

# WALTHAM TRAFFIC COMMISSION

119 SCHOOL STREET – WALTHAM – MASSACHUSETTS – 02451  
781-314-3400 – FAX 781-314-3406

**MEETING 09/26/19**

**Agenda Item # 1D**

**TO:** Waltham Traffic Commission  
**FROM:** J. Michael Garvin, P.E., Traffic Engineer  
**SUBJECT:** New Waltham High School – Traffic Study  
**DATE:** September 24, 2019

REF: 19-133

---

**ISSUE:** Bryant Associates has submitted the revised traffic study for the new Waltham High School.

**FACTS & FINDINGS:** Bryant Associates submitted the first draft of the traffic study for the new Waltham High School in June 2019.

Based on my initial comments, and based on discussions with City staff, the traffic study has been revised, and the revised study was submitted on September 13, 2019.

The following represents my review of the September 2019 traffic study. The study itself included evaluation of the school's AM peak hour (7:00am – 8:00am) and PM peak hour (2:00pm – 3:00pm). However, the greatest impacts by far are to the AM peak hour traffic, since the high school traffic coincides with the general commuter traffic. When the school is dismissed, from 2:00 to 3:00, there is minimal traffic on the streets that are unrelated to the school. Therefore, my review focuses exclusively on the AM peak hour (7:00am – 8:00am), which is the worst case.

## Study Intersections

The following intersections were included in the study. These were agreed to by Traffic Engineering ahead of Bryant Associates conducting the study:

1. Lexington Street/Stanley Road/Future High School Driveways
2. Lexington Street/Jacks Way (existing entrance to high school)
3. Lexington Street/High School Egress
4. Lexington Street/Lake Street/Bishops Forest Drive
5. Lexington Street/Totten Pond Road/Bacon Street (Piety Corner)
6. Forest Street/Woodcliff Drive



### **Existing High School Traffic**

Bryant Associates calculated the approximate number of vehicle trips (either an entering vehicle or an exiting vehicle) for the existing high school, based on formulas in the ITE Trip Generation Manual, assuming the existing enrollment of 1,474 students.

Based on this calculation, the existing high school generates 1,032 vehicle trips in the AM peak hour (7:00 – 8:00). Of these, 691 were calculated as entering vehicles and 341 as exiting vehicles.

Furthermore, Bryant Associates estimated 40% of the traffic generated by the existing high school is via Forest Street/Woodcliff Drive, while 60% is via Lexington Street/Jacks Way.

Waltham Traffic Engineering conducted a traffic count of the existing high school traffic on Thursday September 19 and Friday September 20, in the AM peak hour (7:00 – 8:00). The results are remarkably similar to the estimations by Bryant Associates, and confirm their calculation of the overall trip generation. There are some differences in the trip distribution, however.

The existing high school generates 1,039 vehicle trips in the AM peak hour, with 683 entering vehicles and 356 exiting vehicles. Of these, about 33% of the high school traffic is via Forest Street/Woodcliff Drive, while 67% is via Lexington Street/Jacks Way.

Traffic Figures 1 and 2 (attached) demonstrate the differences between the calculated and actual volumes for the existing high school. This is also presented below in Table 1.



# New High School

Traffic Figures





## 2 Traffic Figures

Actual (1434 students)

ENTER = 683  
EXIT = 356  
TOTAL = 1.039

Volunteers do not include trips on trucks way unrelated to EHS and high school



**TABLE 1 – Existing Waltham High School Trip  
Generation/Distribution Comparison, AM Peak Hour (7:00 –  
8:00)**

	Bryant Assoc Estimate	Actual Count	Difference (actual – estimate)
TOTAL VEHICLE TRIPS	1,032	1,039	+7
TOTAL ENTERING	691	683	-8
TOTAL EXITING	341	356	+15
Lexington St Northbound (enter)	174	178	+4
Lexington St Southbound (enter)	241	250	+9
Forest St Northbound (enter)	193	178	-15
Forest St Southbound (enter)	83	77	-6
Lexington St Southbound (exit)	103	135	+32
Lexington St Northbound (exit)	102	134	+32
Forest St Southbound (exit)	109	70	-39
Forest St Northbound (exit)	27	17	-10

