn lane and a 13-foot through lane, while the westbound lane is 12 feet wide. Shoulders varying in widths between 3 and 5 feet are located on the north and south sides of the leg.

The north leg of the intersection on Manning Avenue consists of two southbound lanes and one northbound lane. A 12-foot landscaped island is located in the center of the leg separating the northbound and southbound traffic. The southbound lane on this approach splits into two lanes approximately 55 feet north of the intersection forming one 11-foot designated right turn lane and one 28-foot designated left turn lane. Manning Avenue is an unclassified roadway under State institutional jurisdiction, with no posted speed limit.

Maple Street (Route 62) and Preston Street
The intersection of Maple Street (Route 62) and Preston Street is a three-legged unsignalized "Y" intersection. Maple Street (Route 62) forms the north and south legs of the intersection, while Preston Street forms the east leg. An existing Essex Aggie driveway intersects Preston Street from the north at the intersection. Preston Street at the intersection operates under stop sign control while Maple Street (Route 62) operates freely. The Essex Aggie driveway also operates as a stop-controlled approach, although no sign is posted.

At the intersection, Maple Street (Route 62) has one 13-foot travel lane in each direction, with shoulders varying in width between 3.5 feet and 5 feet. The south leg of Maple Street intersects Preston Street at an approximate 45-degree angle. A 6-foot sidewalk is located on the east side of Maple Street (Route 62). The posted speed limit on Maple Street (Route 62) at this intersection is 30 miles per hour in both directions.

The westbound approach to the intersection, on Preston Street, is 20 feet wide west of the intersection, expanding to approximately 105 feet wide just east of the intersection in the vicinity of the school driveway. No striping exists on Preston Street, although the roadway carries two-way traffic. Sight distance to the west on Maple Street from Preston Street is limited by the horizontal curvature of Maple Street and a stone wall running along the south of Maple Street (Route 62). Preston Street is a local, unclassified road with no posted speed limit.

Maple Street (Route 62), Old Maple Street, and the Massachusetts State Police Driveway
The intersection of Maple Street (Route 62) with Old Maple Street and the Massachusetts State Police Driveway forms a four-legged signalized intersection. Land use in the vicinity of the intersection area is a mix of residential, commercial, and institutional. Maple Street (Route 62) runs in an east/west direction while Old Maple Street intersects from the southeast and the Massachusetts State Police Driveway intersects from the north. The signal functions as a six phase signal with protected left turn phases for the eastbound and westbound approaches. The intersection has no pedestrian amenities. This intersection falls within MassDOT jurisdiction.

On the west leg of the intersection, the Maple Street (Route 62) approach has a 12-foot designated left turn lane, a 12-foot through lane, and a 12-foot shared through and right turn lane, and a 3-foot shoulder in the eastbound direction with two 12-foot lanes and a 3-foot shoulder in the westbound direction. A 23-foot wide grass center median separates directional traffic. On the west leg of the intersection, Maple Street (Route 62) has a 12-foot designated left turn lane, a 12-foot through lane, a 12-foot designated right turn lane, and a 4-foot shoulder in the westbound direction with two 12-foot lanes and a 3-foot shoulder in the westbound direction. An approximate 20-foot wide grass center median separates directional traffic.

The northbound approach to the intersection, on Old Maple Street, is approximately 30 feet wide, with one lane in each direction separated by a solid double yellow line. Both lanes widen considerably at Maple Street (Route 62) to facilitate turning movements. The southbound approach to the intersection, the Massachusetts State Police Driveway, has one 12-foot southbound lane and one 12-foot northbound lane.

Maple Street (Route 62) and the existing Essex Aggie Driveways
The existing Essex Aggie campus has three main access points. The first, located opposite the entrance to the NSCC's Berry Hall, operates as an exit only. This driveway opening is approximately 40 feet wide, with "Do Not Enter" signs posted facing Maple Street (Route 62). The second access point to the existing Essex Aggie campus is located approximately 380 feet east of Preston Street. This access-only driveway is approximately 35 feet wide, providing direct access to the main Essex Aggie classroom building, the NSCC Maude Hall, and Parking Lot A. The third driveway is located approximately 175 feet east of the second driveway, allowing both access and egress to the school. This driveway primarily provides access to Lot A, although the main Essex Aggie building can be reached by traversing the parking area. This egress also operates as a stop-controlled approach at its intersection with Maple Street (Route 62).

Existing Traffic Volumes

Based on the traffic counts completed, the a.m. peak hour at the intersections surrounding the school varied slightly, but generally occurred between 7:00 a.m. and 8:15 a.m. The high school begins each day at 7:45 a.m., and it is typical for the a.m. peak hour of a high school to coincide with the a.m. peak hour of the adjacent roadway. The a.m. peak hour analyzed in this report was 7:15 a.m. to 8:15 a.m. The p.m. peak hours of the intersections surrounding the school also varied. Two of the study intersections had peak hours that began between 2:00 p.m. and 3:00 p.m., while two had peak hours that began between 4:30 p.m. and 5:00 p.m. The high school day ends at 2:45 p.m., well before the typical p.m. commuter peak hour. According to the ITE *Trip Generation Manual*, the p.m. peak hour of a high school is expected to occur before the roadway peak hour, resulting in the highest amount of school-related traffic on the roadway during an off-

peak hour. To accurately analyze the full impact of the school, the p.m. school peak hour of 2:15 p.m. to 3:15 p.m. and the p.m. commuter peak hour of 4:30 p.m. to 5:30 p.m. were both analyzed.

The peak hours on Maple Street (Route 62) identified from the 48-hour ATR count vary slightly from those at the intersections. The a.m. peak hour recorded was consistent with the start of the school day, from 7:45 a.m. to 8:45 a.m. The p.m. commuter peak hours varied by day, with one occurring between 4:30 p.m. and 5:30 p.m., and one occurring between 5:15 p.m. and 6:15 p.m. Based on the count data received, the existing Average Daily Traffic (ADT) on Maple Street is 12,902 vehicles per day.

Manual turning movement counts were not completed at the existing school entrances as part of this study since the site was changing significantly. The volumes for the existing school were estimated based on the current enrollment utilizing the *Trip Generation* manual, and information provided by Essex Aggie regarding the number of buses and bus utilization. The estimated volumes are shown in Figure 3 as existing volumes.

Existing a.m., p.m. school, and p.m. commuter peak hour traffic volumes for all study intersections are shown in Figure 3, 4, and 5, respectively.

Safety Analysis

Crash Data

MassDOT crash data for the years 2007 through 2009 was reviewed for the roadway network surrounding the project site. Data received from the Danvers Police Department was also reviewed, and crashes not previously included in the MassDOT data were added. Crash rates were calculated for the study area intersections in accordance with standard MassDOT procedures. The MassDOT statewide average crash rates and the District 4 averages for signalized and unsignalized intersections are provided below. The crash rates are provided in crashes per million entering vehicles.

Table 1: Crash Rate Averages for Signalized and Unsignalized Intersections

	Signalized	Unsignalized
Statewide	0.81	0.61
District 4	0.78	0.59

According to the crash data, two crashes were reported at the intersection of Maple Street (Route 62) with Preston Street between 2007 and 2009. One was reported in 2008 and one was reported in 2009. One of the reported crashes was a sideswipe in the opposite direction, one was a motorist collision with a fixed object, and both resulted in property damage only. The crash rate calculated for this intersection was 0.14, which is below both the MassDOT statewide and District 4 averages for unsignalized intersections.

At the signalized intersection of Maple Street (Route 62) with Old Maple Street and the State Police Driveway, five crashes were reported between 2007 and 2009. Four were of unknown type and one was a rear-end crash. Three involved property damage only and two resulted in injuries. The crash rate calculated for this intersection was 0.25, which is below the MassDOT statewide and District 4 averages for signalized intersections.

Five crashes were also reported at the signalized intersection of Maple Street (Route 62) with East Street and Gregory Street from 2007 to 2009. Two were angle crashes, one was a rear-end crash, one was a sideswipe in the same direction, and one was of unknown type. Four of the reported

crashes involved property damage only and one resulted in an injury. The crash calculated for this intersection was 0.23, which is below the MassDOT statewide and District 4 averages for signalized intersections.

Twelve crashes were also reported at 562 Maple Street from 2007 to 2009, the address for the existing Essex Aggie campus. From the data available, it is unknown if these crashes occurred onsite or at one of the driveway entrances. If they did occur at one of the driveway entrances, the location provided is not specific enough to identify the specific driveway. Six of the reported crashes were rear ends, three were motorist collisions with fixed objects, one was a sideswipe in the opposite direction, one was of unknown type, and one was a motorist loss of control. Eleven of the reported crashes involved property damage only, and one resulted in an injury.

Nineteen crashes were also reported at various locations along Maple Street (Route 62) within the study area between 2007 and 2009. These crashes were reported at specific addresses rather than at existing intersections. Seven of the reported crashes were rear ends, five were angle crashes, three were of unknown type, two were motorist collisions with fixed objects, one was a motorist loss of control, and one was a sideswipe in the opposite direction. Fifteen of the 19 reported crashes involved property damage only, and four resulted in an injury. No crashes were specifically reported at the Maple Street (Route 62) intersection with Manning Avenue during the years reviewed. A summary table of all crash data reviewed and the crash rate worksheet for each intersection is provided in Appendix B.

Sight Distance

A spot speed study was performed on Maple Street (Route 62) in the vicinity of the existing Essex Aggie campus to determine the average travel speeds on the roadway. The data collected is summarized in the table below. Complete results are provided in Appendix A.

Table 2: Speed Data Results for Maple Street (Route 62)

	Posted Speed	**Average Speed**	**True Median (50th Percentile)**	**85th Percentile**	**10 MPH Pace**	**% over 35 MPH**
Eastbound	35	40	40	43	35-44	95
Westbound	35	38	38	42	33-42	70

Speed data was also collected along with the ATR count on Maple Street (Route 62) just east of Preston Street. According to this data, the average speed on Maple Street (Route 62) was 34 miles per hour, while the 85th percentile speed recorded was 39 miles per hour.

Based on the spot speed study performed, a design speed of 45 miles per hour was selected for Maple Street (Route 62), which is greater than the 85th percentile speed recorded on the roadway and the posted 35 mile per hour speed limit. According to the American Association of State Highway and Transportation Officials (AASHTO) publication *A Policy on the Geometric Design of Highways and Streets, Fifth Edition 2004,* the minimum safe stopping sight distance for a 45 mile per hour speed is 360 feet. The minimum safe intersection sight distance is 500 feet.

