Traffic Impact and Access Study

Proposed Cultivation Facility
500 School Street

Mansfield, MA

February 20, 2020

Prepared by:

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Prepared for:

Community Gardens, Inc.

TRAFFIC IMPACT AND ACCESS STUDY

PROPOSED CULTIVATION FACILITY

500 School Street
Mansfield, Massachusetts

Prepared for:

Community Gardens, LLC

February 20, 2020

Prepared by:

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SECTION 1: EXECUTIVE SUMMARY

Bayside Engineering has prepared this study to assess the traffic impact and to evaluate the access requirements of the proposed cultivation facility to be located at 500 School Street in Mansfield, Massachusetts.

This report identifies existing traffic operating parameters on key roadways and intersections within the study area, evaluates the anticipated traffic volume increases as a result of the proposed project, analyzes the project's traffic-related impacts, determines the projects access/egress requirements and identifies appropriate mitigating measures designed to minimize the traffic-related impacts created by the project. The following provides a brief summary of the study findings.

PROJECT DESCRIPTION

The existing commercial building, located at 500 School Street, is proposed to be razed and a 41,866 square foot (sf) cultivation facility constructed in its place. The site is located on the south side of School Street across from Plymouth Street in Mansfield, MA. Currently, the site contains a single building currently used as an autobody repair shop. Access is provided by way of a large curb cut on School Street.

The cultivation facility will employ up to fifty (50) employees at peak operation to cover the six (6) days a week the cultivation facility will be open. On a typical weekday, there would be three (3) shifts (beginning at 7:00 AM, 9:00 AM and 11:00 AM and ending at 3:00 PM, 5:00 PM and 7:00 PM). On Saturday, there would be a single shift (9:00 AM to 5:00 PM). The facility will be closed on Sundays. Access to the site will be provided by a single, full movement curb cut to School Street opposite Plymouth Street. Parking on the site would be provided for twenty-eight (28) vehicles.

When in full operation, the facility is expected to generate six (6) to eight (8) daily deliveries of product to retail dispensaries. Deliveries would occur Monday through Saturday. Deliveries will occur using unmarked minivans (similar to a ford transit van).

Additionally, four (4) daily deliveries of supplies to the facility are anticipated at full operation. These supplies will be coming to the site in thirty (30) foot long box trucks. These deliveries will occur daily, Monday through Friday.

Figure 1 shows the site location in relation to the surrounding area.

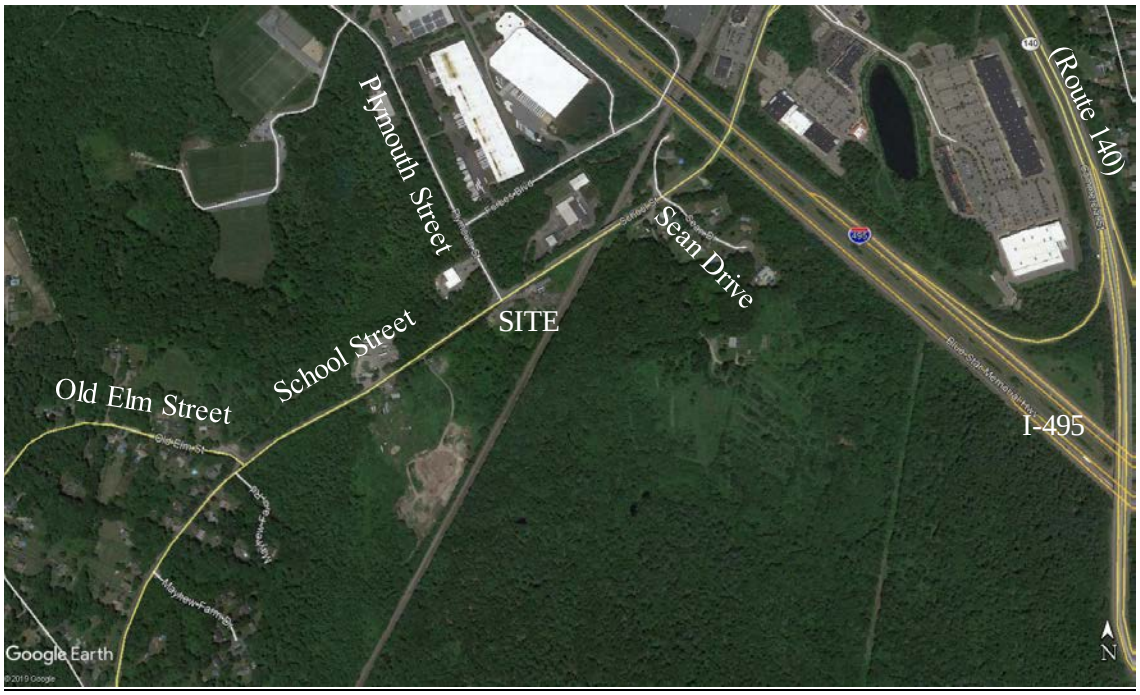


Figure 1
Site Location Map

STUDY METHODOLOGY

This study has been prepared in three stages. The first stage involved an assessment of existing conditions within the study area and included an inventory of roadway geometrics, pedestrian and bicycle facilities and public transportation services. Existing traffic counts were performed at the study area intersections.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the project were assessed along with future traffic demands due to expected traffic growth independent of the proposed project. In accordance with Massachusetts Department of Transportation (MassDOT) guidelines, the year 2027 was selected as the basis for modeling future transportation impacts of the proposed development to reflect a the opening year conditions and a seven-year planning horizon.

The third stage of the study presents and evaluates measures to address traffic issues, if any, and necessary improvements to accommodate the development.

STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- School Street and Old Elm Street
- School Street, Plymouth Street and Existing Site Driveway
- School Street, Old School Street and Sean Drive

EXISTING CONDITIONS

Evaluation of existing conditions within the study area includes a description of roadway geometrics, traffic constraints, land uses at the intersections, and quantification of traffic volumes.

Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in January 2020. Peak-period turning movement counts were conducted during the weekday morning period (7:00 to 9:00 AM) and the weekday evening peak period (4:00 to 6:30 PM). Daily traffic counts were conducted on School Street for a two (2) day period (Wednesday to Thursday) using automatic traffic recorders (ATR).

The traffic-volume data gathered as part of this study was collected during the month of January 2020. Data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. Based upon the available traffic count data, January volumes are slightly lower than average month conditions. To represent average month conditions, existing volumes were adjusted upward by a factor of 1.157.

School Street, west of Plymouth Street was recorded to carry approximately 16,100 vehicles per day (vpd). During the weekday morning peak hour, approximately 1,409 vehicles per hour (vph) were recorded on School Street and during the weekday evening peak hour, 1,754 vph were recorded.

Motor Vehicle Crash Data

Motor vehicle crash data for the study area intersections and roadways were obtained from MassDOT from 2015 to 2019. The motor vehicle crash data was reviewed to determine crash trends in the study area. Twenty-four 24 crashes were reported during the five year interval at the study area intersections. Five (5) crashes were reported at the intersection of School Street and Old Elm Street, fourteen (14) crashes occurred at the intersection of School Street and Plymouth Street and five (5) crashes occurred at the intersection of School Street, Old School Street and Sean Drive. No fatalities were reported.

