

Symmes Maini & McKee Associates, Inc.

Grafton High School/Upper Middle School

**Providence Road (Route 122)
Grafton, Massachusetts**

TRAFFIC IMPACT ANALYSIS



(Existing Grafton High School)



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1.0 INTRODUCTION

1.1 Purpose of Study

This traffic study was prepared at the request of Symmes Maini & McKee Associates, Inc. in connection with its study of the construction of a new Grafton High School and the conversion of the existing high school to an upper middle school on Providence Road (Route 122) in Grafton, Massachusetts. For the benefit of the boards and the citizens of Grafton, the traffic impacts of the proposed development have been evaluated. The study analyzes traffic use attributable to the proposed development of the site and discusses transportation impacts in the vicinity of the site.

1.2 Description of Project

The project site is located on the west side of Providence Road to the north of Brigham Hill Road, as shown in Figure No. 1. The proposed project includes the construction of a new high school and the conversion of the existing high school to an upper middle school. The proposed high school will consist of grades 9-12, with a population of 900 students. The proposed upper middle school will consist of grades 7-8, with a population of 540 students. Access to the schools will be provided through an entrance-only driveway and an exit-only driveway on Providence Road.

2.0 EXISTING CONDITIONS

2.1 Study Area

The project will primarily utilize Providence Road for access to and from the site. Traffic volumes are moderate on Providence Road, which is classified as an Urban Minor Arterial, as presented in the online Road Inventory Interactive Map, which is based on the Year-End 2008 Road Inventory File maintained by the Massachusetts Office of Transportation Planning. Brigham Hill Road and Worcester Street will also be used for access to the site. Traffic volumes are light on Brigham Hill Road, which is classified as a local road, and are heavy on Worcester Street, which is classified as an Urban Principal Arterial. By definition, an arterial highway emphasizes a high level of mobility for through traffic while providing access to local roadways. A local road primarily provides direct access to abutting land and offers the lowest level of travel mobility.

There are two existing driveways for the Grafton High School on Providence Road. The southern driveway has shared access with the Municipal Center located to the south of the high school. There also are two driveways on Brigham Hill Road that are used for high school access. Entering vehicles at the eastern driveway must pass through the Grafton Police Department parking lot to reach the high school. The western driveway is a full-access driveway that provides access behind the Municipal Center.

Providence Road in the vicinity of the existing Grafton High School northern driveway is a two-lane, two-way bituminous roadway, approximately 39 feet in width, with a 9-foot southbound shoulder, an 11-foot southbound travel lane, a 13-foot northbound travel lane, and a 6-foot northbound shoulder. The speed limit is 35 mph to the north of the school and 40 mph to the south of the school, however, the school speed limit sign beacons located in both directions approaching the



Figure 1

Location Map

Symmes Maini & McKee Associates, Inc.
Grafton High School/Upper Middle School
Providence Road
Grafton, Massachusetts

school reduce the speed limit to 20 mph when flashing. There is bituminous curb and sidewalk on the west side of the roadway. There are utility poles located on the east side of the roadway. The existing Grafton High School northern driveway is a two-lane, two-way bituminous roadway, approximately 24 feet in width, and widens to 36 feet at Providence Road. The northern driveway is restricted to entrance-only on school days between the hours of 6:30 and 8:00 A.M. and 1:00 and 2:15 P.M. Land use in the area is institutional, municipal, and residential.

Providence Road in the vicinity of the existing Grafton High School/Municipal Center driveway is a two-lane, two-way bituminous roadway, approximately 32 feet in width, with a 4-foot southbound shoulder, a 12-foot southbound travel lane, a 13-foot northbound travel lane, and a 3-foot northbound shoulder. There is bituminous curb and sidewalk on the west side of the roadway. There are utility poles located on the east side of the roadway. The existing Grafton High School/Municipal Center driveway is a two-lane, two-way bituminous roadway, approximately 27 feet in width.

The intersection of Providence Road and Brigham Hill Road, to the south of Grafton High School, is a four-way unsignalized intersection, which is stop-controlled on Brigham Hill Road. Providence Road at its intersection with Brigham Hill Road is a two-lane, two-way bituminous roadway, approximately 32 feet in width, with a 4-foot southbound shoulder, a 13-foot southbound travel lane, a 12-foot northbound travel lane, and a 3-foot northbound shoulder. There is bituminous curb on the west side of the roadway and bituminous sidewalk on the west side to the north of Brigham Hill Road. There are utility poles located on the east side of the roadway. Brigham Hill Road at its intersection with Providence Road is a two-lane, two-way bituminous roadway, approximately 24 feet in width, with 12-foot travel lanes. The eastbound approach widens to 34 feet at the intersection, with an 18-foot eastbound lane. There is bituminous curb and sidewalk on the north side of the roadway. There are utility poles located on the south side of the roadway. The Grafton Police Department is located on Providence Road between the Grafton High School and Brigham Hill Road.