Sight distance measurements were performed at the each of the two proposed site exits on Maple Street and the two possible locations for an entry only driveway.

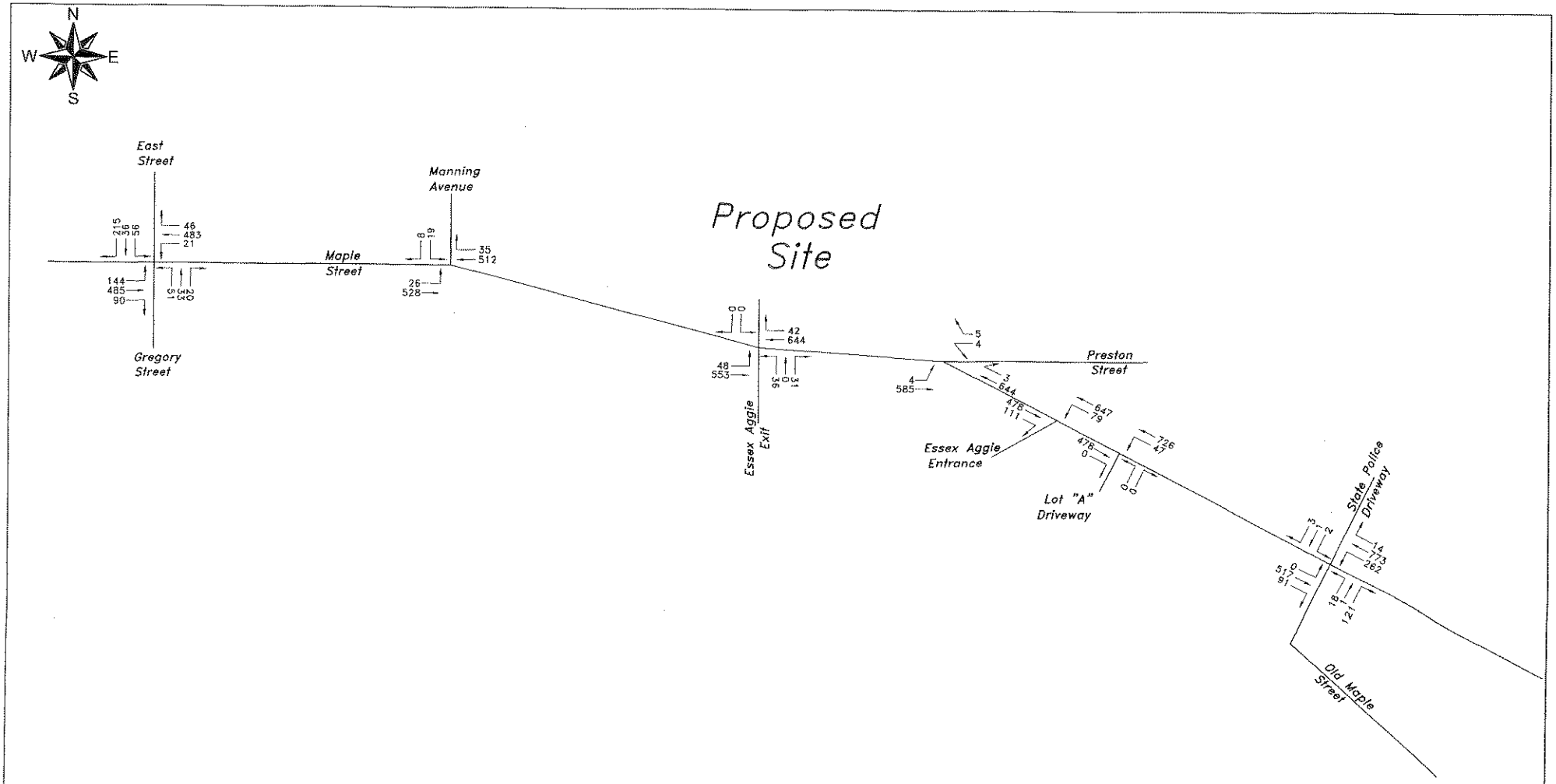

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Figure 3

Essex North Shore Agricultural Technical School
Existing Traffic Volumes
AM Peak Hour
Weekday 7:15 to 8:15 AM

DANVERS, MASSACHUSETTS

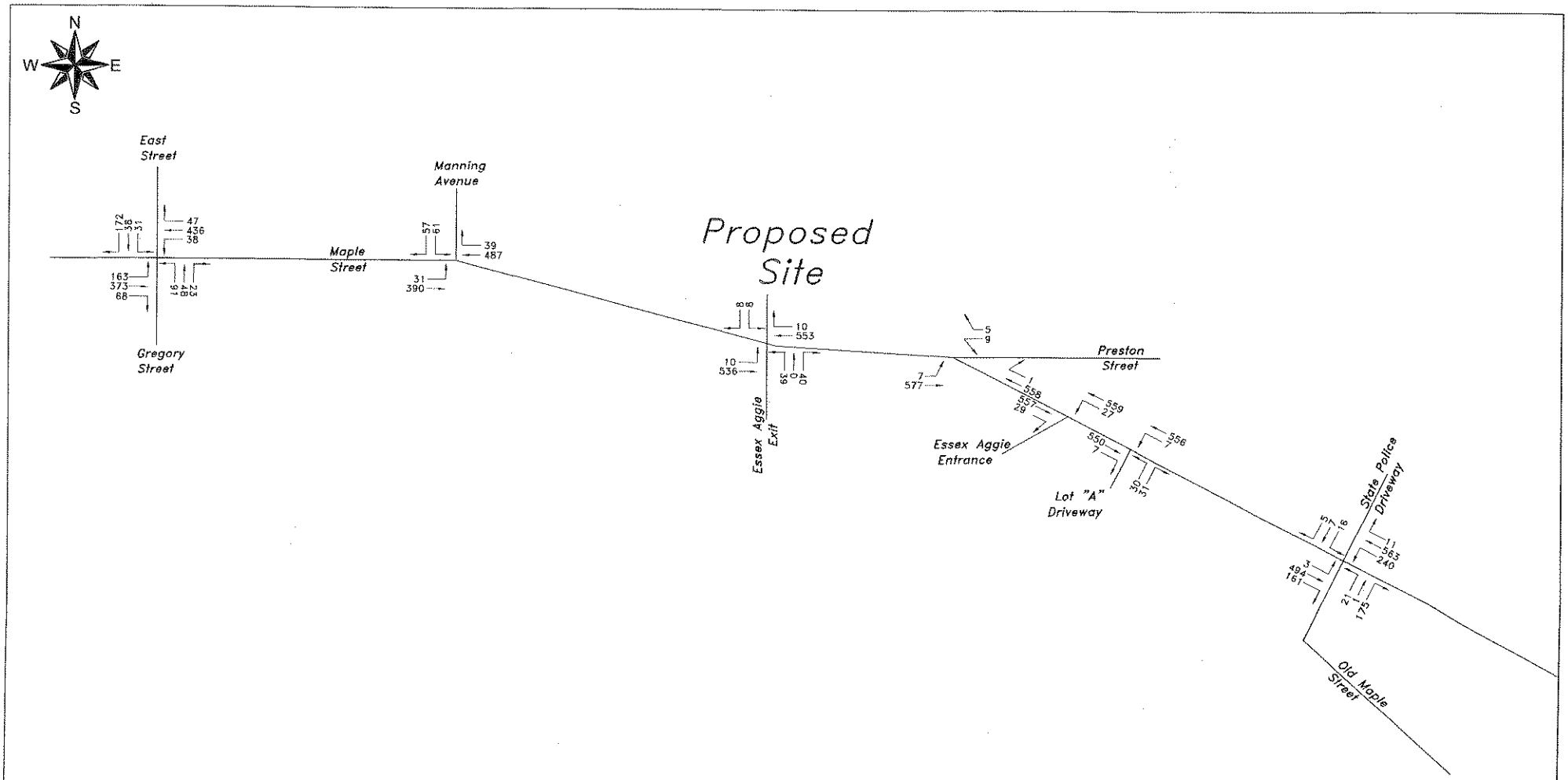

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Figure 4

Essex North Shore Agricultural Technical School
Existing Traffic Volumes
PM School Dismissal Peak
Weekday 2:15 to 3:15 PM

