

**5 | TRAFFIC, PEDESTRIAN AND BICYCLE SAFETY
IMPACT ANALYSIS**

TRAFFIC IMPACT AND ACCESS STUDY

PROPOSED BABSON COLLEGE RESIDENCE HALL Wellesley, Massachusetts

February 6, 2013

Prepared For
Babson College



TEPP LLC

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SUMMARY

PROJECT DESCRIPTION

Babson College (Babson) has retained TEPP LLC to prepare this traffic impact and access study (TIAS) conforming to the Town of Wellesley's Project of Significant Impact (PSI) regulations for a proposed residence hall containing academic facilities to be constructed on the Babson campus in Wellesley, Massachusetts (Proposed Project).

- Although the Proposed Project will create additional on-campus housing, its construction will not result in increased student enrollment.
- The Proposed Project is to provide additional on-campus housing for students and in fact, may actually result in a reduction in student traffic that would have been traveling to and from the Babson campus for classes and activities, particularly during the AM and PM peak hours.
- The size of the Proposed Project exceeds the PSI thresholds. Accordingly, this study will evaluate the impact of the Proposed Project in accordance with the Municipal System Impact Analysis Regulations and other applicable requirements that are contained in the Zoning Bylaw.

The Proposed Project location (Project Site) in relation to the surrounding roadway network is shown in **Figure 1**. The Proposed Project and site plan reflect the addition of a 200-room residence hall for first year students within the residential quadrangle that will:

- provide community and learning spaces;
- address a current shortage of needed rooms;
- provide needed academic space conforming to the Babson curriculum;
- be not less than a Silver rating under the US Green Building Council Leadership and Environmental Design (LEED) rating system;
- be located adjacent to Luksic Hall, Tomasso Hall, and the Blank Center, which are academic buildings; and
- provide access to and egress from the Proposed Project and campus via two primary driveways, one on Wellesley Avenue and the other on Forest Street.



Figure 1. Site location.

STUDY SCOPE

This TIAS reflects and conforms to the requirements of Section XVI-A of the Wellesley Zoning By-law for Projects of Significant Impact.

The TIAS study area consists of the following intersections:

- Wellesley Avenue/Forest Street unsignalized intersection
- Wellesley Avenue/Babson West Gate unsignalized intersection
- Forest Street/Babson Main Gate unsignalized intersection

This TIAS analyzes traffic operations for the weekday AM and PM peak hours under the following conditions:

- 2012 existing
- 2017 no-build (with background traffic growth)
- 2017 build (with background traffic growth and the Proposed Project)

SIGHT DISTANCES

TEPP LLC measured/observed relevant available sight distances and roadway vehicle speeds for the following unsignalized intersections:

- Wellesley Avenue/Forest Street unsignalized intersection.
- Babson West Gate driveway on Wellesley Avenue.
- Babson Main Gate driveway on Forest Street.

The available sight distances will be adequate. Sight lines should be maintained to prevent inappropriate roadside obstructions or vegetation.

There has been a significant improvement to sight lines at Babson West Gate driveway on Wellesley Avenue due to the removal of a large tree that had previously obscured views for traffic turning to the left from the gate.

An additional measure is proposed to further improve the existing sight lines from the Forest Street main driveway looking to the east, specifically minor branch trimming on one tree.

ACCIDENTS

Accident data for the study area intersections were obtained from the Massachusetts Department of Transportation (MassDOT) for the period from 2008 to 2010, the latest three years of available data:

- For unsignalized intersections, the statewide average accident rate is 0.61 accidents per million entering vehicles (acc/mev) and the district-wide accident rate is 0.57 acc/mev.
- The crash rate experienced at the Wellesley Avenue and Forest Street intersection is slightly above the state- and district-wide averages. Independent of the Proposed Project, in the context of a recent PSI filing, the Wellesley Country Club has committed to improve the Wellesley Avenue and Forest Street intersection through the installation of “all-way” plaques to the existing stop signs.
- If these signs are not installed prior to the completion of the Proposed Project, Babson will pay for installation of such signs to help improve safety and operation of the intersection.

TRIP GENERATION

The existing Babson driveways are not expected to see an increase in traffic as a result of the Proposed Project. In fact, there may be a reduction given that some students who would otherwise be commuting to and from the campus during peak hours will no longer be commuting.

The current campus generates the following vehicle-trips:

- West Gate Driveway along Wellesley Avenue
 - Weekday daily, 2,480 (total of in and out)
 - Weekday AM peak hour, 277 (267 in and 10 out)
 - Weekday PM peak hour, 246 (66 in and 180 out)
- Main Gate Driveway along Forest Street
 - Weekday daily, 4,200 (total of in and out)
 - Weekday AM peak hour, 241 (217 in and 24 out)
 - Weekday PM peak hour, 348 (115 in and 233 out)
- Total of both driveways
 - Weekday daily, 6,680 (total of in and out)
 - Weekday AM peak hour, 518 (484 in and 34 out)
 - Weekday PM peak hour, 594 (181 in and 413 out)

This TIAS includes historic and campus traffic generation from 1993 to 2012, based on traffic counts at Babson Main Gate driveway and Babson west gate driveway. Weekday AM peak hour trip generation has been relatively constant and weekday PM peak hour trip generation has tended to decrease over time. This is despite the addition of several hundred thousand square feet of campus floor area since 1993. Over the past decade, overall enrollment has been relatively stable.

AREA TRAFFIC VOLUMES

TEPP LLC obtained the existing daily and peak-hour traffic-volumes along the study area roadway and intersections. Future volume increases are only expected as a result of background area growth and other development projects. The current area traffic volumes on the area roadways include:

- Wellesley Avenue west of Babson West Gate driveway
 - Weekday daily, 8,700 (total both directions)

- Weekday AM peak hour, 945 (726 eastbound and 219 westbound)
- Weekday PM peak hour, 819 (254 eastbound and 565 westbound)
- Forest Street (east of Babson Main Gate driveway)
 - Weekday daily, 5,020 (total both directions)
 - Weekday AM peak hour, 418 (138 eastbound and 280 westbound)
 - Weekday PM peak hour, 819 (240 eastbound and 236 westbound)

CAPACITY ANALYSIS

TEPP LLC conducted capacity analysis for the weekday AM and PM peak hours under the existing and future conditions as described above for all relevant study-area intersections to calculate levels of service, delays and queues

Capacity analysis findings are:

- Although delays may be experienced during the peak hours at the intersection of Wellesley Avenue and Forest Street, the Proposed Project is not expected to exacerbate this condition. In fact, the Proposed Project may reduce traffic volumes by providing necessary on-site student housing rather than relying on off-campus housing or commuting.
- The site driveway intersections with Wellesley Avenue and Forest Street are expected to operate at LOS C or better under the weekday AM and PM peak hours under both Existing and No-Build/Build conditions.
- Operations at the study intersections are consistent with previous studies performed. The site driveways are expected to continue to operate below capacity.