PROBABLE IMPACTS OF THE PROJECT

No-Build Traffic Volumes

To determine the impact of site-generated traffic volumes generated by the project on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2027. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2027. The Southeastern Regional Planning and Economic Development District (SRPEDD) was contacted to determine an appropriate growth rate. The SRPEDD determined that for the Town of Mansfield, an annual growth rate of 0.5 percent is appropriate. Therefore, this study used a 0.5 percent compounded growth rate to develop future No-Build conditions. One (1) other background project was identified and included in the future background projections.

Build Traffic Volumes

Site generated traffic was based on anticipated characteristics of proposed site operations. The Institute of Transportation Engineers (ITE) *Trip Generation* manual[1] currently does not have a land use code or data for cultivation facilities.

During an average weekday, the proposed cultivation facility is expected to generate a total of 136 vehicle trips (68 vehicles entering and 68 vehicles exiting). During the weekday morning peak hour, the proposed project is expected to generate a total of 23 vehicle trips (22 vehicles entering and 1 vehicle exiting) and during the weekday evening peak hour, a total of 22 vehicle trips (1 vehicle entering and 21 vehicles exiting). During the Saturday midday peak-hour, 1 vehicle trip (1 vehicle entering and 0 vehicles exiting) is expected.

TRAFFIC OPERATIONS ANALYSIS

In order to assess the impacts of the proposed project on the roadway network, traffic operations analyses were performed at the study area intersections under 2020 Existing, 2027 No-Build and 2027 Build conditions. These analyses indicate that the proposed project will not result in a significant impact on traffic operations at the study area intersections over No-Build conditions.

[1] *Trip Generation*, Eighth Edition; Institute of Transportation Engineers; Washington, DC; 2009.

RECOMMENDATIONS

A review of the existing traffic volume dates indicates that the intersection of School Street and Plymouth Street currently operates at a poor level of service (long delays for vehicles exiting Plymouth Street). The volume of traffic expected to be generated by the project will not significantly affect existing intersection operations. The existing traffic volume data indicates signalization of the intersection would be warranted. The existing signal system should be upgraded to a full traffic signal with emergency vehicle preemption and the Plymouth Street approach should be re-striped to provide an exclusive right-turn lane and a shared through/left-turn lane. With these measures, the intersection is projected to operate at LOS B during the weekday morning peak hour and at LOS D during the weekday evening peak hour, with or without the project. The project proponent is willing to work with the Town to implement this measure.

Any landscaping or sidewalk features should be set back to maintain sight lines. In order to maintain sight distances, it is recommended that a sight distance triangle be established along the site frontage, in both directions from a point fifteen (15) back at the site driveway and extending to each of the corners of the site along School Street. Within this triangle, any existing vegetation should be cut-back and any plantings be designed to be low growth plantings so as to not impede sight lines.

SUMMARY

Review of the proposed project and the access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will meet safety standards and have a minimal impact on existing traffic conditions. With the proposed access, and maintaining sight distances from the driveways (clear sight lines along frontage), safe and efficient access can be provided to the patrons of the proposed project and to the motoring public in the area.

SECTION 2: EXISTING TRAFFIC CONDITIONS

STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- School Street and Old Elm Street
- School Street, Plymouth Street and Existing Site Driveway
- School Street, Old School Street and Sean Drive

FIELD SURVEY

A comprehensive field inventory of the proposed site was conducted in January 2020. The inventory included collection of existing roadway geometrics, traffic volumes, and safety data for the existing study area intersections and site access driveway locations. Traffic volumes were measured by means of automatic traffic recorder (ATR) counts and substantiated by manual turning movement counts (TMCs) conducted at the study area intersections.

GEOMETRICS

Primary study area roadways are described below.

Roadways

School Street

School Street is generally a collector roadway under the jurisdiction of the Town of Mansfield. In the vicinity of the site, School Street is classified functionally as a Rural Minor Collector. School Street traverses Mansfield in a general north/south direction

from its northern terminus at the intersection of West Street and Copeland Drive to its southern terminus south of Otis Street where the road name changes to Elm Street. However, in the site vicinity, School Street generally traverses west and east and will be referred to as west and east in this report. In the study area, School Street is a two-lane roadway. Additional turn lanes are provided at major signalized intersections (near Mansfield Crossing and Route 140). The posted speed limit is 40 miles per hour (mph). Illumination is provided by way of street lights mounted on poles. Land use along School Street in the study area consists of commercial uses.

Intersections

School Street and Old Elm Street

Old Elm Street intersects School Street from the north to form this three-legged, unsignalized intersection. The School Street approaches each consist of single lanes, 11 feet (ft) wide permitting left or right turns. The Old Elm Street approach consists of a single lane, approximately 16 feet wide permitting left or right turns. Land use in the vicinity of the intersection consists of single-family homes and wooded land. Old Elm Street is under STOP sign control. The posted speed limit on Old Elm Street is 30 mph.

School Street, Plymouth Street and Existing Site Driveway

Plymouth Street intersects School Street from the north and the existing site driveway intersects form the south to form this four-legged, unsignalized intersection. The School Street approaches each consist of single lanes, 11 to 13 ft wide permitting left or right turns. The Plymouth Street approach consists of a single lane, 12 feet wide permitting left or right turns. The existing site driveway consists of an approximately 100 ft wide curb cut opposite Plymouth Street. Land use in the vicinity intersection consists of commercial properties and the existing site. Plymouth Street is under STOP sign control. The Mansfield Fire Station is located to the north on Plymouth Street and at the intersection there is a fire pre-emption traffic signal to allow emergency vehicles to exit Plymouth Street to School Street. The traffic signal flashes red for Plymouth Street and yellow for School Street during normal operation. The speed limit on Plymouth Street is 40 mph.

School Street, Old School Street and Sean Drive

School Street forms the east and west legs of this unsignalized intersection, Old School Street forms the north leg and Sean Drive forms the south leg. The School Street approaches each consist of single lanes, 12 to 13 ft wide permitting left or right turns. The Old School Street approach consists of a single lane, approximately 15 feet wide that permits all movements. The Sean Drive approach consists of a single lane, 12 feet wide that permits all movements. Land use at the intersection consists of primarily of residential homes and wooded land. The Old School Street and Sean Drive approaches each operate under STOP sign control.

TRAFFIC VOLUMES

Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in January 2020. Peak-period turning movement counts were conducted on Wednesday, January 29, 2020 during the weekday morning and evening peak periods (7:00 to 9:00 AM and 4:00 to 6:30 PM) at the following intersections:

- School Street and Old Elm Street
- School Street, Plymouth Street and Existing Site Driveway
- School Street, Old School Street and Sean Drive

Daily traffic counts were conducted on School Street for a two-day period using automatic traffic recorders (ATR).

Analysis of the peak-period traffic counts indicated that the weekday morning commuter peak hour generally occurs between 7:15 AM and 8:15 AM and the weekday evening commuter peak generally hour occurs between 4:30 and 5:30 PM. The traffic count worksheets are provided in the Appendix.