DANVERS, MASSACHUSETTS

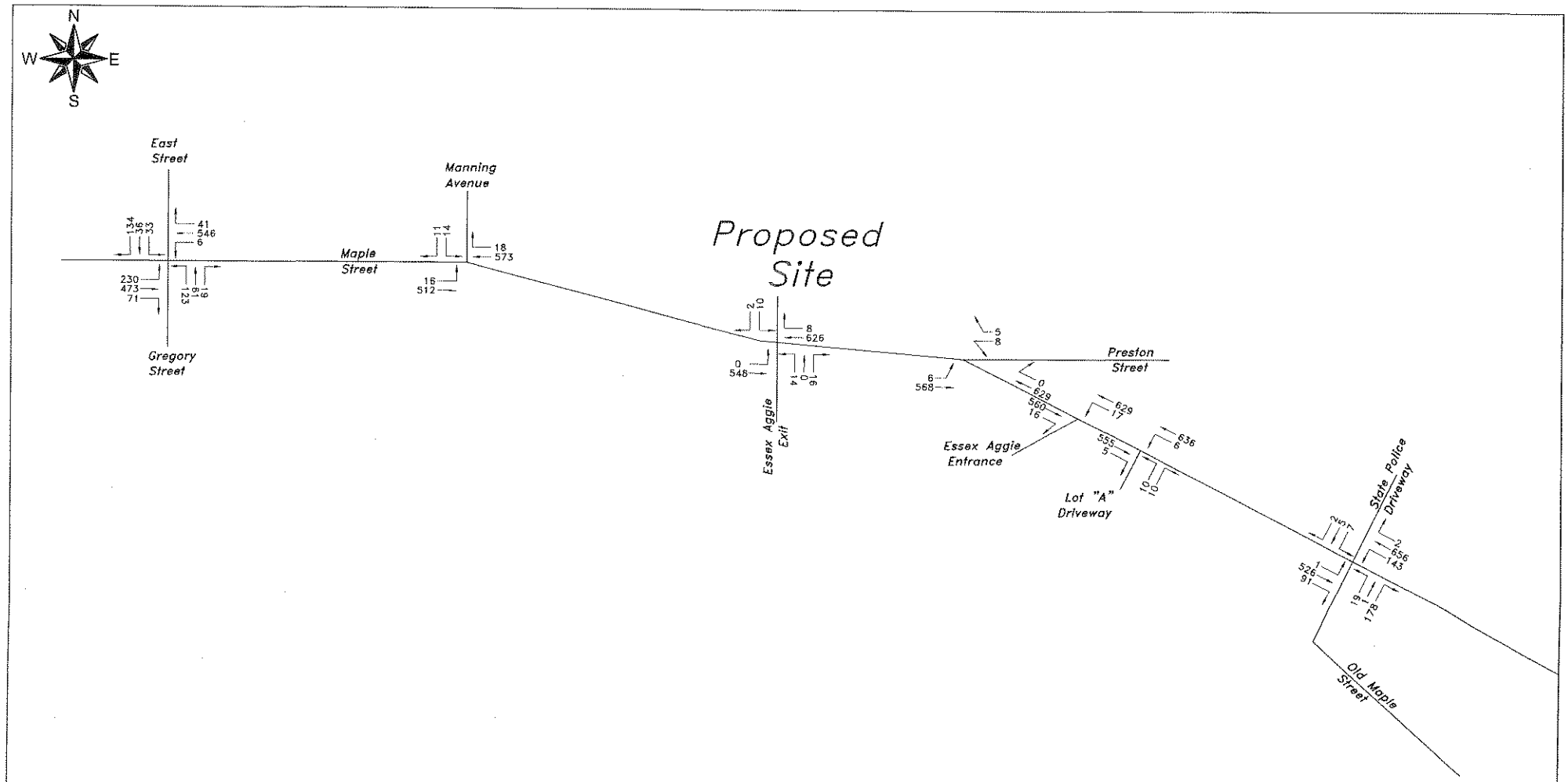

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Figure 5

Essex North Shore Agricultural Technical School
Existing Traffic Volumes
PM Peak Hour
Weekday 4:30 to 5:30 PM

DANVERS, MASSACHUSETTS

The westernmost proposed site entrance is located on Maple Street (Route 62) directly opposite Sunset Avenue, approximately 580 feet southeast of the Manning Avenue intersection. From this proposed site entrance, the available stopping site distance to the west is approximately 480 feet to a driveway located just east of Manning Avenue. A utility pole located just west of the proposed site entrance creates a break in the line of sight, but visibility continues west of the pole. At the limit of available sight distance, it is restricted by a Kiwanis International sign posted along the north side of Maple Avenue (Route 62). The available stopping sight distance meets the AASHTO requirement for the posted speed limit and the selected design speed. From this site entrance to the east, the available stopping sight distance is over 1,000 feet. A State standard "Entering Danvers" sign is posted along the north side of the roadway adjacent to the proposed entrance, and may require relocation for construction of the site driveway.

Intersection sight distance measurements were also taken from this site entrance at a point 15 feet north of Maple Street (Route 62). It should be noted that the existing ground north of Maple Street (Route 62) slopes downhill, but is expected to be brought to grade for construction of the site driveway. From the site entrance to the west, the available intersection sight distance is approximately 300 feet, limited by the presence of several large trees along the north side of the roadway. Removal of these trees would increase the available intersection sight distance to approximately 600 feet, near the intersection at Manning Avenue. From this site entrance to the east, the available intersection sight distance is approximately 225 feet, although two trees and a sign are located within the sight triangle. The limitation at 225 feet is a "Welcome to Danvers/Middleton" sign surrounded by shrubs. Several of the trees within the sight triangle may require removal for the construction of the site driveway. According to AASHTO, if the intersection sight distances cannot be achieved, but the available sight distance for an entering vehicle is at least equal to the appropriate stopping sight distance, then drivers have sufficient sight distance to anticipate and avoid collisions.

The second site driveway is proposed directly across from Prentiss Road, approximately 400 feet west of the existing main Essex Aggie entrance. From this proposed site driveway, the available stopping sight distance to the west is approximately 830 feet and the available stopping sight distance to the east is approximately 300 feet. To the east, sight distance is restricted by the presence of a large tree and utility pole on the north side of the roadway. Removal of this tree would increase the available stopping sight distance to approximately 550 feet. Utility poles along the north side of the roadway create breaks in the available line of sight, but do not restrict the available sight distance.

From this site entrance, the available intersection sight distance to the west is approximately 450 feet, while the available intersection sight distance to the east is approximately 550 feet. In both directions, large trees restrict the available sight distance. Removal of these trees will significantly improve the available intersection sight distance. It is also recommended that the sight triangles adjacent to the site entrance be kept clear of new trees, plants, and signage that may restrict visibility.

Future Conditions

To account for background growth within the vicinity of the project, the existing traffic volumes were projected over a five-year horizon from 2011 to 2016. Recent Census data for the Towns of Danvers and Middleton were reviewed to determine the appropriate growth rate. The growth rate exhibited by the three towns was less than 1% per year, therefore, a growth rate of 1% per year was determined to be adequate. This growth rate is also in line with the growth rate utilized in the traffic impact study prepared earlier this year for a proposed affordable housing development in Danvers.

The Town of Danvers Planning Department was contacted to determine additional projects within the Town whose trip generation should be included as background growth in the completion of this study. Two projects were identified, and are described below.

1. Proposed Affordable Housing Development located at 121 Conifer Hill Drive – This development is located approximately one mile east of the proposed ENSATHS and is currently proposed to include 90 affordable housing units and associated parking. Access to the site is proposed via two unsignalized driveways to be constructed on Conifer Hill Drive. This project has been approved by the Town of Danvers and permitted, with construction expected to begin in the Spring of 2012. A copy of the April 2011 Traffic Impact and Access Study prepared by Greenman-Pederson, Inc. for the project was obtained from the Town to determine the potential impact on the new ENSATHS.

2. The second potential development is a 120-bed skilled nursing facility located at 15 Kirkbride Drive in Danvers, Massachusetts. This development, Sunbridge at Hathorne Hill, is the third phase of redevelopment of the previously approved Danvers State Hospital Redevelopment Project. A copy of the August 2010 traffic memorandum prepared by Vanasse Hangen Brustlin, Inc. for this project was obtained from the Town of Danvers, and trip generation from this project expected in the area of the new ENSATHS was included in this study.

Traffic volumes for the a.m. peak hour, p.m. school peak hour, and p.m. commuter peak hour future no-build conditions are provided in Figures 6, 7, and 8, respectively.