IMPROVEMENT MEASURES

As described in this study, improvements measures are proposed to complement the Proposed Project and include:

- Although adequate, the limiting factor looking east exiting the site driveway on Forest Street is the lower branches of an evergreen tree. If these lower branches were trimmed, the available sight line would be increased to 500 feet. Babson will trim these bottom branches further improving sight lines.
- Independent of the Proposed Project, the Wellesley Country Club committed to improve the Wellesley Avenue/Forest Street intersection by installing “all-way” plaques to the existing stop signs. If these signs are not installed prior to the completion of the

Proposed Project, Babson will install the signs to help improve safety and operation of the intersection.

In addition, Babson will continue implementation of transportation-demand management, consisting of:

- shuttle bus service including the Olin and Wellesley College campuses and shopping areas in the Towns of Wellesley and Natick and the Massachusetts Bay Transportation Authority system
- carpooling support
- expanded-bicycle-use support and bicycle-sharing program
- flex-time schedule
- the summer four-day work week program and wellness programs

Babson will also continue to work with the Town on expanded bus service.

EXISTING CONDITIONS

INTRODUCTION

Existing conditions include:

- physical conditions of the transportation network, roads and intersections
- traffic volumes
- sight distances
- accident history
- other relevant information

PHYSICAL CONDITIONS

TRANSPORTATION NETWORK

Figure 1 shows the transportation network, which includes the following existing streets:

- Wellesley Avenue
- Forest Street

The TIAS study area includes the following existing intersections:

- Wellesley Avenue/Forest Street unsignalized intersection
- Wellesley Avenue/Babson West Gate unsignalized intersection
- Forest Street/Babson Main Gate unsignalized intersection

WELLESLEY AVENUE

Wellesley Avenue:

- Is generally oriented in an east-west direction.
- Connects Washington Street (Massachusetts Route 16) to the west with Hunnewell Street to the east.

Near the study area, Wellesley Avenue:

- Is a two-lane roadway (one lane in each direction) under local jurisdiction with a well-defined double yellow center and white edge lines providing 12-foot wide travel lanes and 1-foot wide shoulders.
- The land use along Wellesley Avenue in the vicinity of the site includes the Wellesley Country Club, Babson, and residential dwellings.
- The pavement is generally in good condition.
- Has a 5-foot wide bituminous concrete sidewalk located near the Forest Street intersection and extends into the Babson campus.
- The sidewalk is part of the sidewalk network adjacent to Babson extending along Forest Street as well as part of the Charles River Link Trail.
- The sidewalk appears to be in fair to good condition with no significant signs of cracking, deterioration, heaving, sinking, shifting, patching, missing sections, encroaching vegetation, or obstacles. There is one section of the sidewalk on the southerly side of the roadway approaching Forest Street where it appears tree roots are beginning to heave the sidewalk.
- The posted speed limit is 30 miles per hour (mph) in proximity to the site. The 85th percentile observed speeds were recorded to be 36 mph eastbound and 38 mph westbound.

FOREST STREET

Forest Street:

- Is generally oriented in an east-west direction.
- Connects Washington Street (Route 16) in the west with Central Avenue in the east.

Near the study area, Forest Street:

- Is a two-lane roadway (one lane in each direction) under local jurisdiction with a well-defined double yellow center and white edge lines providing 12-foot wide travel lanes and 1-foot wide shoulders.
- Land use along Forest Street in the vicinity of the site includes the Wellesley Country Club, Babson, and residential dwellings.
- The pavement along Forest Street is generally in fair to good condition.
- There is a 6-foot wide bituminous sidewalk on the westerly side of Forest Street extending from the Babson driveway northerly through the intersection with Wellesley Avenue.

- An 8-foot wide painted crosswalk is provided across the Wellesley Avenue eastbound intersection approach connecting the area sidewalk network.
- The sidewalk appears in good condition with no significant signs of cracking, deterioration, heaving, sinking, shifting, patching, missing sections, encroaching vegetation, or obstacles.
- There were no observed speed limit signs within proximity to the site. However, the 85th percentile observed speeds were recorded to be 38 mph eastbound and 39 mph westbound.

WELLESLEY AVENUE/FOREST STREET INTERSECTION

The intersection has:

- Wellesley Avenue and Forest Street intersect to form a skewed four-legged unsignalized intersection under all-way STOP-sign control.
- The left-turns from the Wellesley Avenue westbound approach to Forest Street and right-turns from Forest Street northbound onto Wellesley Avenue are channelized by a raised delta island and are also under STOP-sign control.
- Both the Wellesley Avenue eastbound and westbound approaches provide a 12-foot wide single lane approach with a 2-foot wide shoulder under STOP control and have visible STOP lines.
- An 8-foot wide painted crosswalk is provided across the eastbound approach.
- The Forest Street northbound approach provides a 12-foot wide single lane with a 2-foot wide shoulder under STOP-sign control and has a visible STOP line.
- The Forest Street southbound approach provide an 11-foot wide single lane with a 1-foot wide shoulder under STOP-sign control and has a visible STOP line.
- Sight lines are provided on each of the four intersection approaches that allow each vehicle at the STOP line to see vehicles at each of the other three STOP lines.

WELLESLEY AVENUE/BABSON WEST GATE DRIVEWAY INTERSECTION

The intersection has:

- The existing Babson West Gate driveway meeting Wellesley Avenue to form a three-legged unsignalized intersection with the northbound site driveway approach under STOP-sign control.
- The Wellesley Avenue approaches each provide a 12-foot wide single general purpose lane with 1-foot wide shoulders.

- The site driveway approach provides a 12-foot wide single general-purpose lane under.
- The driveway gate is closed on the weekends as well as from 8 PM to 7 AM on the weekdays.

FOREST STREET/BABSON MAIN GATE DRIVEWAY INTERSECTION

The intersection has:

- The existing Babson Main Gate driveway meeting Forest Street to form a three-legged unsignalized intersection with the northbound site driveway approach under STOP-sign control.
- The Forest Street eastbound approach provides a 10-foot wide through lane and a 10-foot wide right-turn lane. The Forest Street westbound approach provides a 12-foot wide single general purpose lane with a 1-foot wide shoulder.
- The site driveway approach provides a 20-foot wide general-purpose lane which is used for two exiting lanes from the site driveway. Directional travel on this approach is separated by a 30-foot wide landscaped center island.

TRAFFIC VOLUMES

TRAFFIC COUNTS

TEPP LLC obtained turning movement counts:

- at the existing study-area intersections
- on Wednesday, November 14, 2012
- from 7:00 to 9:00 AM and from 4:00 to 6:00 PM

TEPP LLC also obtained automatic traffic volume counts to obtain daily traffic volumes:

- on the study-area roadways and site driveways
- between Tuesday and Wednesday, November 13 and 14, 2012
- included directional traffic as well as vehicle travel speeds

The traffic count data are in **Appendix B**.