Seasonal Adjustment

The traffic-volume data gathered as part of this study was collected during the month of January 2020. Available traffic volume data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. The traffic data showed January volumes to be slightly lower than average month conditions. Therefore, the January traffic volumes were adjusted upward by a factor of 1.157 to represent average month conditions. The 2020 existing weekday daily and peak-hour traffic volumes for average-month conditions are summarized in Table 1. The 2020 Existing weekday morning and weekday evening peak hour traffic flow networks are shown graphically on Figure 2. The seasonal worksheets are provided in the Appendix.

TABLE 1
EXISTING WEEKDAY TRAFFIC-VOLUME SUMMARY[a]

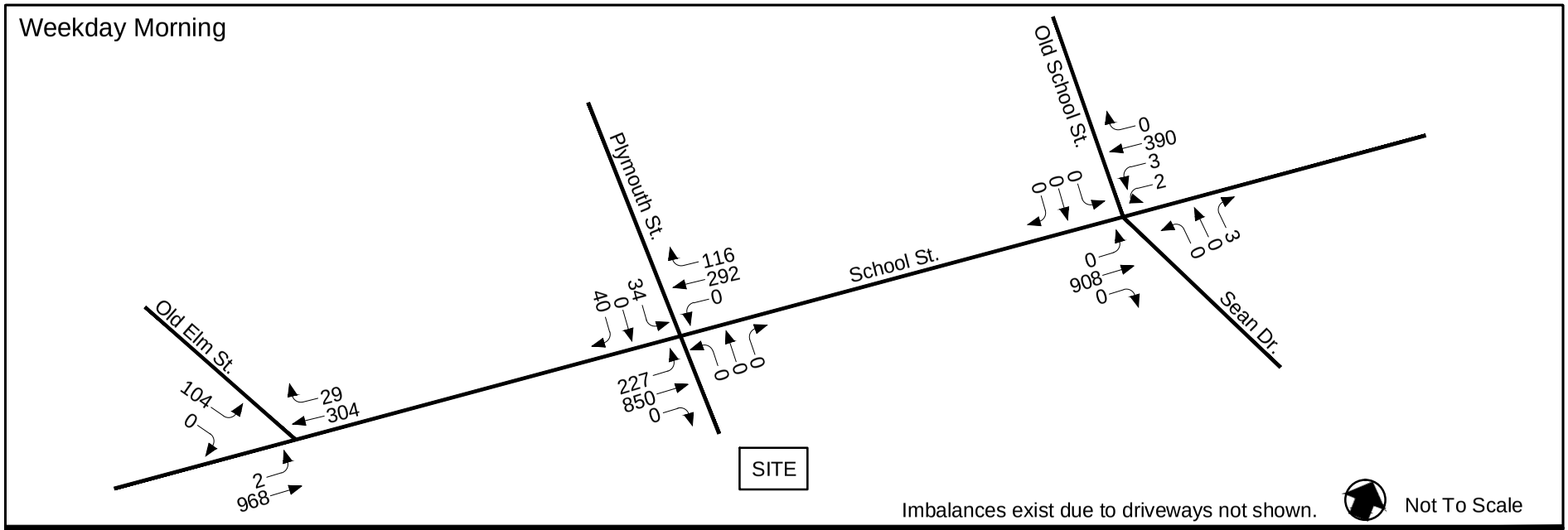
Location	Daily Traffic Volume[b]	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Traffic Volume[c]	K Factor[d]	Directional Distribution[e]	Traffic Volume	K Factor	Directional Distribution
School Street, west of Plymouth Street	16,000	1,409	8.8	76.4% EB	1,754	10.9	72.5% WB

[a]Two-way traffic volume.
[b]Daily traffic expressed in vehicles per day.
[c]Expressed in vehicles per hour.
[d]Percent of daily traffic volumes which occurs during the peak hour.
[e]Percent of peak-hour volume in the predominant direction of travel.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

School Street, west of Plymouth Street, was recorded to carry approximately 16,100 vehicles per day (vpd). During the weekday morning peak hour, approximately 1,409 vehicles per hour (vph) were recorded and during the weekday evening peak hour, 1,754 vph were recorded.

MOTOR VEHICLE CRASH DATA

Motor vehicle crash data for the study area intersections and roadways were obtained from the Massachusetts Department of Transportation (MassDOT) for 2015 through 2019. Twenty-four (24) crashes were reported during the five year interval at the study area intersections. Five (5) crashes were reported at the intersection of School Street and Old Elm Street, fourteen (14) crashes occurred at the intersection of School Street and Plymouth Street and five (5) crashes occurred at the intersection of School Street, Old School Street and Sean Drive. No fatalities were reported. The crash data is included in the Appendix. The crash data is summarized in Table 2. None of the intersections experienced a significant crash rate.



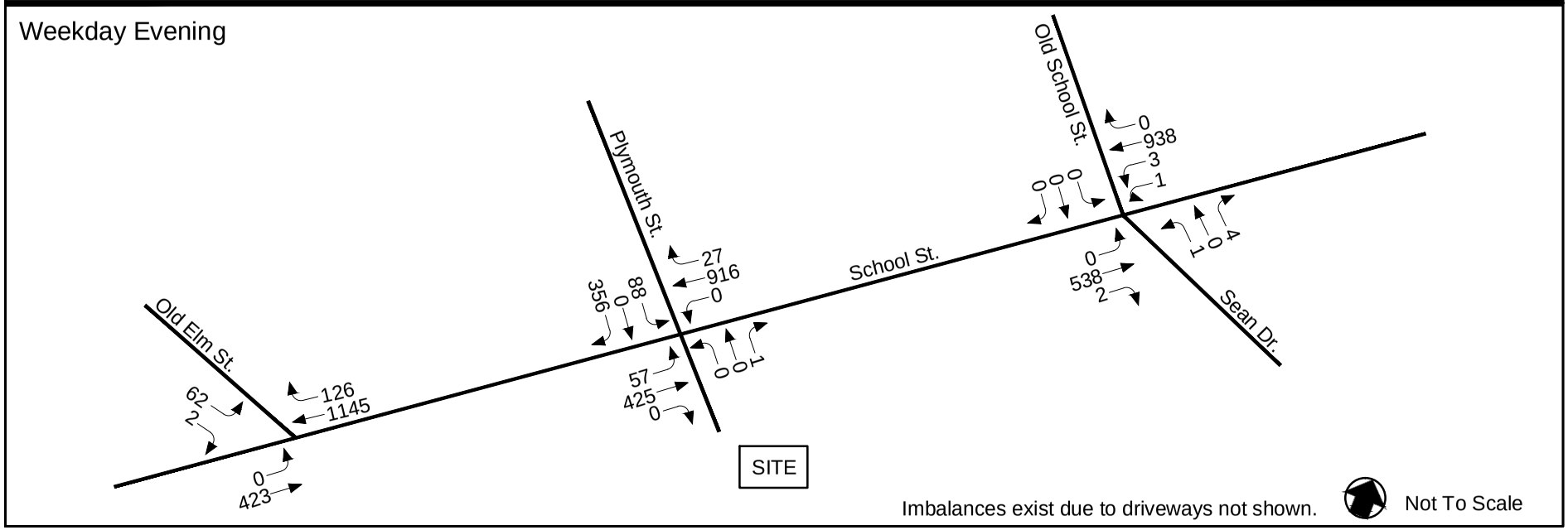


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Figure 2

2020 Existing
Weekday Peak Hour
Traffic Volumes

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TABLE 2
MOTOR VEHICLE CRASH DATA SUMMARY[a]