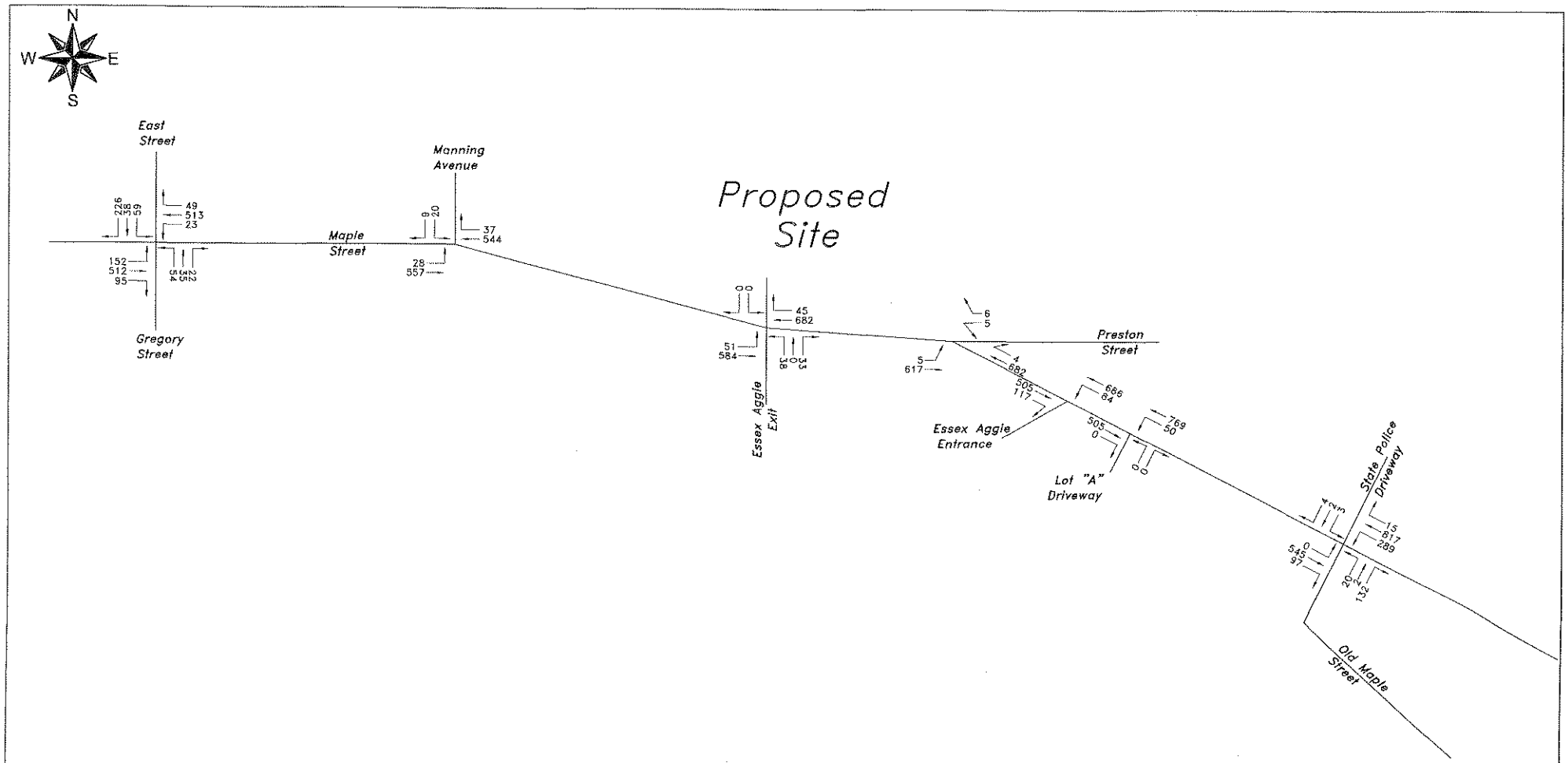

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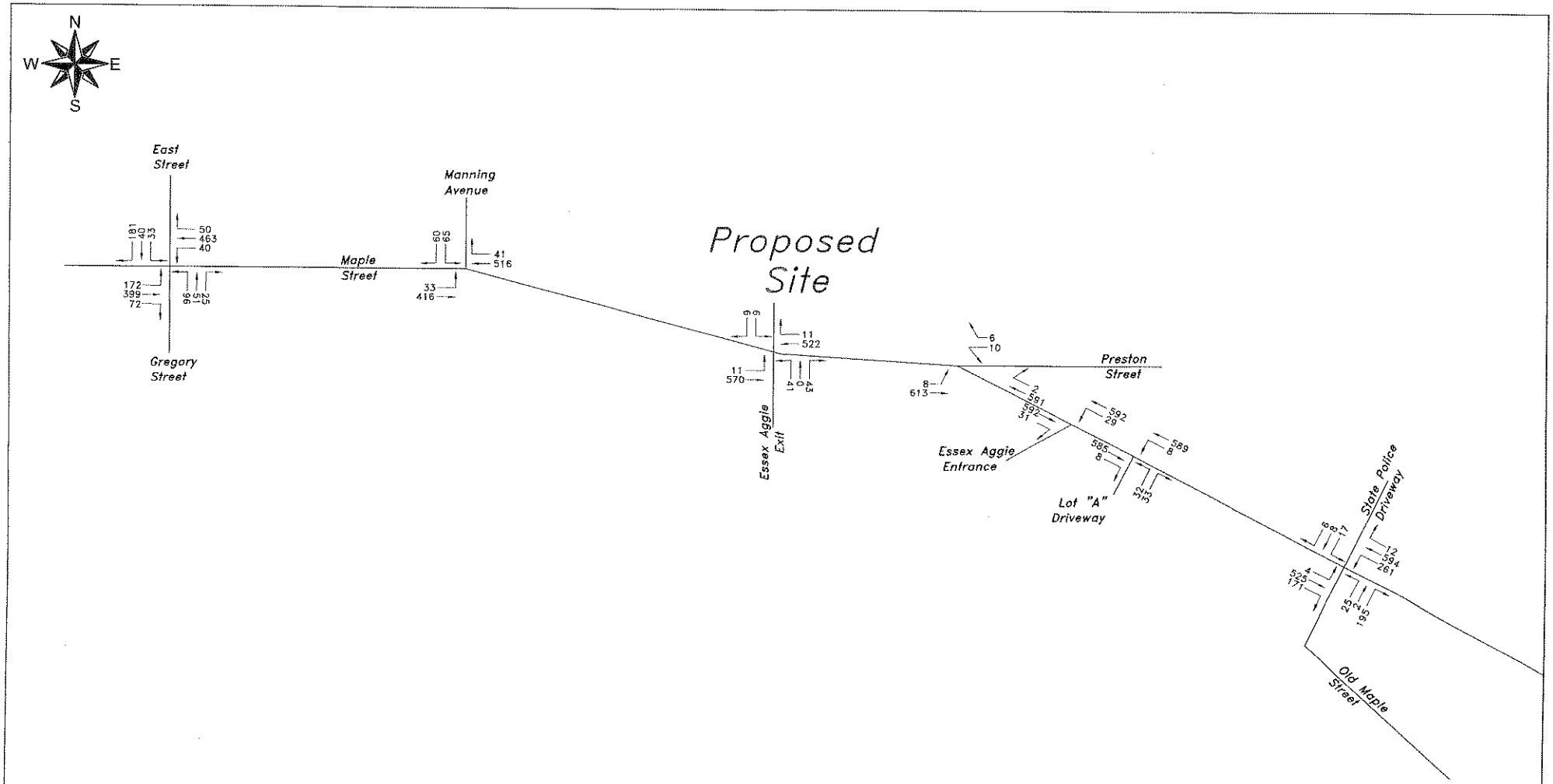
Figure 6

Essex North Shore Agricultural Technical School
Future (2016) No Build Traffic Volumes
AM Peak Hour
Weekday 7:15 to 8:15 AM

DANVERS, MASSACHUSETTS



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DATE: January 2013

Figure 7

Essex North Shore Agricultural Technical School
Future (2016) No Build Traffic Volumes
PM School Dismissal Peak
Weekday 2:15 to 3:15 PM

DANVERS, MASSACHUSETTS

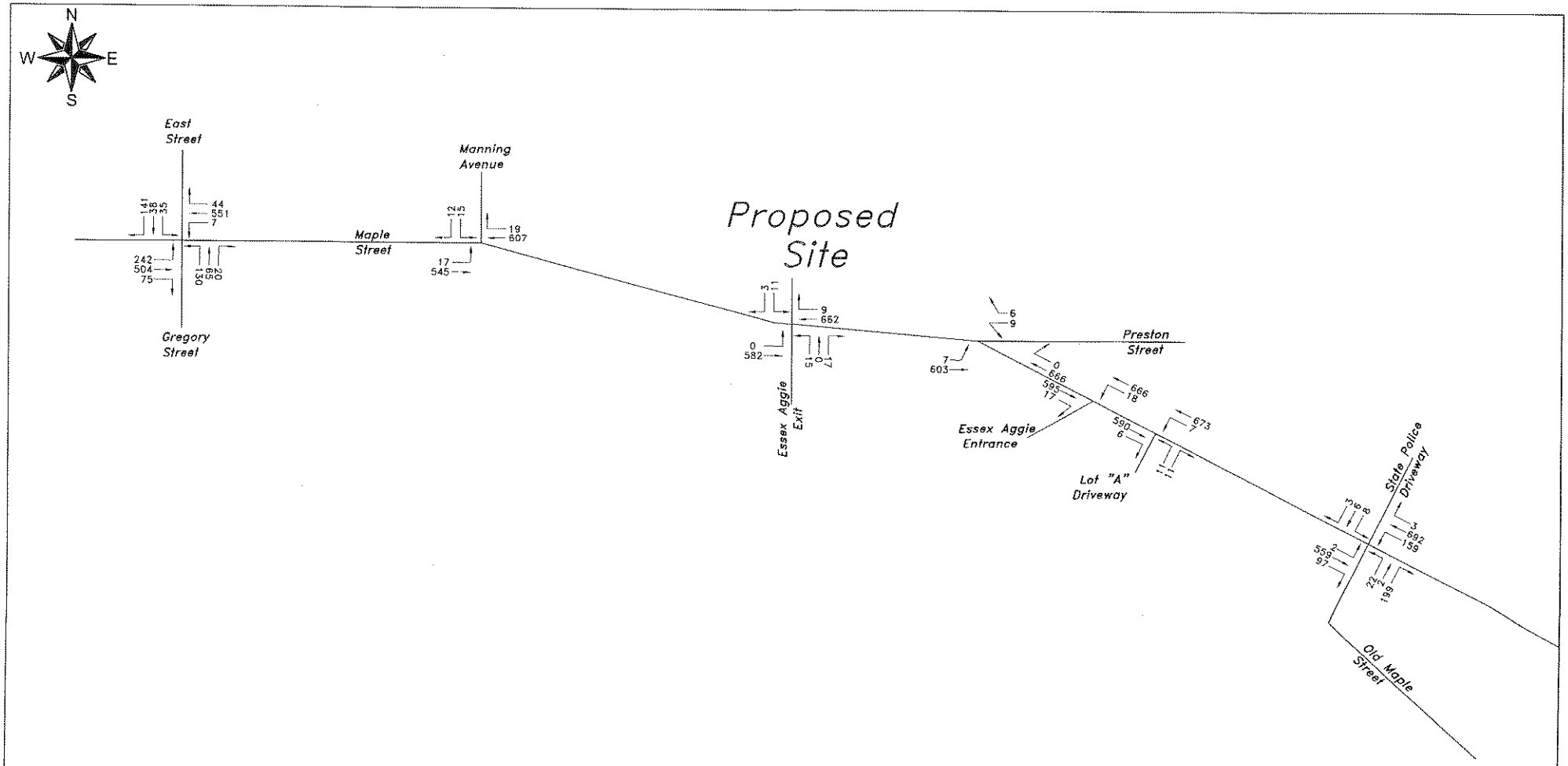

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Figure 8

Essex North Shore Agricultural Technical School
Future (2016) No Build Traffic Volumes
PM Peak Hour
Weekday 4:30 to 5:30 PM

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Build Conditions

The future 2016 build condition represents the future 2016 no-build condition plus the traffic expected to be generated by the construction of the proposed ENSATHS.

Trip Generation

Under existing conditions, Essex Aggie has an enrollment of 501 students, with 95 faculty working at the school. Currently, 25 buses service the school. It was assumed that approximately 65% of the existing student population utilizes the available buses. Essex Aggie administration indicated that this assumption was appropriate, and may be slightly low during the winter months. Using these assumptions, it was determined that 291 trips are generated during the a.m. peak hour, 210 trips are generated during the p.m. school peak hour, and 234 trips are generated during the p.m. commuter peak hour at the existing Essex Aggie. These assumptions were compared to the ITE trip generation. Where ITE trip generation volumes were greater than the assumed school specific volumes, ITE trip generation volumes were used to provide a more conservative analysis. In addition, the NSCC currently maintains a small campus at Essex Aggie, which uses Berry Hall on the north side of Maple Street (Route 62) and Maude Hall on the south side of Maple Street (Route 62). These trips were also included in the existing trip generation. A summary is provided below.

Table 3: Existing Trip Generation Summary

Time Period	AM Peak Hour			PM School Peak Hour			PM Commuter Peak Hour		
	Entering	Exiting	Total	Entering	Exiting	Total	Entering	Exiting	Total
School-Specific Assumptions	237	54	291	70	140	210	44	50	94
LUC 530 – High School	143	67	210	48	97	145	31	34	65
Volume Used in Analysis	**237**	**67**	**304**	**70**	**140**	**210**	**44**	**50**	**94**

The proposed ENSATHS will maintain the existing 501 Essex Aggie students, and will add approximately 939 new students from the existing North Shore Agricultural Technical High School and the Peabody High School Vocational Technical Program. The existing North Shore Agricultural and Technical High School will close, and merge with the existing Essex Aggie.

To determine the appropriate number of trips expected at the new facility, a variety of information was reviewed. Information obtained from the existing Essex Aggie indicated that the school is currently serviced by 25 buses, and that up to 40 buses could be expected following construction of the new school. Trips to the new school were generated using many of the assumptions made to generate the existing Essex Aggie trips. Trips were estimated at the proposed site driveways based on the full capacity of the new school, and that volume was distributed at the proposed site driveways. The new difference in site trips between the existing and the proposed was added to the study intersections in the vicinity of the new school. The trip generation estimates based on school-specific information were again compared to the Trip Generation manual for LUC 530, High School, and the more conservative of the two was utilized in the analysis. A summary of the proposed trips is provided in Table 4 and complete trip generation calculations are provided in Appendix C.