As shown, the calculated trip generation for the overall school matches up very closely to the actual traffic count (only off by seven vehicles). However, some of the individual turning movements are off by quite a bit more (not enough trips were assigned to exit onto Lexington Street and too many trips were assigned to exit onto Forest Street, for example).

#### **New (Larger) High School Traffic**

Bryant Associates estimated the number of vehicle trips that will be generated by the new high school assuming the projected enrollment of 1,830 students, as opposed to the existing enrollment of 1,474 students.

This estimation was simply an increase of 24.2% over the existing traffic volumes (1,830 / 1,474). This is a reasonable way to estimate the increase in traffic volumes.

Table 2 presents the hypothetical case of the new larger high school being built on the same property of the existing high school, for the purpose of comparison of traffic volume numbers.



**TABLE 2 – Projected Waltham High School Trip Generation/Distribution Comparison, AM Peak Hour (7:00 – 8:00) – ASSUMING BUILT IN EXISTING LOCATION, WITH 1,830 STUDENTS**

	Bryant Assoc Estimate	Traffic Engineering Estimate	Difference (Traffic Engineering – Bryant Assoc)
<b>TOTAL VEHICLE TRIPS</b>	1,281	1,290	+9
<b>TOTAL ENTERING</b>	858	848	-10
<b>TOTAL EXITING</b>	423	442	+19
Lexington St Northbound (enter)	216	221	+5
Lexington St Southbound (enter)	299	310	+11
Forest St Northbound (enter)	240	221	-19
Forest St Southbound (enter)	103	96	-7
Lexington St Southbound (exit)	128	168	+40
Lexington St Northbound (exit)	127	166	+39
Forest St Southbound (exit)	135	87	-48
Forest St Northbound (exit)	34	21	-13

Figure 3 depicts what the high school traffic only would be, in the hypothetical case where the larger high school were built on the existing high school property.

### **Relocation to 554 Lexington Street**

Next, these vehicle trips were redistributed onto the roadways with the new (larger) high school located at 554 Lexington Street (the former Stigmatine Fathers and Brothers property; the proposed location). The driveway for the proposed high school will be on the west side of Lexington Street, directly opposite Stanley Road. This location is approximately 800 feet south of Jacks Way.

All of the traffic into and out of the proposed high school will be via Lexington Street. There is no proposed secondary access drive onto another street.

In discussions with the City since the draft traffic study in June, it was agreed that the gates at the top of Woodcliff Drive will remain open during the school days after the new high school is constructed at 554 Lexington Street. This will allow for vehicles to travel to and from the new high school by way of Jacks Way, Woodcliff Drive, and Forest Street if that is more convenient than



# New High School

3

Traffic Figures

AM: PROPOSED

HIGH SCHOOL

TRAFFIC IF

BUILT ON

EXPANSION SITE

(1,830 PASSES)

NOTE: THIS IS  
HYPOTHETICAL  
CASE OF NEW  
LARGER HIGH  
SCHOOL AT  
EXISTING SITE

ENTER = 848  
EXIT = 442  
TOTAL = 1,290

530  
212  
168  
2166  
221  
215  
227  
227



strictly via Lexington Street. This will help mitigate traffic impacts on Lexington Street somewhat.

Bryant Associates assumed that none of the traffic that currently uses Woodcliff Drive to drive to or from the existing high school will switch over to using strictly Lexington Street once the new high school is constructed at 554 Lexington Street. All the drivers on their way to the new high school (who today arrive from Woodcliff Drive) will drive past the old high school building, past Kennedy Middle School, and then turn left onto Lexington Street and continue south to 554 Lexington Street.