Scenario	Location: School Street and Old Elm Street	Location: School Street, Plymouth Street and Existing Site Driveway	Location: School Street, Old School Street and Sean Drive
Year:			
2015	0	2	1
2016	4	3	2
2017	0	2	0
2018	1	6	2
2019	0	1	0
Total	5	14	5
Average[b]	1.0	2.8	1.0
Crash Rate[c]	0.17	0.45	0.20
Significant[d]	No	No	No
Type:			
Angle	2	1	0
Rear-End	0	9	2
Head-On	1	0	0
Sideswipe	0	0	0
Single Vehicle	1	2	3
Pedestrian/Bicycle	1	2	0
Unknown	0	0	0
Total	5	14	5
Time of Day:			
Weekday (7:00 to 9:00 AM)	2	1	0
Weekday (4:00 to 6:00 PM)	0	3	1
Remainder of Day	3	10	4
Total	5	14	5
Pavement Conditions:			
Dry	3	12	3
Wet	0	2	2
Snow/Ice/Slush	1	0	0
Sand, Mud, Dirt, Oil, Gravel	1	0	0
Total	5	14	5
Severity:			
Property Damage Only	3	9	4
Personal Injury	1	5	1
Fatal Accident	0	0	0
Unknown	1	0	0
Total	5	14	5

[a]Source: MassDOT, 2015 through 2019.
[b]Average crashes over three-year period.
[c]Crash rate per million entering vehicles (mev).
[d]Signalized intersections are significant if rate >0.73 crashes per million vehicles, and unsignalized intersections are significant if rate >0.57 crashes per million vehicles.

VEHICLE SPEEDS

Existing speed data for School Street was also obtained from the automatic traffic recorder counts. The speed data is summarized in Table 3.

TABLE 3
OBSERVED VEHICLE SPEEDS

Direction	Posted Speed Limit (mph)	Average Observed Speed[a] (mph)	85th Percentile Speed (mph)
School Street Eastbound	40	41	45
School Street Westbound	40	42	46

[a]Based on speed data compiled in January 2020.

As shown in Table 3, the average speed of vehicles travelling eastbound or westbound was found to be 41 and 42 mph respectively on School Street. The 85th percentile speed was found to be 45 mph for eastbound vehicles and 46 mph for westbound vehicles. The 85th percentile speed is the speed at which sight distances are typically evaluated.

PUBLIC TRANSPORTATION

Public transportation services in Mansfield are provided by the Massachusetts Bay Transportation Authority (MBTA). The closest stop to the site is the Providence/Stoughton Line at 1 Crocker Street which is 2.5 miles north of the site. The Providence/Stoughton Line runs from Wickford Junction to South Station. Service is provided Monday through Friday from 4:45 AM to 12:58 AM. On Saturday and Sunday, service is provided from 6:20 AM to 12:21 AM. The MBTA schedule for the Providence/Stoughton Line is provided in the Appendix.

PLANNED ROADWAY IMPROVEMENTS

Officials for the Town of Mansfield were contacted regarding roadway improvements planned for the study area intersections. No capacity related improvements are currently planned.

SECTION 3:
FUTURE NO-BUILD AND BUILD TRAFFIC CONDITIONS

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2027. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2027. Consideration of these factors resulted in the development of 2027 No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic flow networks to develop the 2027 Build conditions.

FUTURE 2027 NO-BUILD TRAFFIC VOLUMES

Traffic growth on area roadways is a function of the expected land development in the immediate area as well as the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

Background Traffic Growth

Traffic-volume data compiled by MassDOT from permanent count stations and historic traffic counts in the area were reviewed in order to determine traffic growth trends. Based on a review of this data, it was determined that traffic volumes within the study area have shown little growth or generally decreased over the past several years. The Southeastern Regional Planning and Economic Development District (SRPEDD) was contacted to determine an appropriate growth rate. The SRPEDD determined that for the Town of Mansfield, an annual growth rate of 0.5 percent is appropriate. Therefore, a 0.5 percent per year compounded annual background traffic growth rate was used to account for potential future traffic growth external to the study area and presently unforeseen development.

Specific Development by Others

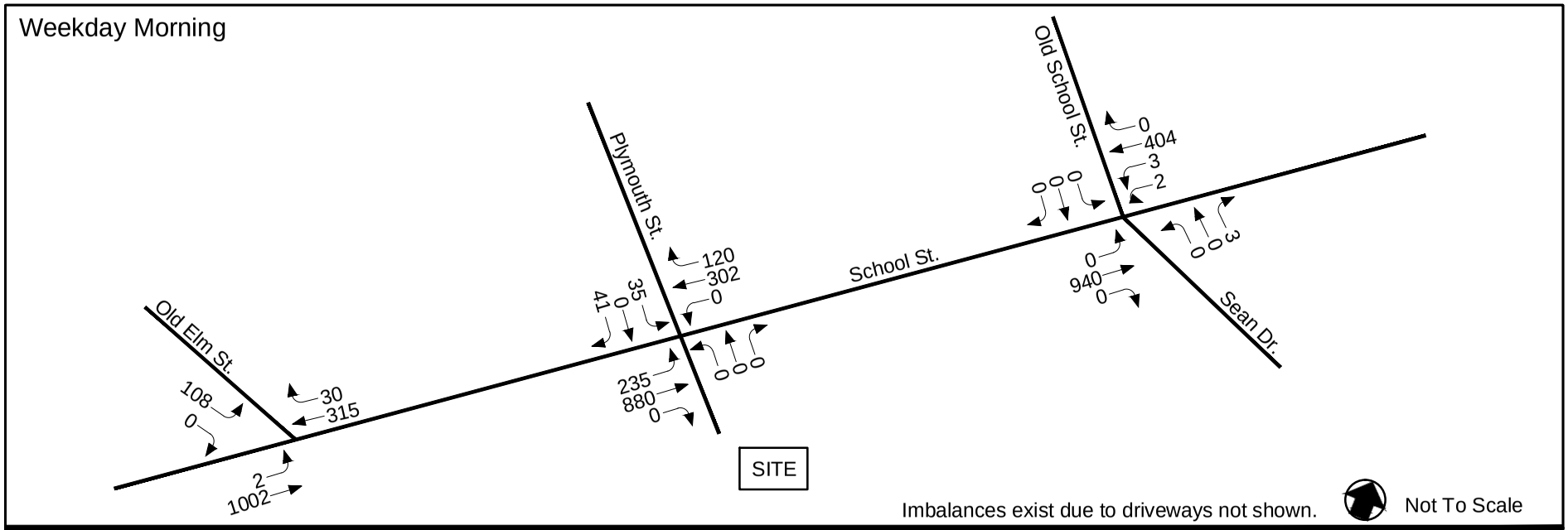
Traffic volumes generated by the specific local developments by others were included in the 2027 No-Build condition. The Town of Mansfield was contacted to identify specific planned developments. Based on these discussions, there is one potential project that is underway that would impact future volumes. This is the proposed recreational marijuana retail facility at 321 School Street in Mansfield.