Table 4: Proposed Trip Generation Summary – 1,440 Student Capacity at ENSATHS

Time Period	AM Peak Hour			PM School Peak Hour			PM Commuter Peak Hour		
	Entering	Exiting	Total	Entering	Exiting	Total	Entering	Exiting	Total
School-Specific Assumptions	576	124	700	175	356	531	112	127	239
LUC 530 – High School	411	194	605	138	280	418	88	99	187
Volume Used in Analysis	**576**	**194**	**770**	**175**	**356**	**531**	**112**	**127**	**239**

Additionally, following construction of the new ENSATHS, the NSCC Essex Aggie campus will be eliminated, providing students the option to take classes at other NSCC campuses. With the elimination of this campus, some NSCC students will be removed from the existing traffic stream on Maple Street (Route 62). Initial estimates were made to determine this volume based on the capacity of the Berry Hall and Maude Hall classrooms, and the traffic study provided for the expansion of the existing NSCC Danvers Campus was referenced to confirm the assumptions. It is assumed that during the a.m. peak hour, 90 students currently access the NSCC Essex Aggie campus, 20 students access the campus during the p.m. school peak hour, and 8 students access the campus during the p.m. peak hour.

The overall change in trips along Maple Street (Route 62) as a result of the construction of the new ENSATHS was calculated based on the ITE weekday trip generation rates for a 1,440-student high school (LUC 530), minus the existing traffic due to the 501-student high school (LUC 530), and minus the trips currently on the roadway because of the NSCC Essex Aggie campus (LUC 540). Using ITE trip generation LUC 530, the existing Essex Aggie trip generation was calculated to be approximately 988 trips per day for the current enrollment of 501 students. For the new 1,440 student ENSATHS, the expected daily trip generation is 2,462 trips per day. ITE trip generation LUC 540 was then used to determine the existing number of trips that will be removed from the traffic stream due to the closing of the NSCC Essex Aggie campus, which is expected to be 554 trips per day. The resulting net gain in daily trips expected for the proposed site is 920 trips per day. The existing ADT on Maple Street (Route 62) of 12,902 vehicles per day is expected to increase to approximately 13,822 vehicles per day.

To provide a conservative analysis of the new ENSATHS and potential reuse of several of the existing buildings on the Essex Aggie campus, trip generation estimates for the existing site were included in the analysis. It has been indicated that any new use contained within the Essex Aggie buildings will have to be educational in nature, but that details of the potential reuse are unknown at this time. The specific type of use, the area to be reused, the potential number of new students, or potential number of new faculty and/or administration are still to be determined when and if a viable occupant is identified. Trip generation estimates were made for the existing buildings based on a 50-student daycare and a 30-employee school administrative building. Trips for the daycare were added to the a.m. and p.m. commuter peak hours, and trips for the school administrate staff were added to the a.m., p.m. school, and p.m. commuter peak hours to be conservative. It was determined viable that the staff could conclude their day along with the school, or may not finish the day until the typical p.m. commuter peak hour. A table of the estimated trips used in the analysis is provided below.

Table 5: Estimated Trip Generation – Existing Essex Aggie Building Reuse

Time Period	AM Peak Hour			PM School Peak Hour			PM Commuter Peak Hour		
	Entering	Exiting	Total	Entering	Exiting	Total	Entering	Exiting	Total
LUC 565 – Day Care Center	22	20	42	0	0	0	19	22	41
30-Employee Admin. Bldg.	30	0	30	0	30	30	0	30	30
Total	**52**	**20**	**72**	**0**	**30**	**30**	**19**	**52**	**71**

Trip Distribution

At the proposed ENSATHS, trip distribution to the site entrances was based on the proximity to the parking areas, the restrictions expected for the parking areas, and the bus circulation. Buses will drop off in the front of the school, and will pick up in both the front and rear of the school. Buses will enter at either the east or west driveway and exit at the center driveway. The west parking lot is expected to be student parking, therefore it was assumed that all of these students would enter and exit via the west site driveway. Faculty will be able to use all remaining parking areas onsite; therefore, they were split between the east and west driveways entering and the west and center driveways exiting based on the proximity of the parking areas to the driveways.

While trips were distributed at the site entrance based on the entire capacity of the new school, trips added to the study area intersections were limited to the difference between existing and proposed.

Trips added into the traffic stream based on the potential reuse of portions of the existing Essex Aggie campus followed the existing traffic patterns on Maple Street (Route 62).

Complete trip distribution calculations are provided in Appendix C, and the site-generated trips are shown in Figure 9.

Site Circulation

The proposed ENSATHS site will have three access points on Maple Street (Route 62). The western access, located opposite Sunset Avenue, will allow both access and egress. After the a.m. drop-off to just before p.m. dismissal, this driveway will be gated and no access or egress movements will be allowed. The center site driveway, located opposite Prentiss Road, will allow egress only at all times. The eastern site driveway will allow access only at all times. A guard shack is proposed onsite at the bottom of the eastern site driveway. All visitors will be required to check in upon arrival during off-peak hours.

Several designated parking areas are located onsite. The western parking area and the easternmost parking area located near the athletic fields will be designated as student parking. The parking area located in front of the school will be approximately ¼ visitor parking and ¾ faculty parking. The bus loop located at the rear of the school will also contain faculty parking in its center. Buses will drop off in front of the school during the a.m. peak hour, and will pick up in the bus loop in the rear of the school and in front of the school during the p.m. school peak hour. Parents will use the bus loop for drop-off during the a.m. peak hour, and the front visitor/faculty parking area for p.m. pick-up.

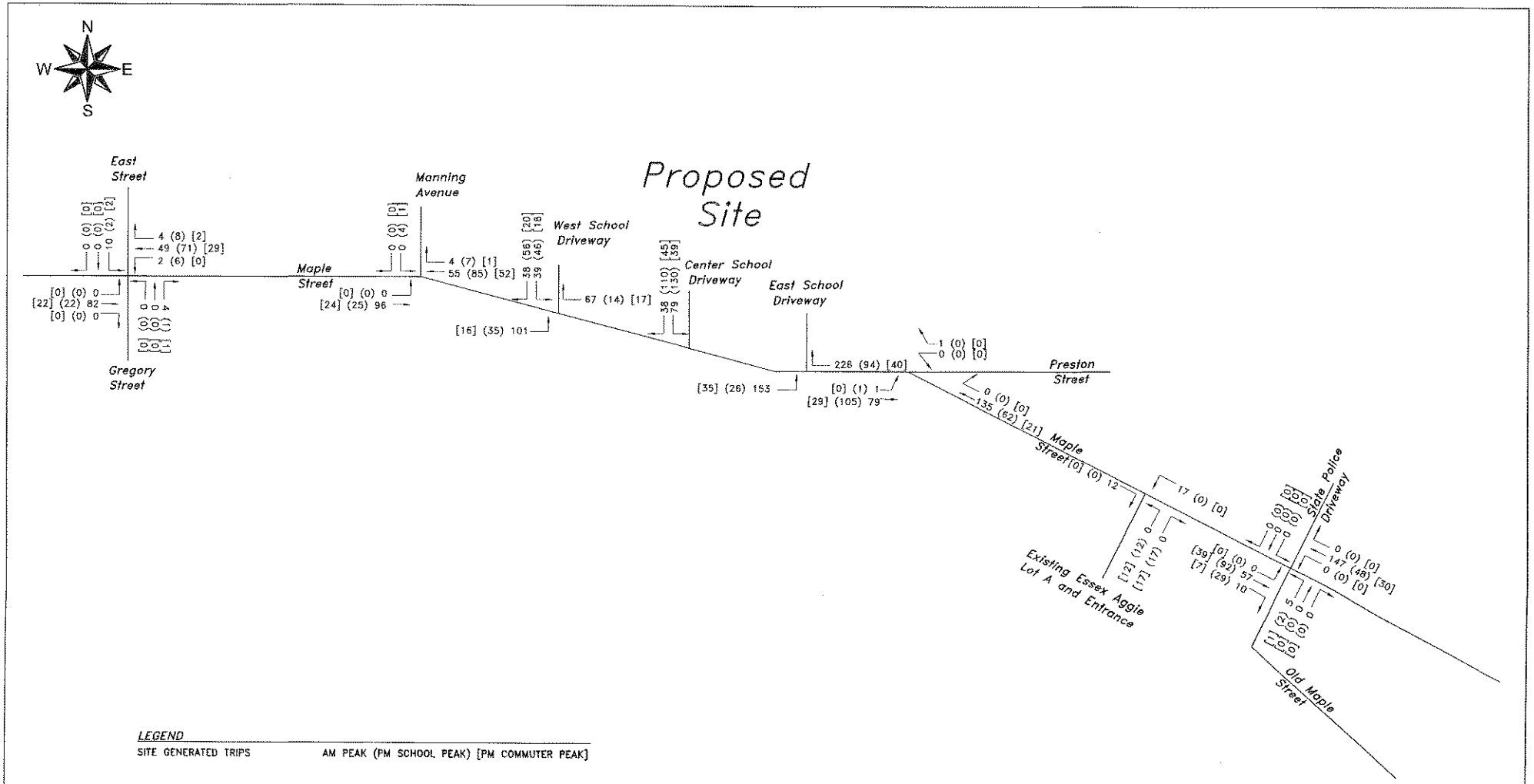

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Figure 9

Essex North Shore Agricultural Technical School

Site Generated Traffic Volumes

DANVERS, MASSACHUSETTS

Capacity Analysis – Existing, Future No-Build, and Future Build Conditions

Capacity analysis was completed for all study intersections for existing, future 2016 no-build, and future 2016 build conditions. Capacity analysis characterizes intersections based on their level of service (LOS). LOS is a quality measure describing operational conditions within a traffic stream, generally in terms of service measures such as speed, travel times, traffic interruptions, etc. Six LOS are defined for each type of facility, from A to F, with A representing the best operating conditions and F representing the worst operating conditions. The LOS criteria for signalized and unsignalized intersections are provided below.

Table 6: LOS Criteria for Signalized and Unsignalized Intersections

	Signalized Intersection	**Unsignalized Intersection**
LOS	Delay Time (sec/veh)	Delay Time (sec/veh)
A	≤ 10	0-10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

Maple Street (Route 62) and East Street/Gregory Street

The signalized intersection of Maple Street (Route 62) with East Street and Gregory Street currently operates at LOS B during the a.m. peak hour and LOS C during the p.m. school and commuter peak hours. Under future build conditions, no change is expected to intersection LOS, with delay increases of less than five seconds per vehicle. Under future build conditions, intersection LOS changes from LOS B to LOS C, and LOS C to LOS D. Intersection delay increases during the a.m. and p.m. school peak hours are less than five seconds per vehicle, while during the p.m. commuter peak, an increase of approximately 19 seconds per vehicle is expected. Because this is a signalized intersection, mitigation of expected impacts could likely be achieved with optimization of the existing signal timing.