MONTHLY ADJUSTMENT

The traffic volumes were balanced and historical traffic volume data was reviewed to determine if seasonal adjustments were required to reflect an average month condition:

- Consistent with state and local guidelines for traffic impact assessment, historical traffic volume data were obtained from the Massachusetts Department of Transportation (MassDOT).
- The nearest MassDOT permanent count station is located on I-95 in Newton, south of Route I-90 (Station No. 415).
- Based on this information, traffic during the month of November is approximately 1.0 percent above annual average month traffic conditions and therefore, the traffic count data was used to reflect above annual average traffic volume conditions.

The MassDOT permanent count station data are in Appendix B.

EXISTING TRAFFIC VOLUMES

Table 1 and Figures 2 and 3 show the 2012 existing weekday volumes.

Table 1. 2012 existing weekday traffic volumes.

Location	Daily Vehicles ^a	Peak-Hour Information			
		Peak Hour	Vehicles ^a	K-factor ^b	Percent Direction
Wellesley Avenue west of West Gate driveway	8,700	AM	945	10.9	77 Eastbound
		PM	819	9.4	69 Westbound
Forest Street east of the Main Gate driveway	5,020	AM	454	9.0	62 Westbound
		PM	476	9.5	50 Eastbound
West Gate driveway south of Wellesley Avenue	2,480	AM	277	11.1	96 Southbound
		PM	246	9.9	73 Northbound
Main Gate driveway south of Forest Street	4,200	AM	241	5.7	90 Southbound
		PM	348	8.3	67 Northbound

^aTotal of both directions.

^bK = the percent of daily volume that occurs during the peak hour.

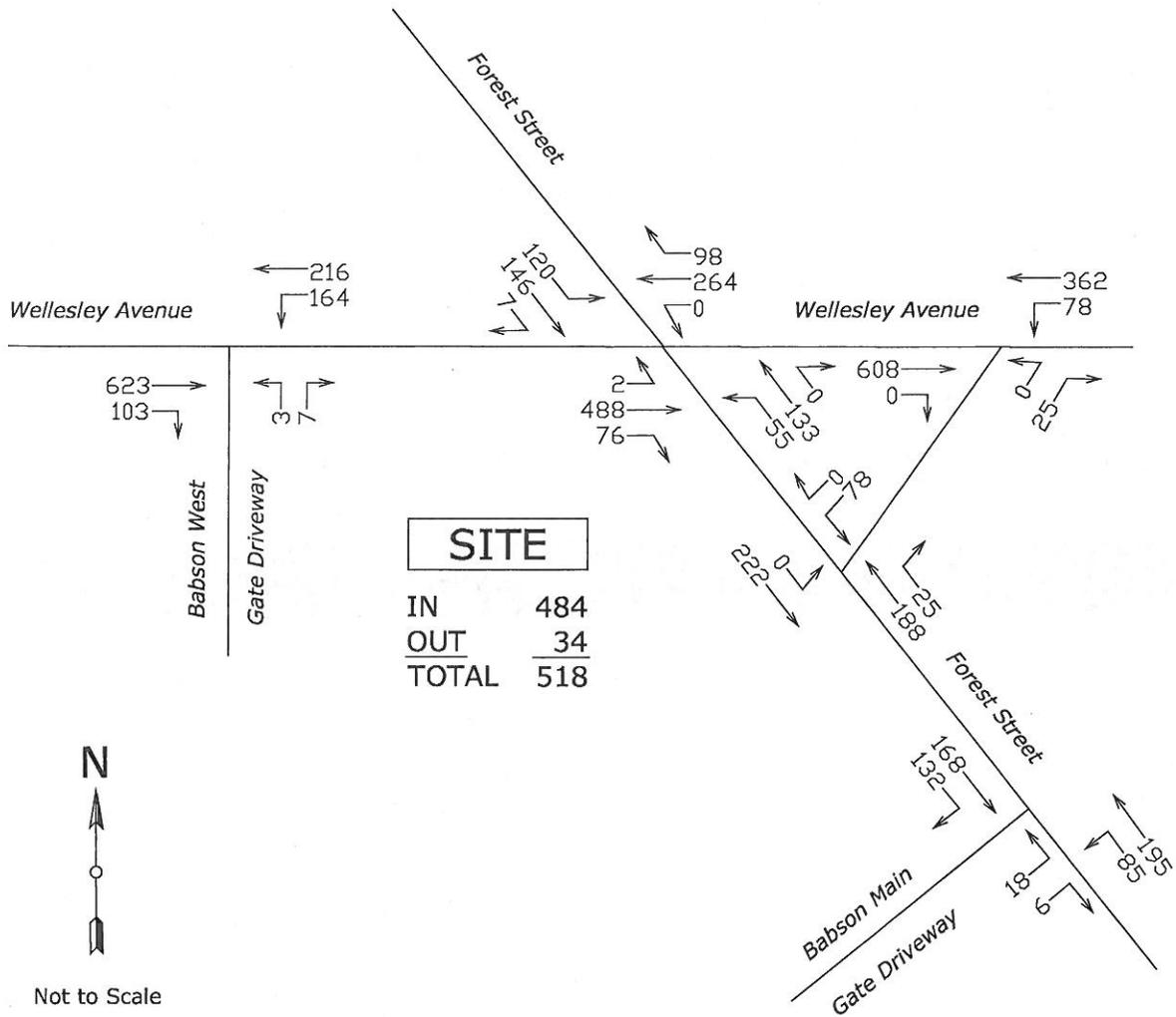


Figure 2. 2012 existing AM peak-hour volumes.