Trips for this project were obtained from the traffic report prepared for the project, with the appropriate sections included in the Appendix.

A second project was also identified within Mansfield Crossing. The existing Sports Authority space is being converted into a multi-screen theater. Based on the project application, this change is not projected to result in a significant change in peak hour traffic generation. The corresponding traffic letter is included in the Appendix.

No-Build Condition Traffic Volumes

The 2027 No-Build weekday morning and weekday evening peak-hour traffic volumes were developed by applying a compounded 0.5 percent annual growth rate to the 2020 Existing through peak-hour traffic volumes and adding traffic from the identified background project. Figure 3 shows the projected 2027 No-Build peak hour traffic volumes for the weekday morning and weekday evening peak-hours.



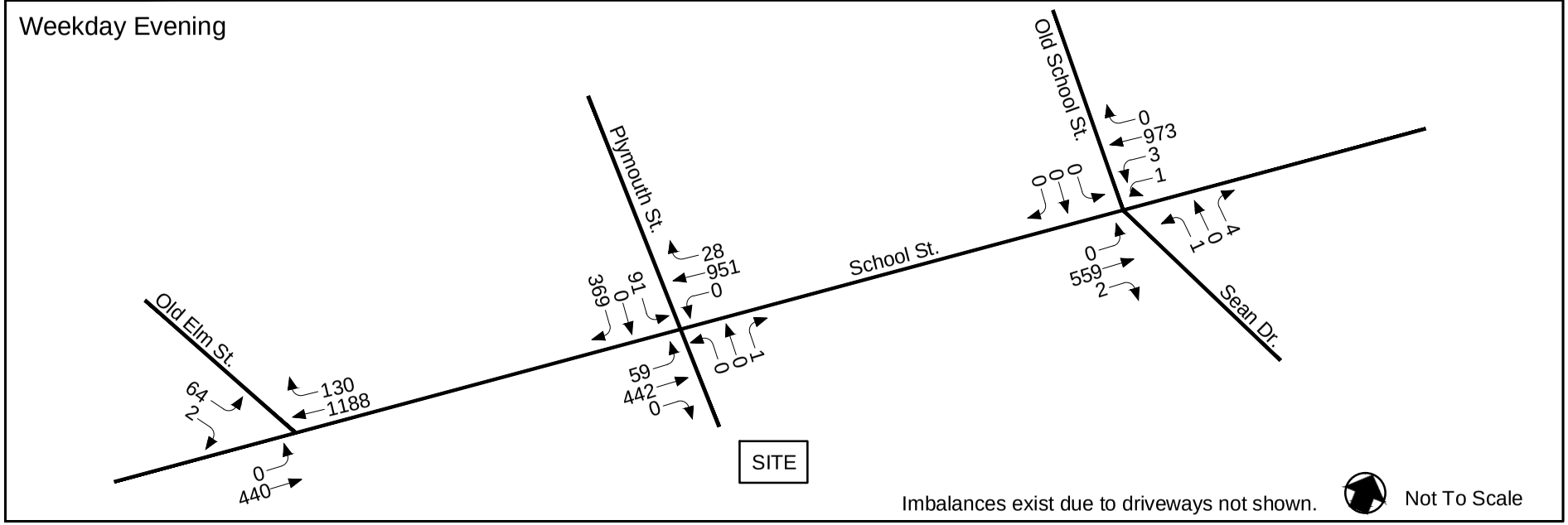


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Figure 3

2027 No-Build
Weekday Peak Hour
Traffic Volumes

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FUTURE 2027 BUILD CONDITIONS

Project Description

The cultivation facility will employ up to fifty (50) employees at peak operation to cover the six (6) days a week the cultivation facility will be open. On a typical weekday, there would be three (3) shifts (beginning at 7:00 AM, 9:00 AM and 11:00 AM and ending at 3:00 PM, 5:00 PM and 7:00 PM). On Saturday, there would be a single shift (9:00 AM to 5:00 PM). The facility will be closed on Sundays. Access to the site will be provided by a single, full movement curb cut to School Street opposite Plymouth Street. Parking on the site would be provided for twenty-eight (28) vehicles.

When in full operation, the facility is expected to generate six (6) to eight (8) daily deliveries of product to retail dispensaries. Deliveries would occur Monday through Saturday. Deliveries will occur using unmarked minivans (similar to a ford transit van).

Additionally, four (4) daily deliveries of supplies to the facility are anticipated at full operation. These supplies will be coming to the site in thirty (30) foot long box trucks. These deliveries will occur daily, Monday through Friday.

Site Traffic Generation

Trips for the Project were determined based on the expected site characteristics. Using the characteristics described above, the trip-generation for the facility was determined and is summarized in Table 4. The calculations are included in the Appendix.

TABLE 4
TRIP-GENERATION SUMMARY

	Proposed Marijuana Cultivation facility Trips[a]
Daily	136
Weekday Morning Peak Hour:	
Entering	22
Exiting	1
Total	23
Weekday Evening Peak Hour:	
Entering	1
Exiting	21
Total	22
Saturday	50
Saturday Midday Peak Hour:	
Entering	1
Exiting	0
Total	1

[a]Based on anticipated site characteristics.

As can be seen in Table 4, the facility is expected to generate approximately 136 vehicle trips on an average weekday (two way volume over the operational day of the facility (68 vehicles entering and 68 vehicles exiting). During the weekday morning peak hour, 23 vehicle trips (22 vehicles entering and 1 vehicle exiting) are expected and during the weekday evening peak-hour, 22 vehicle trips (1 vehicle entering and 21 vehicles exiting) are expected.

Trip Distribution

The directional distribution of the vehicular traffic approaching and departing the site is a function of population densities, the location of retailers where the product will be sold, existing travel patterns, similar uses, and the efficiency of the existing roadway system. Existing traffic flows were reviewed to determine the expected trip distribution pattern. Table 5 summarizes the expected trip distribution.

TABLE 5
PROPOSED TRIP DISTRIBUTION

Route	Direction	Percent of Trips
School Street	East	32%
School Street	West	63%
Old Elm Street	North	5%
Total		100 %

Future Traffic Volumes - Build Condition

The site-generated traffic was distributed within the study area according to the percentages summarized in Table 5. Figure 4 shows the site-generated traffic volumes associated with the project. The site generated volumes were then superimposed onto the 2027 No-Build traffic volumes to represent the 2027 Build traffic-volume conditions. The anticipated 2027 Build weekday morning and weekday evening traffic volumes are graphically presented in Figure 5. These volumes were used as the basis for all analysis as well as to identify potential mitigation measures to ameliorate the project's impacts.