The intersection of Worcester Street, Providence Road, and Carroll Road is a four-way signalized intersection. Worcester Street at its intersection with Providence Road is a two-way bituminous roadway. The eastbound approach of Worcester Street at the intersection consists of a 15-foot travel lane and a 2-foot shoulder. The channelized right turn lane from Worcester Street eastbound to Providence Road southbound is approximately 20 feet in width, with 2-foot shoulders. Providence Road southbound is stop-controlled at its intersection with the channelized right turn lane. The westbound approach of Worcester Street consists of two 11-foot travel lanes and a 1-foot shoulder. There is granite curb on both sides of the roadway. There are utility poles located on the south side of the roadway. Providence Road at its intersection with Worcester Street is a two-way, three-lane bituminous roadway. The Providence Road approach consists of an 11-foot left turn lane, an 11-foot shared left turn, through, and right turn lane, and a 1-foot shoulder. There is granite curb on both sides of the roadway. Carroll Road at its intersection with Worcester Street is a two-way, two-lane bituminous roadway, approximately 38 feet in width, with 14-foot travel lanes, a 4-foot southbound shoulder, and a 6-foot northbound shoulder. The channelized right turn lane from Carroll Road southbound to Worcester Street westbound is approximately 28 feet in width, with a 1-foot shoulder. There is granite curb on both sides of the roadway. There are utility poles located on the east side of the roadway.

2.2 Data Collection

Traffic turning movement counts were conducted at the intersections of Providence Road and the existing Grafton High School driveways; Worcester Street, Providence Road, and Carroll Road; and Providence Road and Brigham Hill Road between the hours of 6:00 and 10:00 A.M. and 1:00 and 6:00 P.M. on Thursday, November 5, 2009. Road tubes were utilized to obtain two-day traffic counts on Providence Road to the north of the Grafton High School driveways, on the channelized right turn lane from Worcester Street to Providence Road, and on the access roadway between the high school and the municipal center from 12:00 A.M. on Wednesday, November 4, 2009 to 11:59 P.M. on Thursday, November 5, 2009. The traffic count data is shown in Appendix A.

The calculated school A.M. peak hour for the existing Grafton High School is 6:30 – 7:30 and the school P.M. peak hour is 1:45 – 2:45. These peak hours were utilized for the analysis of all the study intersections since the school construction and conversion is the focus of this report.

Pertinent field observations including existing stopping sight distance, location of existing utilities, posted speed limits, traffic control devices, etc. were made on November 18, 2009. Accident data (Appendix D) for the period January 1, 2006, through October 23, 2009, was obtained from the Grafton Police Department. Continuous 24-hour traffic speed data (shown in Appendix E) was obtained using road tubes on Providence Road to the north of the Grafton High School driveways on Wednesday, November 4, 2009 and Thursday, November 5, 2009.

3.0 TRAFFIC FORECASTS

3.1 Traffic Volumes

Existing traffic volumes for the study area were developed from traffic data obtained by Transportation Data Corporation (TDC).

The total 24-hour two-way traffic volume (from the road tube counts) on Providence Road in the vicinity of the proposed site is approximately 14,000 vehicles per day. The school hours for the existing Grafton High School are from 7:20 A.M. to 1:55 P.M. The school A.M. peak hour, as indicated in Section 2.2, occurred between 6:30 and 7:30, with two-way traffic volumes on Providence Road, the Grafton High School northern driveway, and the Grafton High School/Municipal Center driveway of 961 vehicles, 282 vehicles, and 152 vehicles, respectively. The school P.M. peak hour was measured between 1:45 and 2:45, with two-way traffic volumes on Providence Road of 981 vehicles, on the Grafton High School northern driveway of 114 vehicles, and on the Grafton High School/Municipal Center driveway of 166 vehicles.

The two-way traffic volumes on Providence Road and Brigham Hill Road were 927 vehicles and 90 vehicles, respectively, during the school A.M. peak hour. The two-way traffic volumes were 940 vehicles on Providence Road and 179 vehicles on Brigham Hill Road during the school P.M. peak hour.