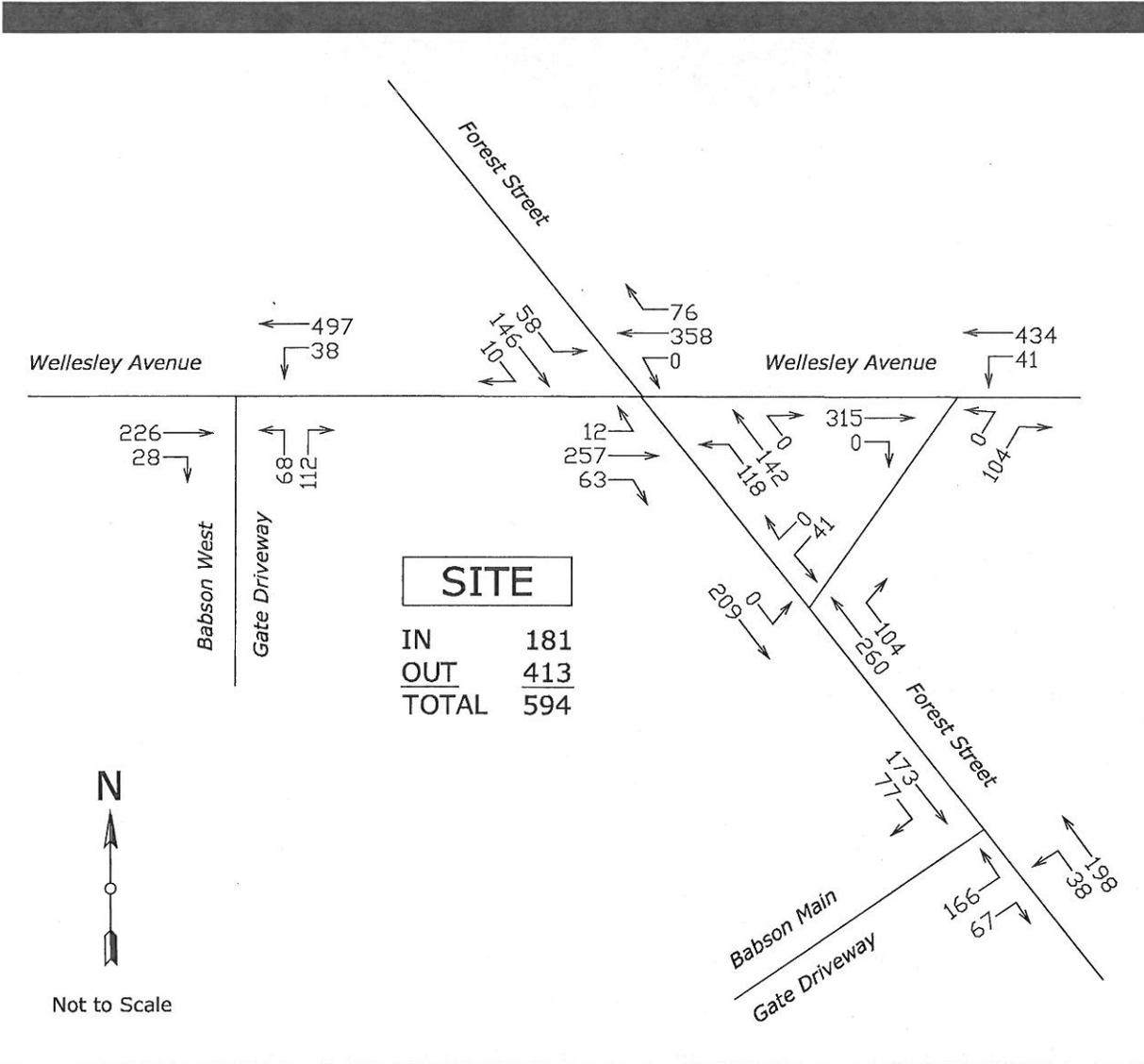


Figure 3. 2012 existing PM peak-hour volumes.

HISTORIC CAMPUS TRAFFIC GENERATION

Table 2 summarizes historic and campus traffic generation from 1993 to 2012, based on traffic counts at the Main Gate driveway and the West Gate driveway. Weekday AM peak hour trip generation has been relatively constant and weekday PM peak hour trip generation have tended to decrease over time. This is despite the addition of several hundred thousand square feet of campus floor area since 1993.

Table 2. Campus trip generation.

Year	Vehicle-Trips	
	AM Peak Hour	PM Peak Hour
1993	498	757
1999	571	743
2001	498	597
2004	513	612
2006	509	673
2012	518	594

SIGHT DISTANCES

The American Association of State Highway and Transportation Officials (AASHTO) has established the authoritative policy for sight distances at unsignalized intersections. Stopping Sight Distance (SSD) is considered at unsignalized intersections. SSD provides for safety and is fundamental to intersection operation. SSD enables a driver, on the major road, to perceive and react accordingly to a vehicle entering the major road from a minor road. SSD is conservative because it encompasses a wide range of brake-reaction times and deceleration rates.¹

TEPP LLC measured/observed relevant available sight distances for following unsignalized intersections:

- Wellesley Avenue/Babson West Gate unsignalized intersection
- Forest Street/Babson Main Gate unsignalized intersection
- Wellesley Avenue/Forest Street unsignalized intersection (all-way stop)

Table 3 shows that available sight distances exceed AASHTO SSD² for major-street approach speeds. Sight lines should be and maintained to avoid inappropriate roadside obstructions or vegetation. For all-way stop intersections such as the Wellesley Avenue and Forest Street intersection, AASHTO requires that the first vehicle on each approach be able to see the first vehicle of the other approaches. This requirement is met for the Wellesley Avenue and Forest Street intersection.

¹ AASHTO, *A Policy on Geometric Design of Highways and Streets*, Fifth Edition (Washington, DC, 2004), page 651.

² AASHTO, page 112 and 115.

Table 3. Sight distances.

Intersection	To/From	Speed (mph)		Sight Distances (ft)	
		Posted Limit	85 th Percentile	SSD ^a	Available
Wellesley Avenue/ West Gate driveway	East	30	38	280	500+
	West	30	36	260	500+
Forest Street/ Main Gate driveway	East	not posted	39	290	340
	West	not posted	38	280	500+

^aFor observed 85th percentile speed.

As shown in **Table 3**, SSD is provided for the site driveways on Wellesley Avenue and Forest Street. Although adequate, the limiting factor looking east exiting the site driveway on Forest Street is the lower branches of a pine tree. If these lower branches were trimmed, as **Figure 4** shows, the available sight line would be increased to 500 feet. Babson has agreed to trim these bottom branches.