A summary of 2027 peak-hour projected traffic-volume changes in the site vicinity are shown in Table 6. These volumes are based on the expected increases from the site traffic generation.

TABLE 6
TRAFFIC-VOLUME INCREASES[a]

Location/Peak Hour	2027 No-Build	2027 Build	Volume Increase over No-Build	Percent Increase over No-Build
School Street, west of Old Elm Street				
Weekday Morning	1,319	1,334	15	1.13
Weekday Evening	1,630	1,644	14	0.86
School Street, east of Sean Drive				
Weekday Morning	1,352	1,359	7	0.52
Weekday Evening	1,540	1,547	7	0.45

[a]All volumes are vehicles per hour, total of both directions.

As shown in Table 6, project-related peak hour increases are in the range of seven (7) to fifteen (15) bi-directional vehicles during the peak hours. This is approximately equivalent to one additional vehicle every eight (8) minutes or less per direction on average during the peak hours.

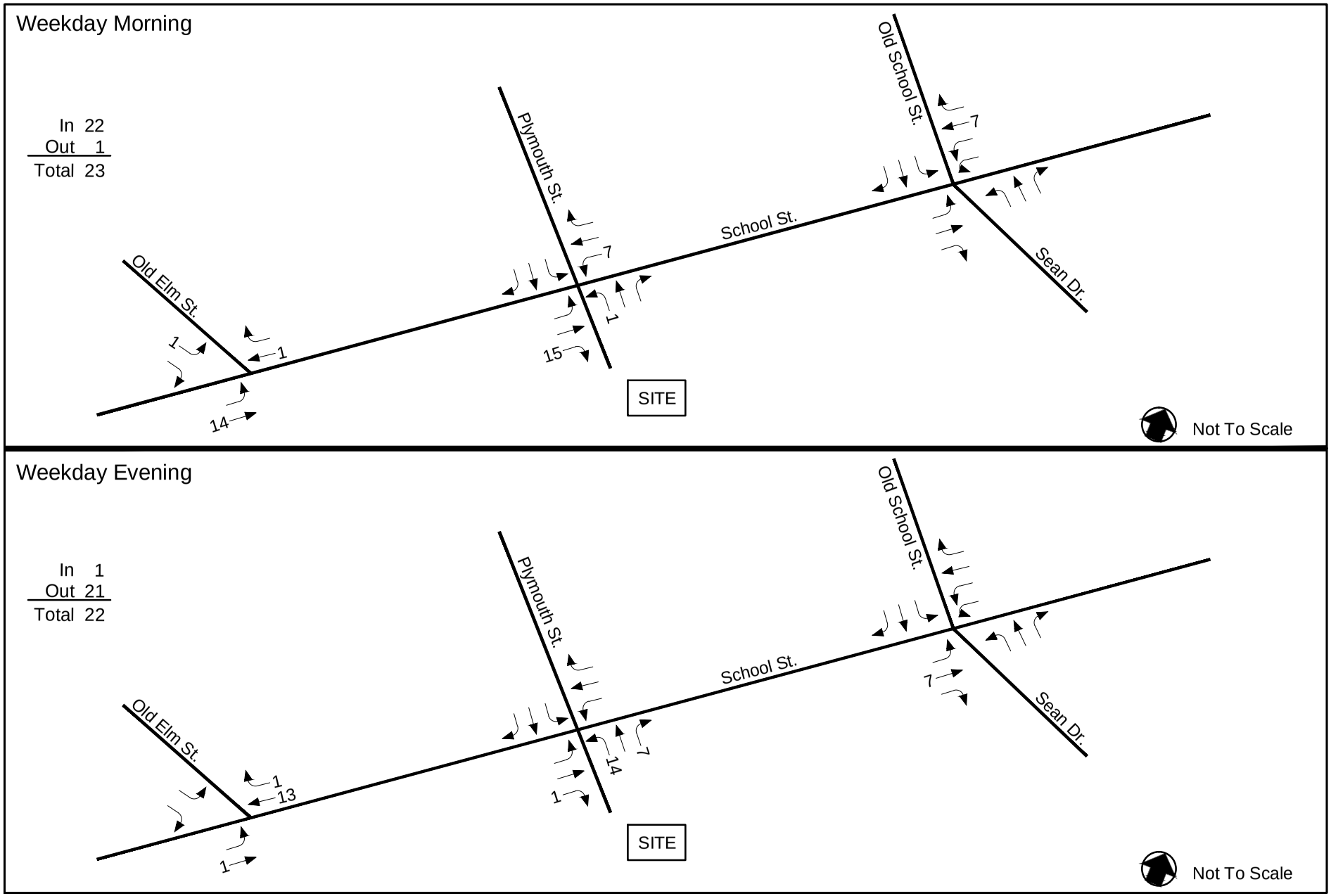

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Figure 4

Site Generated
Weekday Peak Hour
Traffic Volumes

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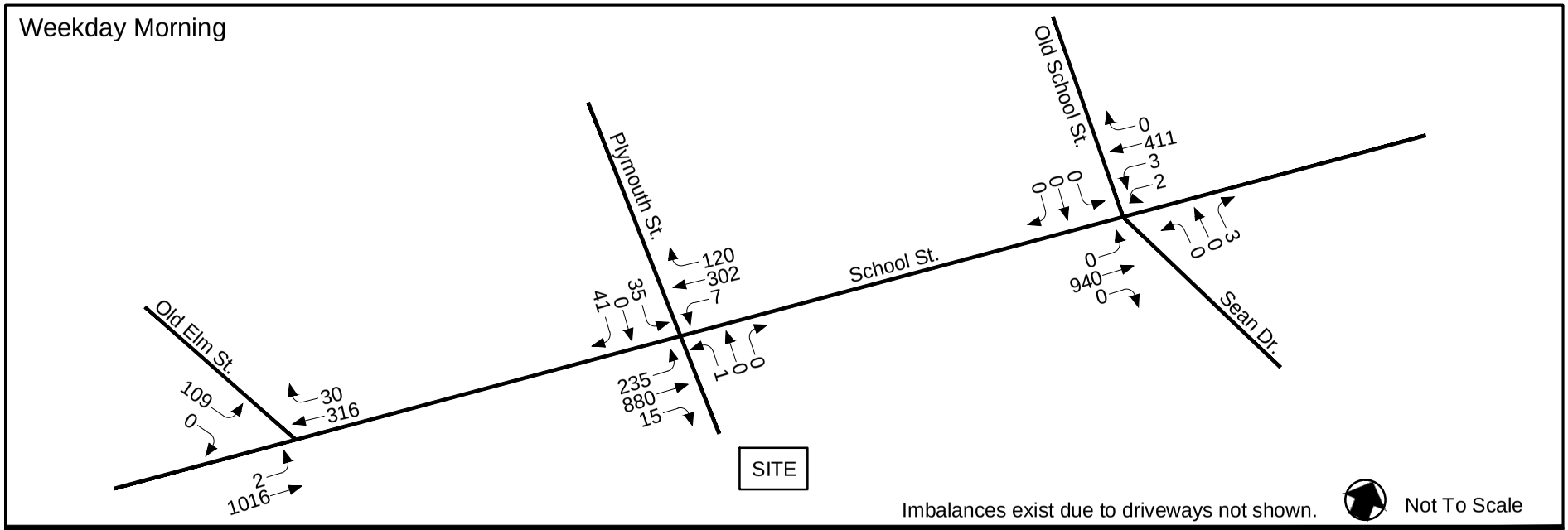