The two-way traffic volumes on Worcester Street, Providence Road, and Carroll Road were 1,599 vehicles, 988 vehicles, and 172 vehicles, respectively, during the school A.M. peak hour. The two-

way traffic volumes were 1,622 vehicles on Worcester Street, 1,013 vehicles on Providence Road, and 150 vehicles on Carroll Road during the school P.M. peak hour.

The traffic anticipated to be generated by the development was added to the turning movement count volumes for use in determining levels of service (LOS).

3.2 Vehicle Trip Generation

To evaluate the traffic impacts of the proposed development, it is necessary to determine the amount of traffic expected to be generated by the proposed improvements. Typically, the trip generation calculations are based on data compiled in Trip Generation (8th edition), an informational report published by the Institute of Transportation Engineers (ITE). Trip Generation is a tool for planners, transportation professionals, zoning boards, and others who are interested in estimating the number of vehicle trips generated by a proposed development or land use. This document is based on more than 4,800 trip generation studies submitted to the Institute by public agencies, developers, consulting firms, and associations. In addition, more specific information from the traffic turning movement counts for the existing Grafton High School has been used for the trip generation.

Currently, there are approximately 685 students and 90 staff at the existing Grafton High School. The new high school will be able to accommodate approximately 900 students. To estimate the number of trips anticipated to be generated by the additional 215 students, a ratio was developed between the number of existing trips that currently enter and exit the existing Grafton High School, including student, staff, bus, and parent trips, and the increase of students. The volumes anticipated to be generated by the proposed high school expansion during the school A.M. and school P.M. peak hours, can be found in Table No. 1.

The number of trips anticipated to be generated by the addition of 540 students for the upper middle school was estimated using ITE Trip Generation Land Use Code 522, Middle School/Junior High School, which sets forth trips generated at facilities similar to the proposed development. The volumes anticipated to be generated by the proposed upper middle school during the school A.M. and school P.M. peak hours can be found in Table No. 1.

The distribution of the anticipated new vehicle trips by direction was based upon the existing trip patterns observed in the traffic count data and the expected usage of the driveways for the schools. These trips were added to the existing volumes that were counted for analysis of the build conditions.

Table No. 1
Trip Generation Summary
Proposed Expansion

Time Period	Direction	Grafton High School	Upper Middle School	Total New Trips
School A.M. Peak Hour	Enter	103	161	264
	Exit	48	131	179
School P.M. Peak Hour	Enter	17	75	92
	Exit	58	92	150

The proposed site will eliminate the existing connection between the Grafton High School and the Municipal Center. The existing traffic patterns would be altered to follow the proposed changes to the site layout. Vehicles currently accessing the high school from Brigham Hill Road will be required to use the proposed driveways on Providence Street. Vehicles accessing the Municipal Center from Providence Street will be required to use the driveways on Brigham Hill Road. Trips for the existing pre-school were removed from the study intersections since the pre-school is being relocated to the elementary schools.

The trip generation calculations and the distribution of the traffic anticipated to be generated by the development are shown in Appendix B.

4.0 CAPACITY ANALYSIS

4.1 General

Capacity analyses in this report focus on the peak hours of traffic volume for the school because they represent the most critical periods for operations. It is expected that there will be minimal impact from the school during the remaining hours of the day.

4.2 Intersections

The intersection capacity analysis was prepared using the Highway Capacity Manual, 2000 edition, published by the Transportation Research Board. The analysis utilizes the concept of Level of Service. The term “level of service” is defined as a qualitative measure describing operational conditions within a traffic stream based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. There are six levels of service utilized for the analysis. They are given letter designations from A to F, with Level of Service A representing the most favorable operating conditions and Level of Service F the least. The level of service criteria for unsignalized and signalized intersections are shown in Table No. 2.

Table No. 2
Level of Service Criteria for Unsignalized and Signalized Intersections
Source: Highway Capacity Manual, 2000

Level Of Service	Average Total Delay (Sec./Veh)	
	Unsignalized Intersection	Signalized Intersection
A	≤10	≤10
B	>10 and ≤15	>10 and ≤20
C	>15 and ≤25	>20 and ≤35
D	>25 and ≤35	>35 and ≤55
E	>35 and ≤50	>55 and ≤80
F	>50	>80

The Town of Grafton Subdivision Rules and Regulations requests that future traffic conditions be calculated for five years from the date of application. Therefore, the existing traffic counts were expanded to 2014 using a conservative annual growth rate of 1.0%.