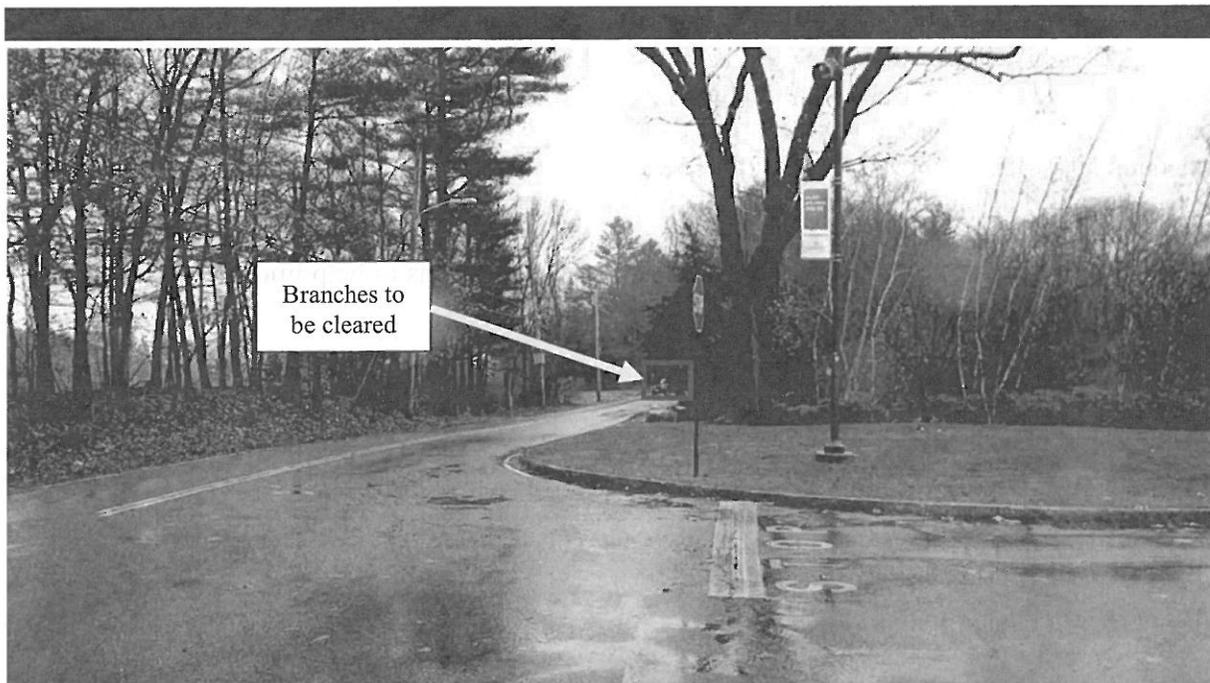


Figure 4. Sight line improvements.

ACCIDENT HISTORY

Accident data for the study area intersections were obtained from MassDOT for the period between 2008 and 2010, the latest three years of available data. A summary of the MassDOT accident data is provided in **Table 4**. In addition to the summary, accident occurrence should also be compared to the volume of traffic through a particular intersection to determine any significance:

- The accident rate was calculated for each intersection and compared with the statewide and district-wide averages.
- Intersection accident rate is a measure of the frequency of accidents compared to the volume of traffic through an intersection and is presented in accidents per million entering vehicles (acc/mev).
- For unsignalized intersections, the statewide average accident rate is 0.61 acc/mev and the district-wide accident rate is 0.57 acc/mev.
- A comparison of the calculated accident rate to the statewide and district-wide averages can be used to establish the significance of accident occurrence and whether or not potential safety problems exist.

As shown in **Table 4**, the crash rate experienced at the Wellesley Avenue and Forest Street intersection is slightly above the state- and district-wide averages. Of the 10 accidents that have occurred over the three-year period, 3 included injury. Half of the accidents were cross movements and 40 percent of the accidents occurred during adverse weather conditions. As noted above, independent of the Proposed Project, the Wellesley Country Club has committed in the context of a recent PSI filing to improve the Wellesley Avenue and Forest Street intersection by installing “all-way” plaques to the existing stop signs. If these signs are not installed prior to the completion of the Proposed Project, Babson will install the signs to help improve safety and operation of the intersection.

Table 4. Accident history 2008 -2010.

	Intersection		
	Wellesley Avenue/ Forest Street	Forest Street/ Main Gate Driveway	Wellesley Avenue/ West Gate Driveway
Number of Accidents	10	0	0
Average Per Year	3.3	0	0
Accident Rate	0.70	0	0
Severity			
Property Damage Only	7	0	0
Personal Injury	3	0	0
Fatality	0	0	0
Type			
Cross Movement/Angle	5	0	0
Rear End	4	0	0
Head On	0	0	0
Fixed Object	1	0	0
Pedestrian	0	0	0
Other	0	0	0
Wet/Icy Conditions	40%	0	0

Source: MassDOT Traffic Operations Safety Management System, 2008 through 2010 data.

FUTURE CONDITIONS

INTRODUCTION

Future conditions include:

- Planned road improvements independent of the Proposed Project.
- Future no-build traffic volumes, with background traffic growth and without the Proposed Project.
- Future build traffic volumes, with background traffic growth and with the Proposed Project (in this case, the build volumes are equal to the no-build volumes)

BACKGROUND TRAFFIC GROWTH

Background traffic growth is:

- independent of the Proposed Project;
- related to land development in the immediate area, population and economic development in the region and changes in travel patterns in the region; and
- generally considers two factors: a general traffic-growth rate and specific planned land developments in the immediate area

Although traffic increases in the area have been less than one percent over the past ten years based on previous traffic volume counts in 2001, 2004, and 2006, this TIAS uses a 1.0-percent annual growth rate as recently submitted and reviewed in the study prepared for the Wellesley Country Club project. This yields a 5.1-percent compounded growth between 2012 and 2017.

This TIAS considers the following specific land developments:

- Wellesley Country Club - redistribution of traffic as a result of a proposed 2,300± square foot golf cart refueling and wash-down station, 20 additional parking spaces where the existing maintenance building is located, and a new 22,000± square foot maintenance building as well as an environmental management center. This project is expected to result in a slight redistribution of traffic on Forest Street.
- National Development - includes a 30,000 square foot commercial building and 135 independent living units located at 27 Washington Street in Wellesley. Traffic from this project is not expected to result in a notable difference in traffic through the study area.

PLANNED ROAD IMPROVEMENTS

The Wellesley Country Club project proponent committed to improve the Wellesley Avenue and Forest Street intersection by installing “all-way” plaques to the existing stop signs.