In my view, this assumption is completely unrealistic. For many drivers, the route via Woodcliff Drive and the Kennedy Middle School road will be longer than it would be to switch over to using just Lexington Street. There may be some vehicles that continue to be on Woodcliff Drive, but it will not be close to 100% of today's vehicles that do so (which is the assumption in the Bryant Associates study).

In order to estimate what percentage of high school traffic would utilize Woodcliff Drive (rather than strictly Lexington Street), travel time runs were conducted during the AM peak hour. This consisted of driving in traffic along various routes to time each route for comparison.

For entering traffic, time runs were measured from (1) the Beaver Street rotary (at Lyman Street) to the new high school driveway (opposite Stanley Road) along both routes (via Woodcliff Drive and via Lexington Street); and (2) the intersection of Trapelo Road/Forest Street to the new high school driveway (opposite Stanley Road) along both routes (via Woodcliff Drive and via Lexington Street).

The results of these time runs are depicted in Figure 4 and in Table 3.

**TABLE 3 – Travel Time Comparison for New High School at 554 Lexington St (minutes:seconds)**

	Via Jacks Way/Woodcliff Dr	Via Lexington St	Reasonable Percent That Would Use Woodcliff Dr
Entering, from Beaver St rotary	4:08	2:50	25%
Exiting, to Beaver St rotary	3:42	4:47	70%
Entering, from Trapelo/Forest	4:50	6:01	70%
Exiting, to Trapelo/Forest	4:18	5:21	60%