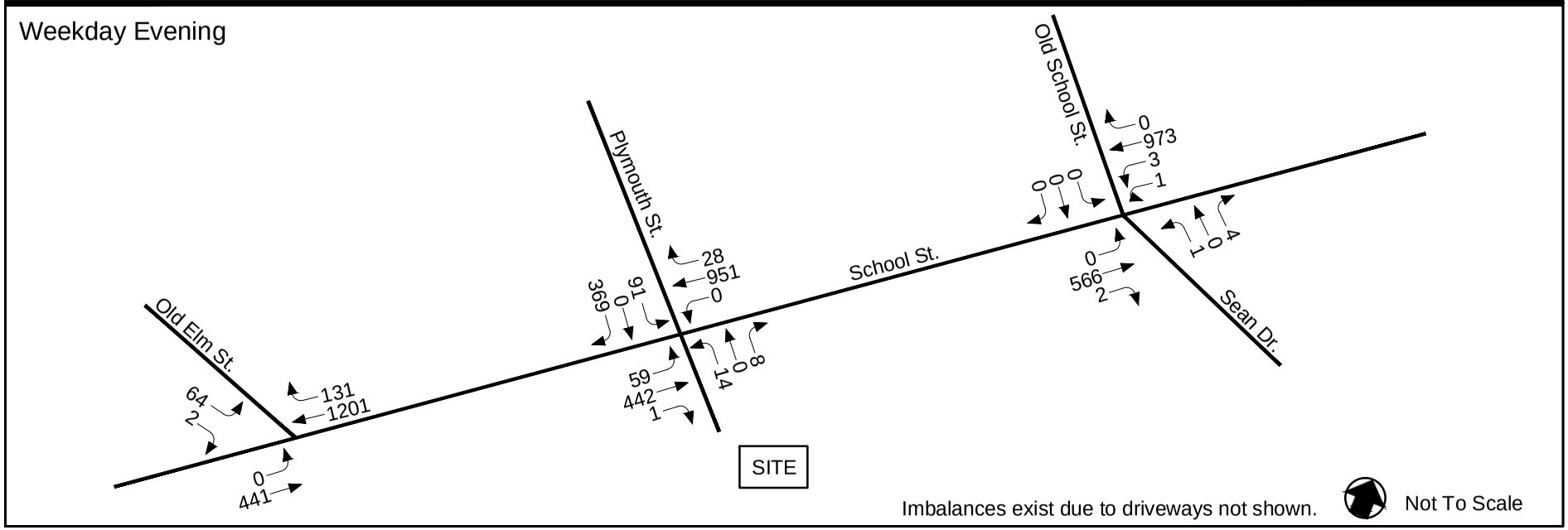

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Figure 5

2027 Build
Weekday Peak Hour
Traffic Volumes

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SECTION 4: ANALYSIS

To assess intersection operations, capacity analyses were conducted for Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the study area intersections serve existing and projected traffic volumes. Vehicle queue analyses provide a secondary measure of the operational characteristics of an intersection or section of roadway under study in terms of lane use and demand.

METHODOLOGY

Levels of Service

Level of service (LOS) is a quantitative measure used to describe the operation of an intersection or roadway segment. The level of service definition is described by the quality of traffic flow and is primarily defined in terms of traffic delays. The primary result of capacity analyses[2] is the assignment of a level of service to traffic intersections or roadway segments under various traffic-flow conditions. Six levels of service are defined for traffic intersections and roadway segments. Levels of service range from LOS A to LOS F. LOS A represents very good operating conditions and LOS F represents very poor operating conditions.

Signalized Intersections

Levels of service for signalized intersections are calculated using the methodology and procedures described in the 2010 *Highway Capacity Manual*. The methodology assesses the intersection based on type of signal operation, signal timing and phasing, progression, vehicle mix, and intersection geometrics. Level-of-service designations are based on the delay per vehicle. Table 7 summarizes the relationship between level of service and delay. The calculated delay values result in level-of-service designations which are

[2]The capacity analysis methodology is based on procedures presented in the *Highway Capacity Manual;* Transportation Research Board; Washington, DC; 2010.

applied to individual lane groups, to individual intersection approaches, and to the entire intersection. In the 2010 HCM methodology, the critical lane group volume to capacity ratio is reported.

TABLE 7
LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS[a]

Delay per Vehicle (Seconds)	Resulting Level of Service v/c[b] < 1.0	Resulting Level of Service v/c[b] > 1.0
≤10.0	A	F
10.1 to 20.0	B	F
20.1 to 35.0	C	F
35.1 to 55.0	D	F
55.1 to 80.0	E	F
>80.0	F	F

[a]*Highway Capacity Manual*; Transportation Research Board; School, DC; 2010; page 18-6.
[b]Volume to capacity ratio.

Unsignalized Intersections

The level of service for an unsignalized intersection is determined by the methodology and procedures described in the 2010 *Highway Capacity Manual.*[3] The level of service for unsignalized intersections is measured in terms of average delay for the critical movements (typically side street turning movements or mainline turning movements). The delay for the critical movements is a function of the available capacity for the movement and the degree of saturation of the lane group containing the critical movement. The delay calculation includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. The definitions for level of service at unsignalized intersections are also provided in the 2010 *Highway Capacity Manual*. Table 8 summarizes the relationship between level of service and average control delay for the critical movements at unsignalized intersections.

[3]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

TABLE 8
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Average Delay (seconds per vehicle)	Resulting Level of Service v/c[b] < 1.0	Resulting Level of Service v/c > 1.0
≤ 10.0	A	F
10.1 to 15.0	B	F
15.1 to 25.0	C	F
25.1 to 35.0	D	F
35.1 to 50.0	E	F
>50.0	F	F

[a]*Highway Capacity Manual*; Transportation Research Board; Elm, DC; 2010; page 19-2
[b]Volume to capacity ratio.

The analytical methodologies used for the analysis of unsignalized intersections use conservative analysis parameters, such as high critical gaps. The critical gap is defined as the minimum time between successive main line vehicles for a side street vehicle to execute the appropriate turning maneuver. Actual field observations indicate that drivers on minor streets accept smaller gaps in traffic than those used in the analysis procedures and therefore experience less delay than calculated by the HCM methodology. **The analysis results overstate the actual delays experienced in the field.** It should be noted that the unsignalized intersections along heavily trafficked roadways operate at constrained levels and the resulting calculated results of the unsignalized intersection analyses should be considered highly conservative.

CAPACITY ANALYSIS RESULTS

Level-of-service analyses were conducted for 2020 Existing, 2027 No-Build, and 2027 Build conditions for the intersections within the study area. The results of the 2027 unsignalized analyses are summarized in Table 9. Detailed analysis sheets are presented in the Appendix.