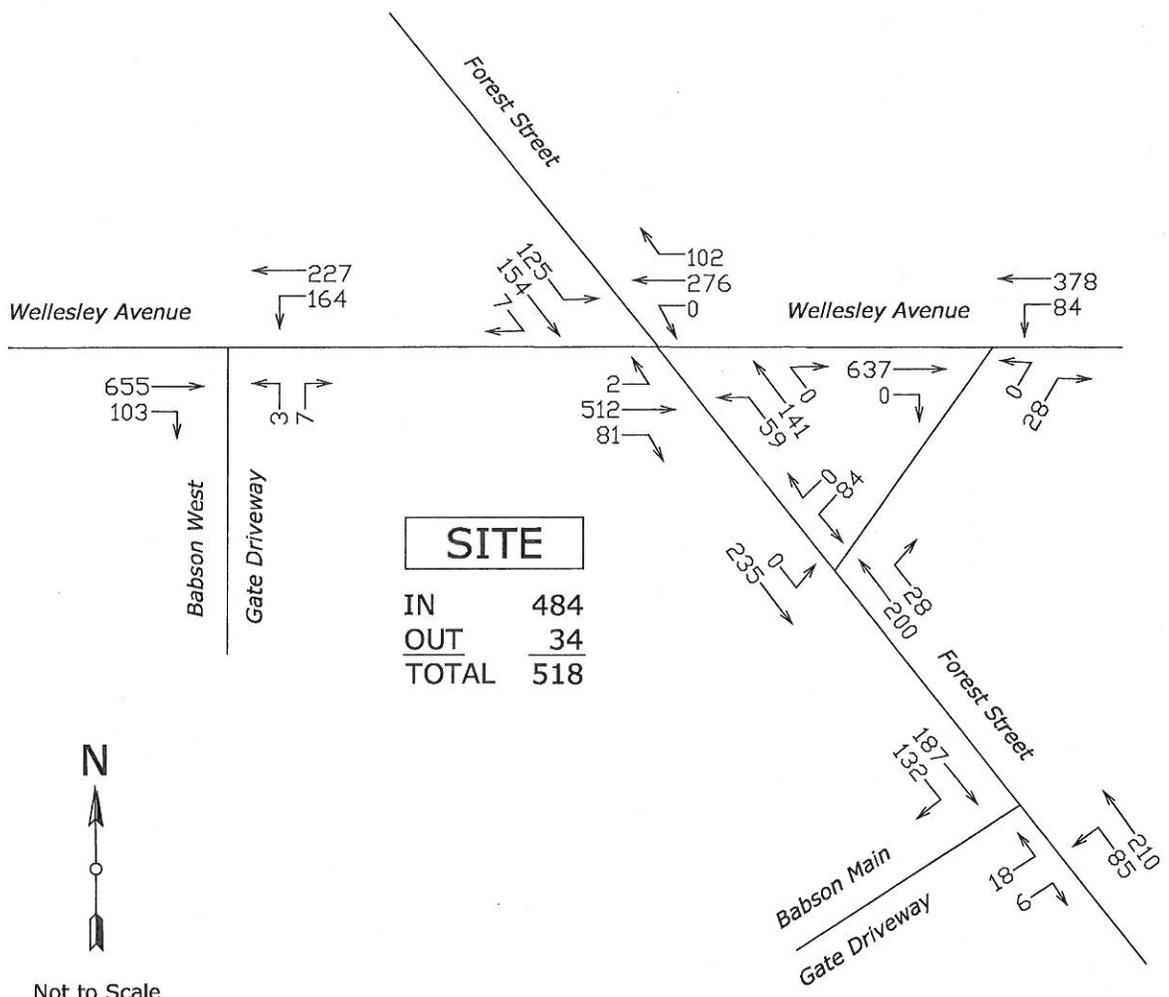
If these signs are not installed prior to the completion of the Proposed Project, Babson will install the signs to help improve safety and operation of the intersection.

NO-BUILD TRAFFIC VOLUMES

The background traffic growth described above was applied to the 2012 existing traffic volumes. **Figures 5 and 6** show the resulting 2012 no-build weekday peak-hour volumes.

SITE TRAFFIC

As described in this report, the proposed 200-room resident hall for first year students will address the current shortage of beds and is not the result of an increase in student enrollment. In fact, since the enrollment is proposed to be maintained and additional on-campus housing will be provided, the Proposed Project may in fact reduce the volume of traffic traveling to and from the campus on a daily basis. However, for the purpose of this study, it is assumed that there will not be a reduction in traffic on the area roadway network. Accordingly, the No-Build traffic volume networks developed as **Figures 5 and 6** are also considered the Build volumes for the Proposed Project.



Not to Scale

Figure 5. 2017 no-build/build AM peak-hour volumes.

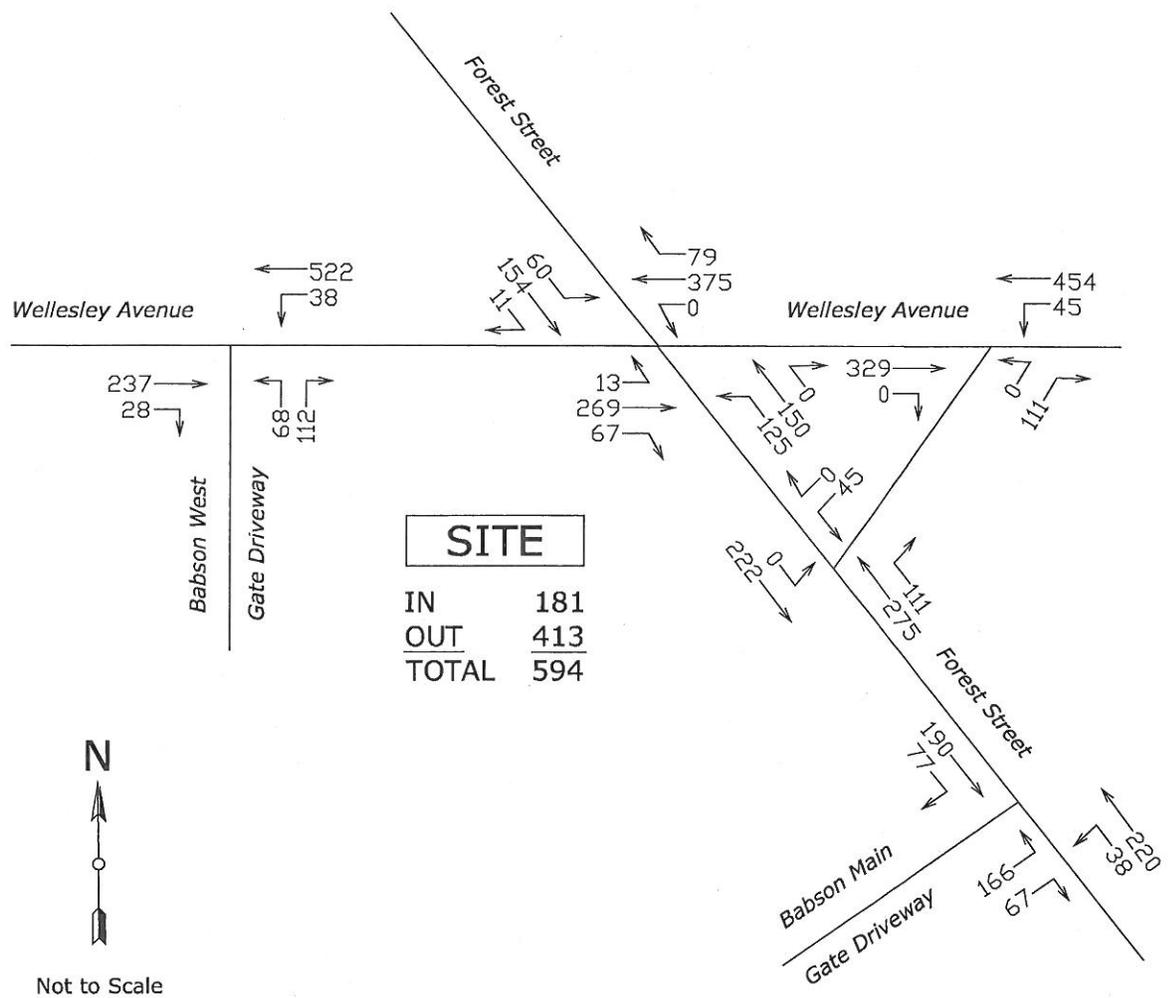


Figure 6 2017 no-build/build PM peak-hour volumes.