# New High School

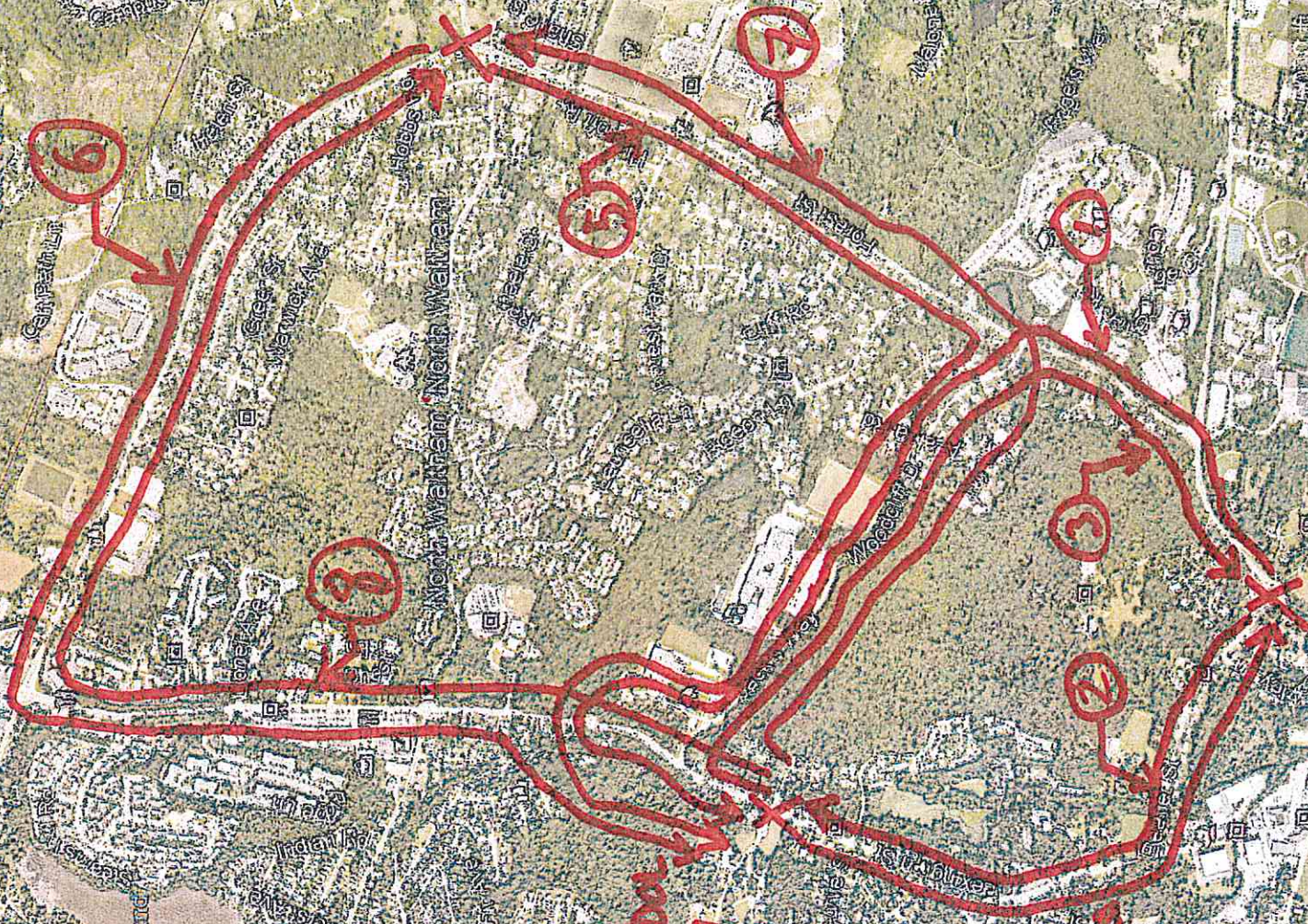
Traffic Figures

MEASURED

TRAVEL TIMES

- 1 = 4:08
- 2 = 2:50
- 3 = 3:42
- 4 = 4:47
- 5 = 4:50
- 6 = 6:01
- 7 = 4:18
- 8 = 5:21

Proposed High School





As shown on Table 3, I would only designate a portion of the traffic that currently uses Woodcliff Drive to continue along that route once the high school moves to the proposed location. The rest of the high school traffic would switch over to Lexington Street without driving on Woodcliff Drive.

For entering traffic, 25% of the traffic that currently turns left onto Woodcliff Drive would remain, with the other 75% switching to turn left from Lexington Street into the new driveway, while 70% of the traffic that currently turns right onto Woodcliff Drive would remain, with the other 30% switching to turn right from Lexington Street into the new driveway.

For exiting traffic, 70% of the traffic that currently turns right from Woodcliff Drive onto Forest Street would remain, with the other 30% switching over to turning right out of the new Lexington Street driveway, while 60% of the traffic that currently turns left from Woodcliff Drive onto Forest Street would remain, with the other 40% switching over to turning left out of the new Lexington Street driveway.

The net effect of these revisions is shown on Table 4.

My projections of traffic related to the new high school are shown on Figure 5.



**TABLE 4 – Projected Waltham High School Trip Generation/Distribution Comparison, AM Peak Hour (7:00 – 8:00) – ASSUMING BUILT AT 554 LEXINGTON ST, WITH 1,830 STUDENTS**

	Bryant Assoc Estimate	Traffic Engineering Estimate	Difference (Traffic Engineering – Bryant Assoc)
TOTAL VEHICLE TRIPS	1,281	1,290	+9
TOTAL ENTERING	858	848	-10
TOTAL EXITING	423	442	+19
Lexington St Northbound (enter, left turn into driveway)	216	387	+171
Lexington St Southbound (enter, right turn into driveway)	642	461	-181
Forest St Northbound (enter, left turn onto Woodcliff Dr)	240	55	-185
Forest St Southbound (enter, right turn onto Woodcliff Dr)	103	67	-36
Lexington St Southbound (exit, right turn from driveway)	128	194	+66
Lexington St Northbound (exit, left turn from driveway)	296	248	-48
Forest St Southbound (exit, right turn from Jacks Way/Woodcliff Dr)	135	61	-74
Forest St Northbound (exit, left turn from Jacks Way/Woodcliff Dr)	34	13	-21

As shown in Table 4, I believe the Bryant Associates projections underestimate the amount of traffic on Lexington Street south of the proposed high school driveway, while overestimating the amount of traffic on Lexington Street north of the proposed high school driveway (since Bryant Associates assumes all traffic currently on Woodcliff Drive will remain on that road). My projections are 237 vehicles more than the Bryant Associates projections for high school traffic on Lexington Street between the driveway and Lincoln Street.