Maple Street (Route 62) and Manning Avenue

The Maple Street (Route 62) approaches to the unsignalized intersection of Maple Street (Route 62) with Manning Avenue currently operate at LOS A with less than 10 seconds of delay during all peak hours. Under Future no build and future build conditions, no change in LOS and minimal increases in delay are expected. The southbound approach to the intersection, Manning Avenue, currently operates at LOS C during all peak hours, and is expected to remain at LOS C with increased delays under future no build conditions. Under future build conditions, the approach changes to LOS D during the a.m. and p.m. school peak hours, with increases in delay of approximately 8 seconds and 7 seconds, respectively. Although LOS and delay changes are expected, the overall volume increase on this approach is minimal, 5 vehicles during all three peak hours combined. The increase in delay is due to the added volume on Maple Street (Route 62), and its impact on the available gaps to enter the through traffic stream. It should be noted that the a.m. and p.m. school peak hours analyzed correspond to shift changes at the correctional facility on Manning Avenue, when exiting volumes are expected to peak. It was indicated to PARE that a traffic signal is proposed at this intersection as part of a separate project. The installation of a signal at this location could be expected to significantly improve overall operations.

Table 7: LOS Table

		Weekday AM Peak			School PM Peak			Commuter PM Peak		
		Existing 2011	Future (2016) No-Build	Future (2016) Build	Existing 2011	Future (2016) No-Build	Future (2016) Build	Existing 2011	Future (2016) No-Build	Future (2016) Build
Maple Street (Route 62) and East Street/Gregory Street										
Northbound		D (35.2)	D (35.3)	D (36.5)	D (39.3)	D (39.8)	D (38.5)	D (41.8)	D (44.3)	D (42.2)
Southbound	Left/Thru	D (35.9)	D (36.1)	D (39.8)	C (29.4)	C (29.5)	C (31.0)	C (27.8)	C (28.2)	C (29.9)
	Right	A (3.0)	A (3.1)	A (3.3)	A (3.3)	A (3.4)	A (3.3)	A (3.7)	A (3.6)	A (3.5)
	Approach	B (12.8)	B (13.0)	B (15.3)	B (10.8)	B (10.9)	B (11.4)	B (11.9)	C (12.0)	C (12.7)
Eastbound	Left	D (41.9)	D (42.6)	D (44.4)	D (45.2)	D (45.9)	D (45.0)	D (45.8)	D (50.2)	D (54.1)
	Thru/Right	A (6.9)	A (7.7)	A (9.8)	A (6.9)	A (7.4)	A (6.5)	A (9.2)	A (9.8)	A (8.3)
	Approach	B (13.9)	B (14.7)	B (17.1)	B (17.2)	B (17.7)	B (16.8)	C (20.1)	C (21.7)	C (21.4)
Westbound		C (21.5)	C (25.0)	D (37.8)	D (39.8)	D (39.8)	E (60.6)	C (28.8)	C (29.1)	E (77.9)
Intersection		B (17.6)	B (19.1)	C (24.7)	C (27.2)	C (33.3)	D (36.6)	C (24.7)	C (25.8)	D (45.1)
Maple Street (Route 62) and Manning Avenue										
Southbound	Left	D (27.4)	D (30.6)	E (41.7)	D (28.4)	D (33.3)	E (48.5)	D (25.6)	D (28.5)	D (39.2)
	Right	B (12.2)	B (12.5)	B (13.3)	B (13.2)	B (13.7)	C (15.9)	B (12.8)	B (13.2)	B (14.4)
	Approach	C (22.9)	C (25.0)	D (32.9)	C (21.0)	C (23.9)	D (32.3)	C (19.9)	C (21.7)	C (28.6)
Eastbound	Left	A (8.8)	A (8.9)	A (9.2)	A (8.8)	A (8.9)	A (9.3)	A (8.9)	A (9.0)	A (9.6)
	Thru	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
	Approach	A (0.4)	A (0.4)	A (0.4)	A (0.6)	A (0.7)	A (0.7)	A (0.3)	A (0.3)	A (0.3)
Westbound		N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Maple Street (Route 62) and Existing Western Essex Aggie Driveway/Berry Hall Entrance										
Northbound		F (61.3)	F (85.0)	D (27.1)	E (38.3)	E (41.4)	C (23.2)	D (27.1)	D (31.0)	D (30.6)
Southbound		N/C	N/C	N/A	C (24.3)	C (24.9)	N/A	D (31.5)	D (34.6)	N/A
Eastbound		A (1.6)	A (1.7)	N/C	A (0.3)	A (0.3)	N/C	N/C	N/C	N/C
Westbound		N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Maple Street (Route 62) and Existing Essex Aggie Center Entrance										
Eastbound		N/C	N/C	N/A	N/C	N/C	N/A	N/C	N/C	N/A
Westbound		A (2.4)	A (2.6)	N/A	A (0.9)	A (0.9)	N/A	A (0.5)	A (0.6)	N/A
Maple Street (Route 62) and Existing Essex Aggie East Entrance/Lot A Entrance										
Northbound		N/C	N/C	N/C	C (21.4)	C (24.0)	C (24.4)	C (20.2)	C (22.1)	C (23.2)
Eastbound		N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Westbound		A (1.3)	A (1.4)	A (1.5)	A (0.2)	A (0.2)	N/C	A (0.2)	A (0.2)	A (0.3)
Maple Street (Route 62) and Preston Street										
Southbound		D (25.8)	D (25.1)	E (38.6)	C (24.2)	D (27.6)	E (37.4)	C (23.0)	D (25.1)	D (34.0)
Eastbound		A (0.2)	A (0.2)	A (0.3)	A (0.2)	A (0.3)	A (0.4)	A (0.2)	A (0.2)	A (0.3)
Westbound		N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Maple Street (Route 62 and Old Maple Street/State Police Driveway										
Northbound		B (15.7)	B (17.2)	B (18.8)	B (18.7)	B (19.3)	C (24.0)	B (13.3)	B (14.6)	B (17.4)
Southbound		C (28.8)	C (32.0)	C (33.9)	D (38.9)	D (41.2)	D (45.1)	C (31.9)	C (34.1)	D (40.4)
Eastbound	Left	N/C	N/C	N/C	D (43.3)	D (47.0)	D (50.4)	D (36.0)	D (39.5)	D (45.5)
	Thru/Right	C (28.7)	C (30.6)	C (31.0)	C (30.9)	C (33.4)	C (33.0)	C (24.0)	C (27.2)	C (25.9)
	Approach	C (28.7)	C (30.6)	C (31.0)	C (30.9)	C (33.5)	C (33.1)	C (24.0)	C (27.2)	C (26.0)
Westbound	Left	C (29.4)	D (36.0)	D (39.4)	D (38.4)	D (42.6)	D (52.6)	C (31.9)	D (35.5)	D (40.3)
	Thru/Right	A (6.3)	A (7.7)	A (8.3)	A (9.7)	B (10.4)	B (10.6)	B (10.7)	B (11.9)	B (10.0)
	Approach	B (12.1)	B (15.0)	B (15.2)	B (18.1)	C (20.1)	C (22.6)	B (14.5)	B (16.3)	B (15.4)
Intersection		B (18.5)	C (20.9)	C (21.2)	C (23.9)	C (25.9)	C (27.8)	B (18.2)	C (20.4)	C (20.3)
Maple Street (Route 62) and Proposed West Site Entrance										
Southbound	Left	N/A	N/A	F (159.9)	N/A	N/A	F (53.0)	N/A	N/A	F (53.5)
	Right	N/A	N/A	B (13.9)	N/A	N/A	B (14.2)	N/A	N/A	B (13.8)
	Approach	N/A	N/A	F (87.9)	N/A	N/A	D (31.7)	N/A	N/A	D (32.6)
Eastbound	Left	N/A	N/A	B (10.5)	N/A	N/A	A (9.6)	N/A	N/A	A (9.8)
	Thru	N/A	N/A	N/C	N/A	N/A	N/C	N/A	N/A	N/C
	Approach	N/A	N/A	A (1.5)	N/A	N/A	A (0.6)	N/A	N/A	A (0.3)
Westbound		N/A	N/A	N/C	N/A	N/A	N/C	N/A	N/A	N/C
Maple Street (Route 62) and Proposed Center Site Entrance										
Southbound	Left	N/A	N/A	B (16.3)	N/A	N/A	B (17.7)	N/A	N/A	B (14.6)
	Thru/Right	N/A	N/A	A (0.4)	N/A	N/A	A (1.5)	N/A	N/A	A (0.6)
	Approach	N/A	N/A	B (11.2)	N/A	N/A	B (10.3)	N/A	N/A	A (7.1)
Eastbound		N/A	N/A	B (12.9)	N/A	N/A	B (13.1)	N/A	N/A	B (9.3)
Westbound		N/A	N/A	B (10.8)	N/A	N/A	B (11.6)	N/A	N/A	B (10.7)
Intersection		N/A	N/A	B (11.8)	N/A	N/A	B (11.9)	N/A	N/A	B (9.8)
Maple Street (Route 62) and Proposed East Site Entrance										
Eastbound	Left	N/A	N/A	B (11.0)	N/A	N/A	A (9.2)	N/A	N/A	A (9.3)
	Thru	N/A	N/A	N/C	N/A	N/A	N/C	N/A	N/A	N/C
	Approach	N/A	N/A	A (2.4)	N/A	N/A	A (0.3)	N/A	N/A	A (0.5)
Westbound		N/A	N/A	N/C	N/A	N/A	N/C	N/A	N/A	N/C

Legend: LOS (Delay/Vehicle in Seconds)
N/C = No Conflict
N/A = Does not exist
* Over Capacity

Maple Street (Route 62) and Preston Street
The southbound Preston Street approach to the intersection of Maple Street (Route 62) with Preston Street currently operates at LOS D during the a.m. peak hour and LOS C during the p.m. peak hours. Under future no build conditions, the approach LOS during all peak hours is expected to be LOS D, with increases in delay of less than four seconds per vehicle. Under build conditions, this approach is expected to operate at LOS E with approximately 39 seconds of delay per vehicle during the a.m. peak hour and 37 seconds of delay per vehicle during the p.m. school peak hour. The increases in delay on this approach are primarily a result of the increased through volumes on Maple Street (Route 62) and their impact on queued left turning vehicles from Preston Street. The actual combined increase in vehicles turning onto or from Preston Street during all peak hours is 3 vehicles.