OPERATIONS ANALYSIS

INTRODUCTION

This TIAS has *quantified* existing, future-no-build and future-build traffic volumes. Capacity analysis models the *quality* of traffic operations. Although comparing build conditions to the no-build conditions typically indicates impacts of the redevelopment on quality of traffic operations, for the Proposed Project the build volumes equal the no-build volumes.

METHODS

Capacity analysis estimates levels of service (LOS) for transportation facilities. LOS indicates the quality of traffic operations based on delay and other measures. The six LOS are designated A to F. LOS A represents the best or highest operating conditions. LOS F is the lowest, but does not necessarily connote failure.

LOS is a function of traffic volumes and traffic control. Because these volumes can vary, LOS of a transportation facility can differ by time of day, day of the week, or month. For example, a transportation facility with a low LOS during peak hours may have a high LOS during other hours. The operational analysis methods of the Transportation Research Board (TRB)³ models LOS for intersections based on calculated delay per vehicle, as shown in Table 5. Synchro 8 analysis software was utilized.

Table 5. Level-of-service criteria for intersections.

Level of Service	Average Delay at Signalized Intersections (seconds/vehicle)	Average Delay at Unsignalized Intersections (seconds/vehicle)
A	≤10.0	≤10.0
B	>10.0 and ≤20.0	>10.0 and ≤15.0
C	>20.0 and ≤35.0	>15.0 and ≤25.0
D	>35.0 and ≤55.0	>25.0 and ≤35.0
E	>55.0 and ≤80.0	>35.0 and ≤50.0
F	>80	>50

From Transportation Research Board, *Highway Capacity Manual 2010* (Washington, D.C., 2010).

³ TRB, *Highway Capacity Manual 2010* (Washington, DC, 2010).

Method inputs include:

- intersection geometry
- traffic control, such as YIELD sign, two-way STOP sign, all-way STOP sign or signal (including phasing, timing and progression)
- traffic volumes
- vehicle composition, such as passenger cars and trucks

The methods are all approximate. In particular, the method for two-way and all-way STOP-sign control can be conservative, with observed delays and queuing shorter than those modeled.

RESULTS

Tables 6 through 9 present results for the study-area intersections for weekday AM and PM peak hours under the 2012 existing and 2017 no-build/build conditions. The table shows computed volumes-to-capacity ratios (V/C), levels of service (LOS), vehicle delays and queues. Capacity analysis worksheets that give background and explanation are in **Appendix D**.

Capacity analysis findings are:

- At the intersection of Wellesley Avenue and Forest Street, delays can be expected for both the eastbound and westbound Wellesley Avenue approaches during the weekday AM and PM peak hours. However, the Proposed Project is not expected to impact the operation of this location and could in fact reduce volumes under the build condition.
- All channelized movements for the Wellesley Avenue and Forest Street intersection operate at level of service (LOS B) or better during the weekday AM and PM peak hours under existing conditions and are expected to continue to operate at these levels under the future no-build/build condition. Vehicle queues are expected to typically be less than 1 vehicle on these approaches.
- The West Gate site driveway approach to Wellesley Avenue is expected to operate at LOS C during both the weekday AM and PM peak hours under the Existing and No-Build/Build conditions. Vehicle queues are expected to be approximately 3 vehicles or less on this approach.
- The Main Gate site driveway approach to Forest Street is expected to operate at LOS C or better during both the weekday AM and PM peak hours under the existing condition and no-build/build conditions. Vehicle queues are expected to be approximately 3 vehicles or less on this approach.

Table 6. 2012 existing weekday AM peak-hour capacity analysis summary.

Intersection and Movements ^a	Volume-to-Capacity	Level of Service	Delay ^b	Queue ^c
Wellesley Avenue/Forest Street Unsignalized Intersection				
Forest Street NB LTR	0.47	C	19.2	2.5
Wellesley Avenue EB LTR	1.20	F	67.9	13.5
Wellesley Avenue WB LTR	0.85	E	39.2	8.6
Forest Street SB LTR	0.72	D	29.3	5.7
Wellesley Avenue/Channelized Turns Unsignalized Intersection near Forest Street				
Channelized NB LR	0.06	B	13.4	0.2
Wellesley Avenue WB LT	0.09	A	9.3	0.3
Forest Street/Channelized Turns Unsignalized Intersection near Wellesley Avenue				
Forest Street EB LT	0.00	A	0.0	0.0
Channelized SB LR	0.16	B	12.7	0.6
Wellesley Avenue/West Gate Driveway Unsignalized Intersection				
Driveway NB LR	0.08	C	19.8	0.2
Wellesley Avenue WB L	0.21	B	10.2	0.8
Forest Street/Main Gate Driveway Unsignalized Intersection				
Driveway NB L	0.06	B	14.2	0.2
Driveway NB R	0.01	A	9.2	0
Forest Street WB L	0.07	A	7.8	0.2

^a EB = eastbound, WB = westbound, SB = southbound, NB = northbound, L = left, T = through, R = right.

^b Average delay in seconds per vehicle.

^c 95th percentile queue in vehicles.

Table 7. 2012 existing weekday PM peak-hour capacity analysis summary.

Intersection and Movements ^a	Volume-to-Capacity	Level of Service	Delay ^b	Queue ^c
Wellesley Avenue/Forest Street Unsignalized Intersection				
Forest Street NB LTR	0.65	D	25.4	5.5
Wellesley Avenue EB LTR	0.82	E	36.4	7.9
Wellesley Avenue WB LTR	0.94	F	55.9	11.8
Forest Street SB LTR	0.56	C	21.5	3.3
Wellesley Avenue/Channelized Turns Unsignalized Intersection near Forest Street				
Channelized NB LR	0.17	B	11.2	0.6
Wellesley Avenue WB L	0.04	A	8.1	0.1
Forest Street/Channelized Turns Unsignalized Intersection near Wellesley Avenue				
Forest Street EB L	0.00	A	0.0	0.0
Channelized SB LR	0.10	B	13.3	0.3
Wellesley Avenue/West Gate Driveway Unsignalized Intersection				
Driveway NB LR	0.41	C	17.5	1.9
Wellesley Avenue WB L	0.03	A	7.8	0.1
Forest Street/Main Gate Driveway Unsignalized Intersection				
Driveway NB L	0.46	C	18.5	2.5
Driveway NB R	0.11	B	10	0.4
Forest Street WB L	0.03	A	7.8	0.1

^a EB = eastbound, WB = westbound, SB = southbound, NB = northbound, L = left, T = through, R = right.

^b Average delay in seconds per vehicle.

^c 95th percentile queue in vehicles.