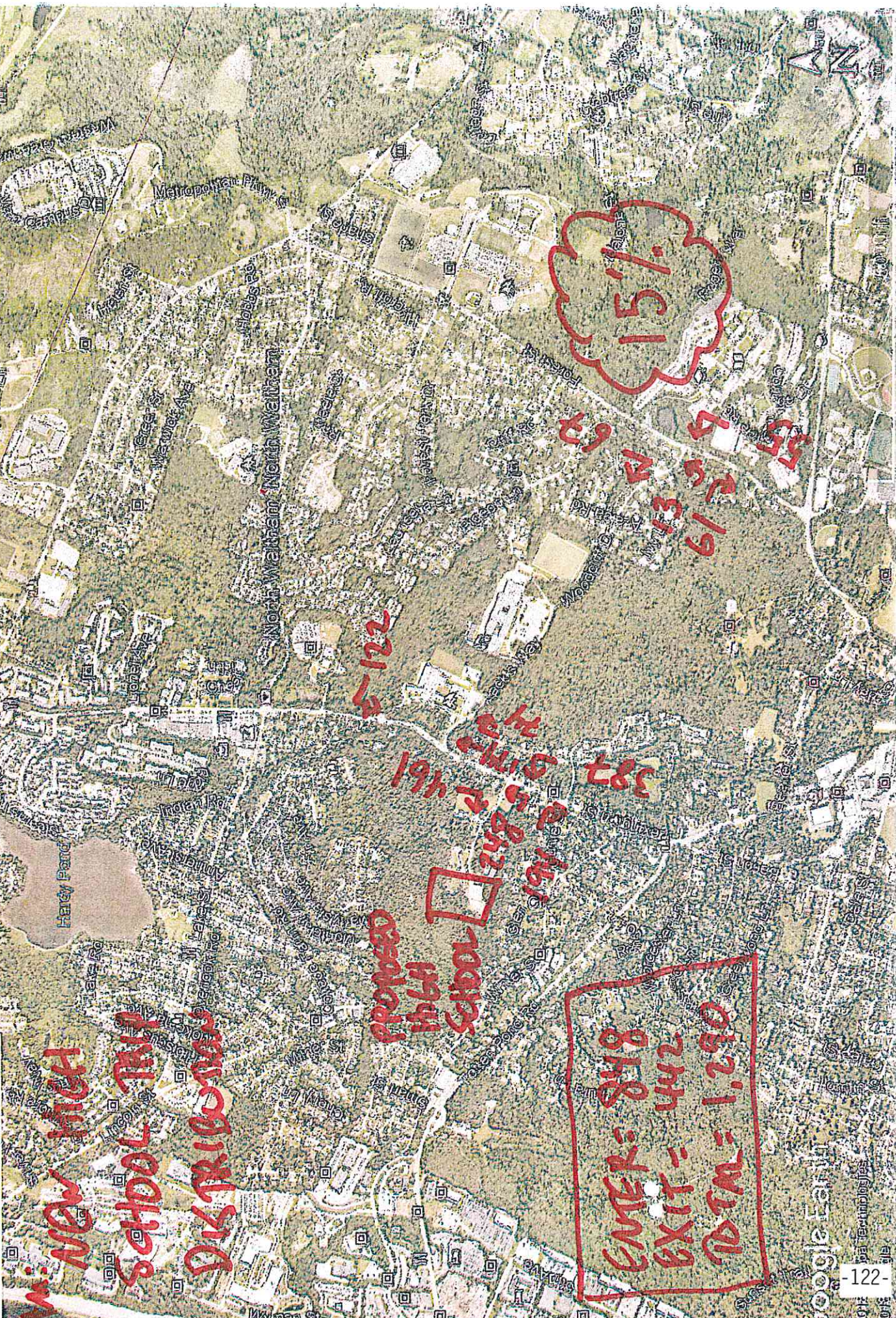
In all, I expect only about 15% of all high school traffic to use Woodcliff Drive/Jacks Way. Bryant Associates assumed 40%.