Unsignalized intersection capacity analysis for the intersections of Providence Road and the existing Grafton High School driveway and Providence Road and the existing Grafton High School/Municipal Center driveway was undertaken using the school A.M. and school P.M. peak hour traffic volumes under no-build conditions in 2014. Unsignalized intersection capacity analysis for the intersections of Providence Road and the proposed Grafton High School and upper middle school entrance-only and exit-only driveways was undertaken using school A.M. and school P.M. peak hour traffic volumes under build conditions in 2014. The analysis for the exit-only driveway includes a left turn lane and a right turn lane for the driveway. Unsignalized intersection capacity analysis for the intersection of Providence Road and Brigham Hill Road was undertaken using the school A.M. and school P.M. peak hour traffic volumes under no-build and build conditions in 2014.

The geometry of the intersection of Worcester Street, Providence Road, and Carroll Road creates an additional unsignalized intersection between Providence Road southbound and the Worcester Street eastbound channelized right-turn lane. This stop-controlled (on Providence Road only) intersection was analyzed separately from the signalized portion of the intersection during the school A.M. and school P.M. peak hours in 2014.

The capacity analysis computations are included in Appendix C. A summary of the level of service for these intersections is shown in Table Nos. 3 and 4 for the school A.M. and school P.M. peak hour, respectively.

Table No. 3
School A.M. Peak Hour - Level of Service Summary
Unsignalized Intersections

Intersection/ Critical Movement	Level of Service	
	2014 No-Build	2014 Build
<i>Providence Road/Existing Grafton High School Northern Driveway</i>		
Northbound Approach	A	N/A
Eastbound Approach	B	N/A
<i>Providence Road/Existing Grafton High School/Municipal Center Driveway</i>		
Northbound Approach	A	N/A
Eastbound Approach	E	N/A
<i>Providence Road/Proposed Entrance-Only Driveway</i>		
Northbound Approach	N/A	C
<i>Providence Road/Proposed Exit-Only Driveway</i>		
Eastbound Approach	N/A	F
<i>Providence Road/Brigham Hill Road</i>		
Eastbound Approach	F	F
Westbound Approach	C	D
Northbound Approach	A	A
Southbound Approach	A	B
<i>Worcester Street/Providence Road</i>		
Southbound Approach	B	C

Table No. 4
School P.M. Peak Hour - Level of Service Summary
Unsignalized Intersections

Intersection/ Critical Movement	Level of Service	
	2014 No-Build	2014 Build
<i>Providence Road/Existing Grafton High School Northern Driveway</i>		
Northbound Approach	A	N/A
Eastbound Approach	D	N/A
<i>Providence Road/Existing Grafton High School/Municipal Center Driveway</i>		
Northbound Approach	A	N/A
Eastbound Approach	F	N/A
<i>Providence Road/Proposed Entrance-Only Driveway</i>		
Northbound Approach	N/A	A
<i>Providence Road/Proposed Exit-Only Driveway</i>		
Eastbound Approach	N/A	F
<i>Providence Road/Brigham Hill Road</i>		
Eastbound Approach	F	F
Westbound Approach	E	F
Northbound Approach	A	A
Southbound Approach	A	A
<i>Worcester Street/Providence Road</i>		
Southbound Approach	B	B

The unsignalized intersection capacity analysis for 2014 shows that the intersection of Providence Road and the proposed Grafton High School and upper middle school entrance-only driveway will operate at LOS C during the school A.M. peak hour and LOS A during the school P.M. peak hour. The proposed Grafton High School and upper middle school exit-only driveway will operate at LOS F during the school A.M. and P.M. peak hours. During the school A.M. peak hour, the westbound approach of the intersection of Providence Road and Brigham Hill Road will change from LOS C to LOS D and the southbound approach will change from LOS A to LOS B. The westbound approach of the intersection of Providence Road and Brigham Hill Road will change from LOS E to LOS F during the school P.M. peak hour. The intersection of Providence Road southbound and the Worcester Street eastbound channelized right-turn lane will change, from LOS B to LOS C, during the school A.M. peak hour, and will operate at LOS B during the school P.M. peak hour under no-build and build conditions.

Due to the poor levels of service for vehicles exiting the proposed Grafton High School and upper middle school exit-only driveway, it may be required to have police details present for a short time during the school A.M. and school P.M. peak hours.