TABLE 9
UNSIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY

Critical Movement/ Peak Hour	2020 Existing					2027 No-Build					2027 Build				
	Demand[a]	V/C[b]	Delay[c]	LOS[d]	Queue[e]	Demand	V/C	Delay	LOS	Queue	Demand	V/C	Delay	LOS	Queue
School Street and Old Elm Street															
All movements from Old	104	0.79	85.4	F	125.0	108	0.88	107.7	F	145.0	109	0.91	115.7	F	152.5
Elm Street:	64	0.77	118.6	F	102.5	66	0.88	153.2	F	117.5	66	0.90	161.2	F	120.0
Weekday Morning															
Weekday Evening															
School Street, Plymouth Street and Existing Site Driveway	74	1.61	424.6	F	252.5	76	1.92	568.7	F	285.0	76	2.04	631.7	F	292.5
All movements from	444	3.01	954.7	F	1275.0	460	3.37	1119.2	F	1377.5	460	3.41	1137.4	F	1385.0
Plymouth Street:															
Weekday Morning															
Weekday Evening															
Left-turn movements															
from School Street (WB):	0	-	0.0	A	0.0	0	-	0.0	A	0.0	7	0.01	0.23	A	22.5
Weekday Morning	0	-	0.0	A	0.0	0	-	0.0	A	0.0	0	-	0.0	A	0.0
Weekday Evening															
All movements from															
Driveway:	0	-	0.0	A	0.0	0	-	0.0	A	0.0	1	0.04	138.7	F	2.5
Weekday Morning	1	-	0.0	A	0.0	1	-	0.0	A	0.0	22	NC	NC	F	NC
Weekday Evening															
School Street, Old School Street and Sean Drive															
All movements from Sean	3	0.03	17.6	C	2.5	3	0.03	18.2	C	2.5	3	0.03	18.2	C	2.5
Drive:	5	0.06	19.8	C	5.0	5	0.07	20.9	C	5.0	5	0.07	21.1	C	5.0
Weekday Morning															
Weekday Evening															

[a]Demand of critical movements in vehicles per hour.
[b]Volume-to-capacity ratio.
[c]Delay in seconds per vehicle.
[d]Level of service.
[e]95th %tile queue in feet.
[e]Delay not representative of actual conditions when v/c is greater than 1.00.
NC = Not calculated. Volume exceeds theoretical capacity

School Street and Old Elm Street

Under 2020 Existing conditions, the critical movements at this unsignalized intersection (all movements out of Old Elm Street) are modeled to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. Under future 2027 No-Build conditions, the critical movements are projected to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. Under 2027 Build conditions, with the project, the critical movements are projected to continue to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. The project is expected to only add one (1) additional vehicle during the peak hours, which does not significantly

increase the volume to capacity (v/c) ratio for the critical movement.

School Street, Plymouth Street and Existing Site Driveway

Under 2020 Existing conditions, the critical movements at this unsignalized intersection (all movements out of Plymouth Street) are modeled to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. Under future 2027 No-Build conditions, the critical movements are projected to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. Under 2027 Build conditions, with the project, the critical movements are projected to continue to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour.

School Street, Old School Street and Sean Drive

Under 2020 Existing conditions, the critical movements at this unsignalized intersection (all movements out of Sean Drive) are modeled to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2027 No-Build conditions, the critical movements are projected to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under 2027 Build conditions, with the project, the critical movements are projected to continue to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

SIGHT DISTANCE

Sight distance measurements were performed at the proposed site driveway intersection with School Street in accordance with Massachusetts Department of Transportation (MassDOT) and American Association of State Highway and Transportation Officials (AASHTO) standards. Stopping sight distance (SSD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. Intersection sight distance (ISD) or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway, to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. Table 10 presents the measured SSD at the driveway intersection. The sight distance calculations are included in the Appendix.

TABLE 10
SIGHT DISTANCE SUMMARY

	Required Minimum (Feet)[a]	Measured (Feet)
Site Driveway and School Street		
Stopping Sight Distance:		
School Street approaching from the east	372	500+
School Street approaching from the west	359	500+
Intersection Sight Distance:		
Site Driveway looking to the east	440[b]/507[c]	500+
Site Driveway looking to the west	430[b]/496[c]	205[d]

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*; American Association of State Highway and Transportation Officials (AASHTO); 2010, and based on observed 85th percentile speed.
[b]Recommended minimum value for vehicles turning right exiting a roadway under STOP-sign control.
[c]Recommended minimum value for vehicles turning left exiting a roadway under STOP-sign control.
[d]The ISD to the west is currently impaired due to the jersey barriers piled up on the site. With the jersey barriers removed, the ISD will exceed 500 feet.

As can be seen in Table 10, the SSD measurements performed at School Street and the proposed site driveway indicate that the intersection exceeds the recommended minimum requirements based on the 85th percentile speeds. In accordance with the AASHTO manual, *"If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road."* Accordingly, the ISD should be at least equal to the SSD, which would allow a driver approaching the minor road to safely stop.

SECTION 5: RECOMMENDATIONS AND CONCLUSION

RECOMMENDATIONS

The final phase of the analysis process is to identify the mitigation measures necessary to minimize the impact of the project on the transportation system. The proponent has made a commitment to implement the mitigation measures listed below.

The capacity analyses performed for the unsignalized study area intersections indicate that generally, the new project trips will not significantly impact intersection operations. There is no reduction in levels of service at the study area intersections (except for the proposed site driveway as there is little or no volume exiting the site today). While the analysis shows the site driveway to operate at a poor level of service, actual conditions are expected to be better than the capacity analysis model indicates. This is due to the conservative nature of the unsignalized capacity analysis modeling algorithms.

A review of the existing traffic volume dates indicates that the intersection of School Street and Plymouth Street currently operates at a poor level of service (long delays for vehicles exiting Plymouth Street). The volume of traffic expected to be generated by the project will not significantly affect existing intersection operations. The existing traffic volume data indicates signalization of the intersection would be warranted. The existing signal system should be upgraded to a full traffic signal with emergency vehicle preemption and the Plymouth Street approach should be re-striped to provide an exclusive right-turn lane and a shared through/left-turn lane. With these measures, the intersection is projected to operate at LOS B during the weekday morning peak hour and at LOS D during the weekday evening peak hour, with or without the project. The project proponent is willing to work with the Town to implement this measure.

Any landscaping or sidewalk features should be set back to maintain sight lines. In order to maintain sight distances, it is recommended that a sight distance triangle be established along the site frontage, in both directions from a point fifteen (15) back at the site driveway and extending to each of the corners of the site along School Street. Within this triangle, any existing vegetation should be cut-back and any plantings be designed to be low growth plantings so as to not impede sight lines.

CONCLUSION

Review of the proposed project and the access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will have a minimal impact on existing traffic conditions. With the proposed access and mitigation measures and maintaining sight distances from the driveways (clear sight lines along frontage), safe and efficient access can be provided to the patrons of the proposed project and to the motoring public in the area.