Maple Street (Route 62) and Old Maple Street/State Police Driveway
The signalized intersection of Maple Street (Route 62) with Old Maple Street and the State Police Driveway currently operates at LOS B during the a.m. and p.m. commuter peak hours, and LOS C during the p.m. school peak hour. Under future no-build conditions, the intersection is expected to operate at LOS C during all peak hours, with delay increases of less than three seconds per vehicle. Under future build conditions, intersection LOS remains at LOS C, with delay increases of less than two seconds per vehicle. Overall impacts of the new ENSATHS on this intersection are minimal.

Maple Street (Route 62) and the Proposed Site Driveways
The proposed intersection of Maple Street (Route 62) and the eastern site driveway is expected to operate with negligible delays on the eastbound and westbound approaches. This intersection will operate as an access only, limiting its potential impact on Maple Street (Route 62).

The proposed intersection of Maple Street (Route 62) with the center site driveway is expected to operate with no delays on Maple Street (Route 62). This intersection will operate as an egress only from the school. As an unsignalized intersection, the southbound approach, the exiting driveway, is expected to operate at LOS E during the a.m. and p.m. school peak hours, and LOS D during the p.m. commuter peak hour. These LOS were calculated assuming that the exit will operate as a single lane. LOS for the right turn could be improved by designating a left turn and a right turn lane on the approach.

The proposed intersection of Maple Street (Route 62) with the western site driveway is also expected to operate with minimal delays on Maple Street (Route 62) during all peak hours. This driveway will be a full-access drive, allowing both access and egress. Assuming two exiting lanes of traffic, the southbound approach is expected to operate at LOS F with considerable delays during the a.m. peak hour, and LOS D with 32-33 seconds of delay per vehicle during the p.m. school and p.m. commuter peak hours. With two exiting lanes, approach delays are decreased by approximately half, however, no impact on approach LOS is realized.

Future build traffic volumes for all study area intersections for the a.m., p.m. school peak, and the p.m. commuter peak hours are shown in Figures 10, 11, and 12.

Potential Mitigation Measures

The proposed intersection of Maple Street (Route 62) with the western site entrance is expected to operate at varied LOS during the a.m., p.m. school, and p.m. commuter peak hours. One potential mitigation option is the installation of a left turn lane on the Maple Street (Route 62) eastbound approach to this intersection. Although this improvement would have no significant impact on approach LOS or delay times, the installation of a 100-foot left turn lane would provide an area for left turning vehicles to queue, minimizing the intersections impact on the eastbound through movement. While this improvement does not provide a significant level of service benefit, it may increase safety at the intersection. Eastbound through vehicles would not be passing queued left turning vehicles on the right through the shoulder, a movement that frequently results in sideswipe collisions. In accordance with the AASHTO *Policy on Geometric Design of Highways and Streets, 2004 Edition*, Exhibit 9-75, designated left turn lanes on two-lane highways should be considered, but are not required, when both the left turn volume (as a percent of the total approach volume) and the opposing through volume thresholds are met. For a 40 mile per hour condition, with an opposing volume of 800 vehicles per hour (VPH), the required advancing volume in the direction of travel, assuming 30% left turns, is 160 VPH. At the western site entrance during the a.m. peak hour, there are 775 opposing vehicles, 192 advancing vehicles, and 27% left turning traffic; therefore, the threshold is met.

Installing a designated eastbound left turn lane would require the realignment of the existing lane striping at the intersection and adjustments to the existing curb line along the north side of Maple Street (Route 62). Measurements taken at the intersection indicate an available curb-to-curb roadway width of approximately 35 feet. If Maple Street (Route 62) was realigned to have one 11-foot through lane, one 11-foot left turn lane, and a 2-foot shoulder in the eastbound direction and one 11-foot through lane and 2-foot shoulder in the westbound direction, the required roadway width would be would be 37 feet at the intersection. As an alternative to realigning the curb, the outside shoulders could be narrowed to a width of one foot, for a total required cross section of 35 feet. The existing roadway width east and west of the intersection is approximately 35 feet, which could accommodate the required tapers for the cross section with one-foot shoulders, but not the cross section with two-foot shoulders. The installation of the turn lane and realignment of existing striping would require coordination with the Towns of Danvers and Middleton as the intersection lies on the border between the two.

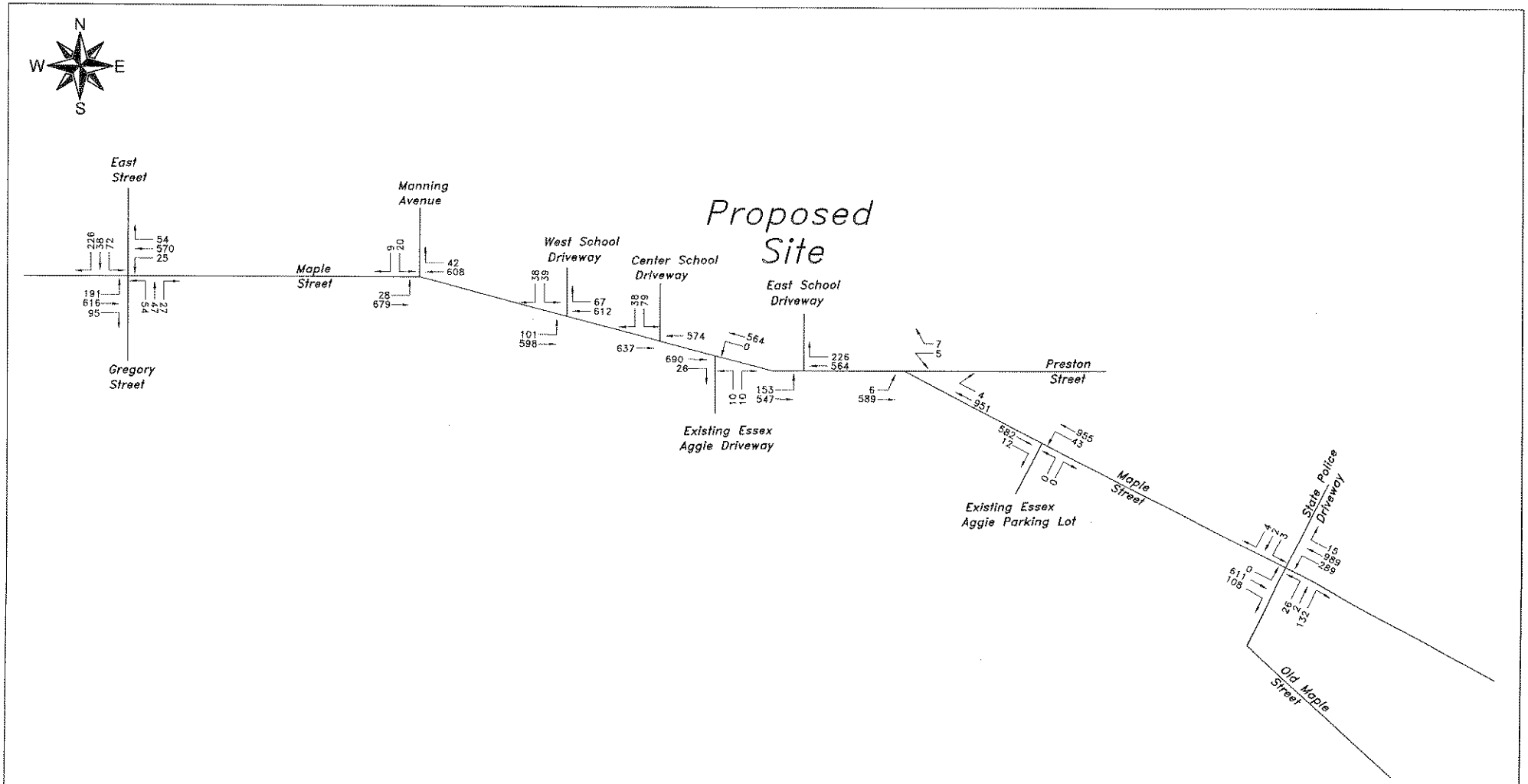
Other mitigation options available for this access include the installation of a traffic signal or a roundabout at the intersection. A preliminary review of the p.m. school peak hour volumes indicate that they may fall short of meeting the peak hour signal warrant. If the signal warrant is not met during this peak hour, which is expected to be the peak hour of site generated trips on the southbound approach, it will not likely be met during other hours of the day. A roundabout would be a viable alternative, presenting safety improvements compared to a traffic signal, but would have significant impacts on right-of-way and the current design of this site entrance. As such, it does not appear to be a viable alternative.

Discussions with the ENSATHS staff indicated a desire for the installation of a traffic signal at the intersection. A signalized intersection at this location would facilitate turning movements from the site, especially for buses during the p.m. school peak hour, and increase the desirability of the intersection as the primary egress from the site. The signal at this intersection would be actuated, such that it will remain green on Maple Street (Route 62) when there are no calls from the site driveway. Although the volumes exiting the site during the p.m. school peak hour are slightly lower than those required to meet the peak hour signal warrant, the through volume on Maple Street (Route 62) is sufficiently high. A signalized intersection at this location will stop

through traffic for exiting vehicles, improving the safety of turning movements at the intersection. The capacity analysis results included in the LOS table, Table 7, are for a signalized intersection at this location.

Transportation Demand Management Program

In an effort to reduce vehicle trips to the project site and support and encourage ridesharing onsite, the project proponent will implement a comprehensive Transportation Demand Management (TDM) Program onsite. Site-specific TDM strategies include the promotion of ridesharing to both faculty and students, as well as the placement of preferential parking spaces throughout the site to enhance the appeal of ridesharing. Ridesharing opportunities could be communicated school email, internal memos, and perhaps through student groups, such as student council or extracurricular clubs. Ridesharing will not only reduce the overall number of daily trips to the site, could improve LOS and delay on roadways in the vicinity of the school.