Signalized intersection capacity analysis for the intersection of Worcester Street, Providence Road, and Carroll Road was undertaken using the A.M. and P.M. peak hour traffic volumes under no-build and build conditions in 2014. The capacity analysis computations are included in Appendix C. A summary of the level of service for these intersections is shown in Table Nos. 5 and 6 for the school A.M. and school P.M. peak hour, respectively.

Table No. 5
School A.M. Peak Hour - Level of Service Summary
Signalized Intersection

Intersection/ Critical Movement	Level of Service	
	2014 No-Build	2014 Build
<i>Worcester Street/Providence Road/Carroll Road</i>		
Overall Intersection	C	D
Eastbound Approach	C	C
Westbound Approach	C	C
Northbound Approach	C	D
Southbound Approach	D	E

The signalized intersection capacity analysis shows that the overall intersection level of service will change, from LOS C to LOS D, with the addition of 4.9 seconds of delay per vehicle, during the school A.M. peak hour. The Carroll Road approach will change, from LOS D to LOS E. This approach, however, has the lowest volumes. There will be no change in the overall level of service at the intersection of Worcester Street, Providence Road, and Carroll Road during the school P.M. peak hour in 2014.

Table No. 6
School P.M. Peak Hour - Level of Service Summary
Signalized Intersection

Intersection/ Critical Movement	Level of Service	
	2014 No-Build	2014 Build
<i>Worcester Street/Providence Road/Carroll Road</i>		
Overall Intersection	C	C
Eastbound Approach	C	C
Westbound Approach	C	C
Northbound Approach	C	C
Southbound Approach	D	D

5.0 SAFETY ANALYSIS

5.1 Geometrics

The geometric configurations of the intersections affected by traffic generated by the proposed development were examined with regard to safe stopping sight distance using principles presented in A Policy on Geometric Design of Highways and Streets, 2004, of the American Association of State Highway and Transportation Officials (AASHTO). AASHTO provides recommendations for necessary sight distance at intersections.

A conservative design speed of 45 mph was utilized for Providence Road in the vicinity of the proposed driveways based on the observed 85th percentile speed of 43 mph for both northbound and southbound traffic, as shown in Appendix E. The minimum safe stopping distance for roadways with a design speed of 45 mph is 360 feet, as required by AASHTO, Exhibit 3-1, Stopping Sight Distance, P. 112. The existing sight distance from both directions on Providence Road exceeds the minimum safe stopping distance.

5.2 Accident History

Accident data for the study area was obtained from the Grafton Police Department for the period from January 1, 2006 to October 23, 2009. A summary of the data received is contained in Appendix D. There were three accidents in the existing Grafton High School parking lot, as shown in Table No. 7. These accidents included one angle accident, one sideswipe, and one vehicle that struck an object. All of these accidents occurred on dry pavement and one accident resulted in an injury.

There was one accident in the Grafton Municipal Center parking lot. This accident was an angle accident, it occurred on dry pavement, and no injuries were reported.

The five accidents at the intersection of Providence Road and the Grafton High School northern driveway included four rear end accidents and one vehicle that backed into another vehicle. One of these accidents occurred on wet pavement and two accidents resulted in injuries.

Table No. 7
Summary of Accidents
Source: Grafton Police Department

Accident Location	January 1, 2006 Through October 23, 2009
<i>Existing Grafton High School Parking Lot</i>	3
<i>Municipal Center Parking Lot</i>	1
<i>Intersection of Providence Road and Grafton High School Northern Driveway</i>	5
<i>Intersection of Providence Road and Grafton High School/Municipal Center Driveway</i>	2
<i>Providence Road between Grafton High School Driveway and Worcester Street</i>	2
<i>Intersection of Worcester Street, Providence Road, and Carroll Road</i>	6
<i>Providence Road between Grafton High School Driveway and Brigham Hill Road</i>	4
<i>Intersection of Providence Road and Brigham Hill Road</i>	3
<i>Providence Road between Brigham Hill Road and Rodnick Road</i>	4
TOTAL	30

The two accidents at the intersection of Providence Road and the Grafton High School/Municipal Center driveway included two rear end accidents. They both occurred on dry pavement and one accident resulted in an injury.

There were two accidents on Providence Road between the Grafton High School driveways and Worcester Street. These accidents included a rear end accident and a sideswipe. Both accidents occurred on dry pavement and there were no injuries reported.