# New High School

5

Traffic Figures





### **Proposed Middle School**

The existing high school building is now projected to house a new middle school, with 650 students. In the June draft traffic study, the proposal was to convert the building to a K-8 school. The newly proposed middle school will generate fewer vehicle trips than the K-8 school would have.

Without knowing exactly what part of the City the new middle school will draw from, it is difficult to precisely determine the trip distribution for the new school. Bryant Associates assumed the distribution would be similar to the pattern observed for the existing high school. While this is not likely to be the case (since the middle school will draw students from only a portion of the City and the high school draws from the full City), I agree that the assumption is probably valid for this purpose. As shown in Figure 2, this means that 33% of the traffic will use Woodcliff Drive, while 67% of the traffic will use Jacks Way.

Proposed Middle School traffic volumes are shown on Figure 6 and on Table 5.

**TABLE 5 – Projected Waltham Middle School Trip Generation/Distribution Comparison, AM Peak Hour (7:00 – 8:00) – IN EXISTING HIGH SCHOOL BUILDING, WITH 650 STUDENTS**

	Bryant Assoc Estimate	Traffic Engineering Estimate	Difference (Traffic Engineering – Bryant Assoc)
TOTAL VEHICLE TRIPS	377	377	0
TOTAL ENTERING	204	204	0
TOTAL EXITING	173	173	0
Lexington St Northbound (enter)	51	53	+2
Lexington St Southbound (enter)	71	75	+4
Forest St Northbound (enter)	57	53	-4
Forest St Southbound (enter)	25	23	-2
Lexington St Southbound (exit)	52	66	+14
Lexington St Northbound (exit)	52	65	+13
Forest St Southbound (exit)	55	34	-21
Forest St Northbound (exit)	14	8	-6



# New High School

Traffic Figures 6

McMILLAN  
SCHOOL

TRIP DISTRIBUTION

265  
566 NEW  
MIDDLE  
SCHOOL

ENTER = 204  
EXIT = 173  
TOTAL = 377

22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100



### Overall Traffic Volume Increases

Lastly, I detailed what Bryant Associates has projected for traffic volume changes, and compared that to my projections. See Table 6 below.