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401-334-4100

PROJECT NO 11698.00

DATE: January 2012

Figure 10

Essex North Shore Agricultural Technical School
Future (2016) Build Traffic Volumes
AM Peak Hour
Weekday 7:15 to 8:15 AM

DANVERS, MASSACHUSETTS

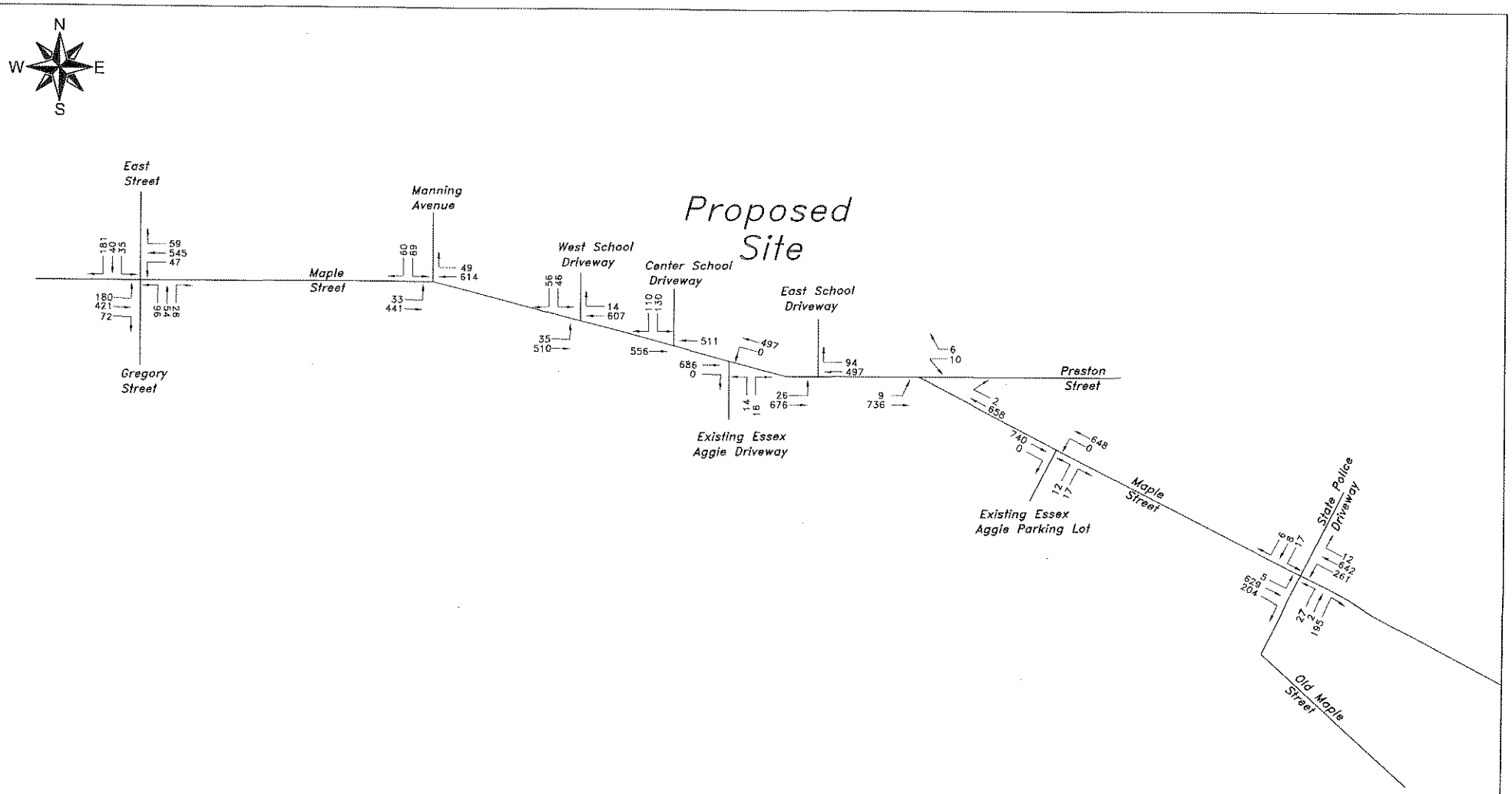

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Figure 11
Essex North Shore Agricultural Technical School
Future (2016) Build Traffic Volumes
PM School Dismissal Peak
Weekday 2:15 to 3:15 PM

DANVERS, MASSACHUSETTS

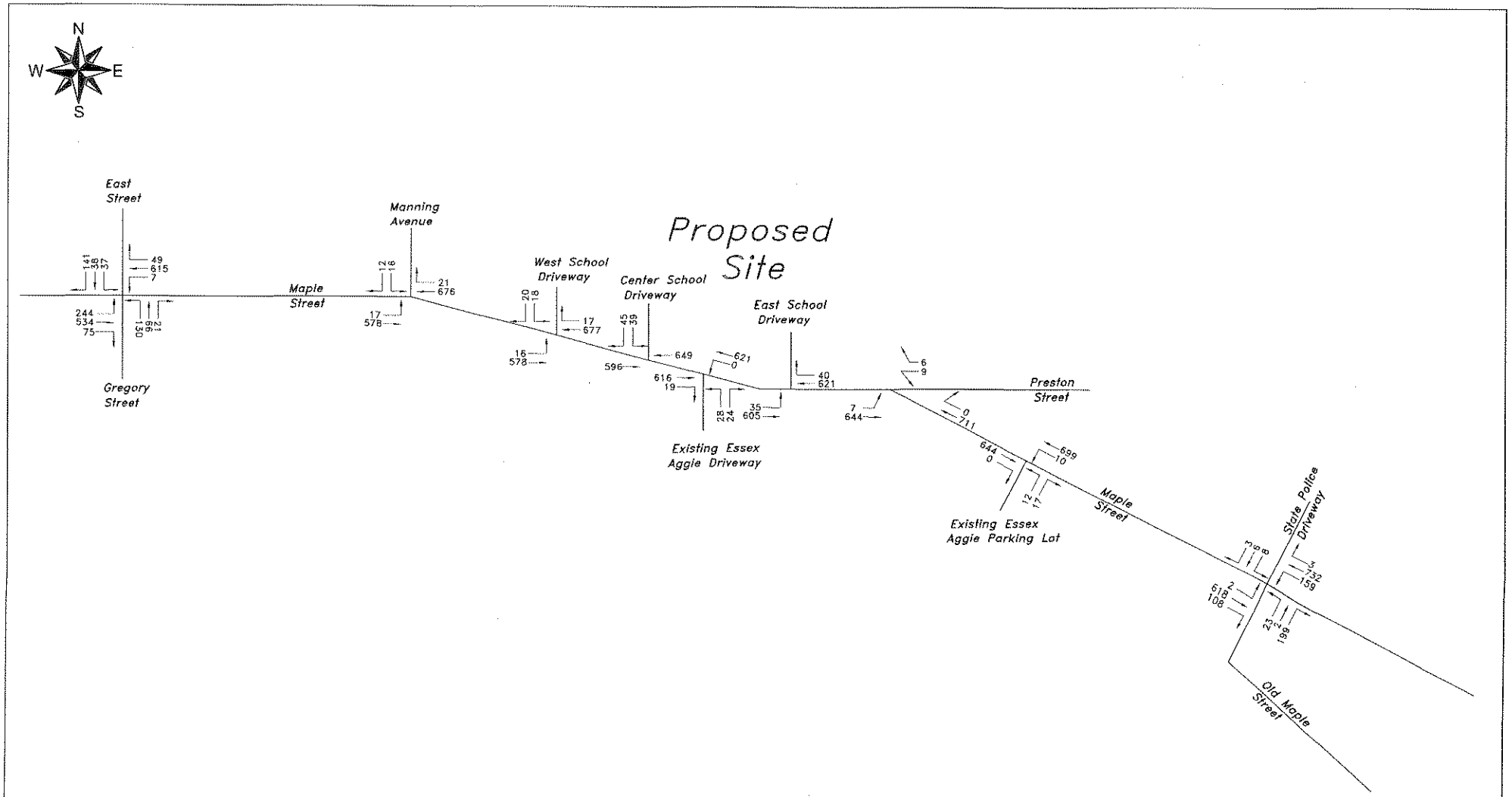

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Figure 12

Essex North Shore Agricultural Technical School
Future (2016) Build Traffic Volumes
PM Peak Hour
Weekday 4:30 to 5:30 PM

DANVERS, MASSACHUSETTS

Conclusions

The crash rates calculated for the signalized and unsignalized intersections within the vicinity of the proposed ENSATHS are all well below the Statewide and District 4 averages. It is not expected that the addition of the new traffic from the proposed school will create an additional safety concern at this intersection.

The available stopping sight distances from the westernmost proposed driveway at the new ENSATHS meet the AASHTO requirements for the posted speed limit and the selected design speed. From the center site driveway, proposed opposite Prentiss Road, the available stopping sight distance to the east does not meet AASHTO requirements, while sight distance to the west does. To the east, the removal of a large tree on the north side of Maple Street (Route 62) would improve sight distance considerably, meeting the required AASHTO distances. Utility poles running along the north side of Maple Street (Route 62) present breaks in the line of sight from both entrances, but do not restrict visibility. Intersection sight distances are not met in all directions from the site entrances due to the presence of trees and signs. It is likely that several of the identified trees will be removed for construction of the new school. According to AASHTO, if the intersection sight distances cannot be achieved, but the available sight distance for an entering vehicle is at least equal to the appropriate stopping sight distance, then drivers have sufficient sight distance to anticipate and avoid collisions.

Level of service and delay impacts are expected at the proposed western and center site driveways, however, the duration of the impacts will be limited to the time surrounding the a.m. student drop-off and the p.m. dismissal each day. The most significant of these delays are expected to occur at the intersection of Maple Street (Route 62) and the western proposed site driveway. To help mitigate the expected impacts at this intersection, it is recommended that the southbound approach to the intersection include a designated left turn and a designated right turn lane. Installation of separate lanes is expected to reduce queue lengths on the southbound approach and reduce delay times for vehicles turning from the site onto Maple Street (Route 62). It is also recommended that a left turn lane be added to the eastbound approach of Maple Street (Route 62) at the western site driveway. A separate lane will allow left turning vehicles to queue on Maple Street (Route 62) without impacting the eastbound through movement.

Signalization of the center site driveway was considered and determined to be the preferred alternative. Although the site exiting volume is slightly below that required to meet the peak hour signal warrant, the through volume on Maple Street (Route 62) is sufficiently high. The installation of a signal at this intersection would facilitate turning movements from the site, and help improve the safety of the intersection for turning vehicles. All recommended improvements on Maple Street (Route 62) will require coordination with the Town of Danvers and some will require coordination with the Town of Middleton. The school is expected to have little to no impact on the roadways surrounding it during the off-peak hours, and the conditions on those roadways are expected to remain at an acceptable performance level

The school will be promoting ridesharing opportunities to its faculty and students, as well as providing preferential parking onsite for those who take advantage of these opportunities. Ridesharing at the school will not only decrease the overall number of daily trips expected, but could also help improve LOS and delay on the roadways adjacent to the site.