The six accidents at the intersection of Worcester Street, Providence Road, and Carroll Road included four rear end accidents, one angle accident, and one vehicle that struck an object. One of the rear end accidents occurred on the channelized right turn lane from Worcester Street eastbound to Providence Road southbound. One accident occurred on wet pavement, the pavement condition of one accident was unknown, and one accident resulted in an injury.

There were four accidents on Providence Road between the Grafton High School driveways and Brigham Hill Road. These accidents included three angle accidents and one rear end accident. All of these accidents occurred on dry pavement and there were no injuries reported.

The three accidents at the intersection of Providence Road and Brigham Hill Road included two angle accidents and one vehicle that struck an object. One of these accidents occurred on wet pavement and there were no injuries reported.

There were four accidents on Providence Road between Brigham Hill Road and Rodnick Street. These accidents included two angle accidents and two rear end accidents. All of these accidents occurred on dry pavement and there were no injuries reported.

The low number of accidents that occurred over this three-year plus period does not indicate the presence of unusual conditions that might be worsened by the addition of the traffic generated by the development.

5.3 Site Circulation

The Layout and Materials Plans, received on December 11, 2009, as shown in Appendix F, were reviewed with regard to layout and vehicular circulation. The proposed site driveways will safely accommodate the traffic that will enter and exit the site. The interior roadways are designed so that traffic will operate on the site in a safe and orderly manner. In addition, the proposed layout will allow for the safe movement of emergency vehicles to and from the development.

The proposed site will have one-way circulation governed by the entrance-only and exit-only driveways on Providence Road. Storage space for buses will be provided in front of the high school and middle school. Separate parking areas for high school staff and middle school staff will be provided, with high school staff located in the parking lot closest to the front of the high school and middle school staff in the parking lot to the west of the middle school. In addition, separate drop-off areas will be provided for parents. High school parents will drop students off on the middle roadway between the parking lots. Middle school parents will use the jug handle located on the northern part of the site. High school students with parking passes will be allowed to park in the large lot closest to Providence Road. An access road is provided to the back of the high school and the stadium to allow for deliveries and emergencies.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This traffic impact analysis was conducted to evaluate the impacts on surrounding roadways and intersections due to the construction of a new Grafton High School and the conversion of the existing high school to an upper middle school on Providence Road (Route 122) in Grafton, Massachusetts. The unsignalized intersection capacity analysis for 2014 shows that the intersection of Providence Road and the proposed Grafton High School and upper middle school entrance-only driveway will operate at LOS C during the school A.M. peak hour and LOS A during the school P.M. peak hour. The proposed Grafton High School and upper middle school exit-only driveway will operate at LOS F during the school A.M. and P.M. peak hours. During the school A.M. peak hour, the westbound approach of the intersection of Providence Road and Brigham Hill Road will change from LOS C to LOS D and the southbound approach will change from LOS A to LOS B. The westbound approach of the intersection of Providence Road and Brigham Hill Road will change from LOS E to LOS F during the school P.M. peak hour. The intersection of Providence Road southbound and the Worcester Street eastbound channelized right-turn lane will change, from LOS

B to LOS C, during the school A.M. peak hour, and will operate at LOS B during the school P.M. peak hour under no-build and build conditions.

It is recommended that the exit-only driveway be striped with both a left turn lane and a right turn lane to maximize the exiting flow of vehicles. Due to the poor levels of service for vehicles exiting the proposed Grafton High School and upper middle school exit-only driveway, the option of using police details for a short time during the school A.M. and school P.M. peak hours should be considered. Since the poor levels of service will only occur for a short amount of time when school begins and ends, no other off site improvements are recommended.

The signalized intersection capacity analysis shows that the overall intersection level of service will change, from LOS C to LOS D, with the addition of 4.9 seconds of delay per vehicle, during the school A.M. peak hour. The Carroll Road approach will change, from LOS D to LOS E. This approach, however, has the lowest volumes. There will be no change in the overall level of service at the intersection of Worcester Street, Providence Road, and Carroll Road during the school P.M. peak hour in 2014.

The geometric configuration of the existing roadways is such that adequate safe stopping sight distances exist for traffic passing and/or utilizing the site. There are no existing unsafe conditions in the vicinity of the development that might be worsened by the addition of the anticipated traffic.

Based upon the analyses, traffic operations on the surrounding roadways and intersections will experience minimal change with the addition of the traffic generated by the proposed improvements. No reduction in safety will occur due to the development as proposed.