Table 8. 2017 no-build/build weekday AM peak-hour capacity analysis summary.

Intersection and Movements ^a	Volume-to-Capacity	Level of Service	Delay ^b	Queue ^c
Wellesley Avenue/Forest Street Unsignalized Intersection				
Forest Street NB LTR	0.52	C	21.3	3.3
Wellesley Avenue EB LTR	1.33	F	69.7	13.2
Wellesley Avenue WB LTR	0.92	F	50.6	10.4
Forest Street SB LTR	0.77	D	34.7	6.7
Wellesley Avenue/Channelized Turns Unsignalized Intersection near Forest Street				
Channelized NB LR	0.07	B	13.8	0.2
Wellesley Avenue WB L	0.10	A	9.5	0.3
Forest Street/Channelized Turns Unsignalized Intersection near Wellesley Avenue				
Forest Street EB L	0.00	A	0.0	0.0
Channelized SB LR	0.18	B	13.2	0.6
Wellesley Avenue/West Gate Driveway Unsignalized Intersection				
Driveway NB LR	0.08	C	20.8	0.3
Wellesley Avenue WB L	0.22	B	10.4	0.8
Forest Street/Main Gate Driveway Unsignalized Intersection				
Driveway NB L	0.07	B	14.7	0.2
Driveway NB R	0.01	A	9.4	0.0
Forest Street WB L	0.07	A	7.8	0.2

^a EB = eastbound, WB = westbound, SB = southbound, NB = northbound, L = left, T = through, R = right.

^b Average delay in seconds per vehicle.

^c 95th percentile queue in vehicles.

Table 9. 2017 no-build/build weekday PM peak-hour capacity analysis summary.

Intersection and Movements ^a	Volume-to-Capacity	Level of Service	Delay ^b	Queue ^c
Wellesley Avenue/Forest Street Unsignalized Intersection				
Forest Street NB LTR	0.70	D	29.4	5.4
Wellesley Avenue EB LTR	0.89	E	46.6	9.6
Wellesley Avenue WB LTR	1.04	F	69.5	13.3
Forest Street SB LTR	0.61	C	24.1	3.9
Wellesley Avenue/Channelized Turns Unsignalized Intersection near Forest Street				
Channelized NB LR	0.18	B	11.4	0.7
Wellesley Avenue WB L	0.04	A	8.1	0.1
Forest Street/Channelized Turns Unsignalized Intersection near Wellesley Avenue				
Forest Street EB L	0.00	A	0.0	0.0
Channelized SB LR	0.11	B	13.8	0.4
Wellesley Avenue/West Gate Driveway Unsignalized Intersection				
Driveway NB LR	0.42	C	18.3	2.1
Wellesley Avenue WB L	0.03	A	7.9	0.1
Forest Street/Main Gate Driveway Unsignalized Intersection				
Driveway NB L	0.49	C	20.2	2.6
Driveway NB R	0.12	B	10.2	0.4
Forest Street WB L	0.03	A	7.8	0.1

^a EB = eastbound, WB = westbound, SB = southbound, NB = northbound, L = left, T = through, R = right.

^b Average delay in seconds per vehicle.

^c 95th percentile queue in vehicles.

CONCLUSION

PROPOSED PROJECT DESCRIPTION

Babson has retained TEPP LLC to prepare this TIAS conforming to the Town of Wellesley's PSI requirements for a proposed residence hall to be constructed on the existing Babson campus in Wellesley, Massachusetts (Proposed Project).

- Although the Proposed Project will create additional on-campus housing, its construction will not result in increased student enrollment and in fact, may actually result in a reduction in student traffic that would have been traveling to and from the Babson campus for classes and activities, particularly during the AM and PM peak hours.
- Based on the size of the Proposed Project, this project exceeds the PSI thresholds. Accordingly, this study will evaluate the impact of the Proposed Project in accordance with the Municipal System Impact Analysis Regulations and other applicable requirements that are contained in the Zoning Bylaw.

The current proposal and site plan includes the addition of a 200-room residence hall for first year students within the residential quadrangle that will:

- provide community and learning spaces;
- address a current shortage of needed rooms;
- provide needed academic space conforming to the Babson curriculum;
- be not less than a Silver rating under the US Green Building Council LEED rating system;
- be located adjacent to Luksic Hall, Tomasso Hall, and the Blank Center, which are academic buildings; and
- for which access to and egress from the Proposed Project and campus to be provided via two primary driveways, one on Wellesley Avenue and the other on Forest Street.

SIGHT DISTANCES

TEPP LLC measured/observed relevant available sight distances for following unsignalized intersections:

- Wellesley Avenue/Forest Street unsignalized intersection
- Wellesley Avenue/Babson West Gate unsignalized intersection

- Forest Street/Babson Main Gate unsignalized intersection

The available sight distances will be adequate. However, improvements are proposed to further increase sight lines looking east (right) exiting the Babson main driveway on Forest Street. Sight lines should be maintained to prevent inappropriate roadside obstructions or vegetation.

TRAFFIC-VOLUME CHANGES

Since the Proposed Project will create additional on-campus housing and not increase the current student enrollment, the Proposed Project is not expected to result in an increase of traffic on the area roadways and intersections.

CAPACITY ANALYSIS

TEPP LLC conducted capacity analysis:

- for the weekday AM and PM peak hours under all relevant existing and future conditions, as described above
- for all relevant study-area intersections
- to calculate levels of service, delays and queues

Capacity analysis findings are:

- Based on the analysis results, delays can be experienced at the intersection of Wellesley Avenue and Forest Street for both the eastbound and westbound Wellesley Avenue approaches during the weekday AM and PM peak hours. However, the Proposed Project is not expected to impact the operation of this location and could in fact reduce volumes under the Build condition.
- The site driveway unsignalized intersections show acceptable operations and queues of approximately three vehicles or less.

IMPROVEMENT MEASURES

As described in this study, improvements measures are proposed to complement the Proposed Project and include:

- Although adequate, the limiting factor looking east exiting the site driveway on Forest Street is the lower branches of an evergreen tree. If these lower branches were trimmed, the available sight line would be increased to 500 feet. Babson will trim these bottom branches further improving sight lines.
- Independent of the Proposed Project, the Wellesley Country Club committed to improve the Wellesley Avenue/Forest Street intersection by installing “all-way” plaques to the existing stop signs. If these signs are not installed prior to the completion of the Proposed Project, Babson will install the signs to help improve safety and operation of the intersection.

In addition, Babson will continue implementation of transportation-demand management, consisting of:

- shuttle bus service including the Olin and Wellesley campuses and shopping areas in the Towns of Wellesley and Natick and the Massachusetts Bay Transportation Authority system
- carpooling support
- expanded-bicycle-use support and bicycle-sharing program
- flex-time schedule
- the summer four-day work week program and wellness programs

Babson will also continue to work with the Town on expanded bus service.