**TABLE 6 – Traffic Volume Changes Due to Project: AM Peak Hour (7:00 – 8:00)**

	Lexington St, south of Stanley Rd	Lexington St, north of existing egress	Forest St, south of Woodcliff Dr	Forest St, north of Woodcliff Dr
Existing traffic volume	1,190 (578 NB & 612 SB)	1,635 (632 NB & 1,003 SB)	1,176 (526 NB & 650 SB)	884 (319 NB & 565 SB)
Background traffic growth (unrelated to this project)	97 (26 NB & 71 SB)	118 (24 NB & 94 SB)	47 (21 NB & 26 SB)	36 (13 NB & 23 SB)
<b>Bryant Associates Calculations:</b>				
Traffic From New 1,830 Student High School (in addition to the existing high school traffic):	67 (42 NB & 25 SB)	82 (24 NB & 58 SB)	73 (47 NB & 26 SB)	27 (7 NB & 20 SB)
Traffic From New 650 Student Middle School	103 (51 NB & 52 SB)	123 (52 NB & 71 SB)	112 (57 NB & 55 SB)	39 (14 NB & 25 SB)
Total Traffic Volume	1,457 (697 NB & 760 SB)	1,958 (732 NB & 1,226 SB)	1,408 (651 NB & 757 SB)	986 (353 NB & 633 SB)
Change From Existing	+267, or +22% (+119 NB & +148 SB)	+323, or +20% (+100 NB & +223 SB)	+232, or +20% (+125 NB & +107 SB)	+102, or +12% (+34 NB & +68 SB)
<b>Waltham Traffic Engineering Calculations:</b>				
Traffic From New 1,830 Student High School (in addition to the existing high school traffic):	268 (209 NB & 59 SB)	129 (40 NB & 89 SB)	-133 (-123 NB & -10 SB)	-14 (-4 NB & -10 SB)
Traffic From New 650 Student Middle School	119 (53 NB & 66 SB)	140 (65 NB & 75 SB)	87 (53 NB & 34 SB)	31 (8 NB & 23 SB)
Total Traffic Volume	1,674 (866 NB & 808 SB)	2,022 (761 NB & 1,261 SB)	1,177 (477 NB & 700 SB)	937 (336 NB & 601 SB)
Change From Existing	+484, or +41% (+288 NB & +196 SB)	+387, or +24% (+129 NB & +258 SB)	+1, or +0% (-49 NB & +50 SB)	+53, or +6% (+17 NB & +36 SB)
<b>Net Difference (from Bryant Associates to Waltham Traffic Engineering)</b>	+217 (+169 NB & +48 SB)	+64 (+29 NB & +35 SB)	-231 (-174 NB & - 57 SB)	-49 (-17 NB & -32 SB)



In general, my opinion is that Bryant Associates assigned too much high school traffic to use Woodcliff Drive/Jacks Way. Their projection is that traffic on Lexington Street south of the proposed driveway will increase by 22% over existing traffic. My projection is that traffic on Lexington Street south of the proposed driveway will increase by 41% over existing traffic. The principal reason for the discrepancy is Bryant Associates' assumption that 40% of the high school traffic will be using Woodcliff Drive/Jacks Way, while I expect about 15% of the high school traffic to use that route.

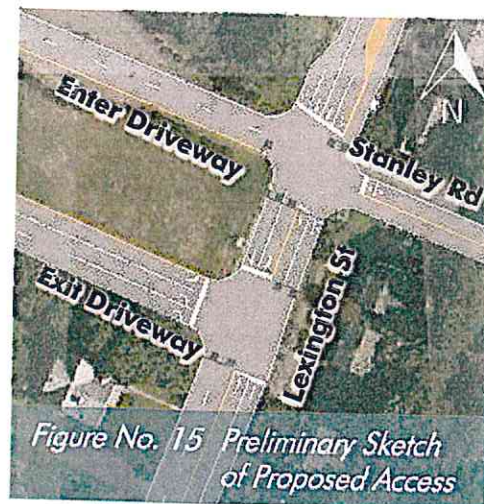
### Expected Traffic Operations

The September traffic study by Bryant Associates projected how the study intersections will operate with the new high school in place, and with a traffic signal at the high school driveway on Lexington Street. The study also assumes that the improvements to Piety Corner (Lexington St/Totten Pond Rd/Bacon St) are complete by the time the new high school opens. Lastly, the traffic study assumes widening Woodcliff Drive (to provide a separate left turn lane and right turn lane) and

The projected AM peak hour Levels of Service at each study intersection, given the assumptions in the Bryant Associates study, are as follows:

1. Lexington Street/Stanley Road/Future High School Driveways

The proposal is to provide a separate entrance driveway and exit driveway (see figure below), with two interconnected traffic signals.



**BRYANT ASSOCIATES**



Bryant Associates ran the capacity analysis for the AM peak hour, and based on their assumptions, the entrance driveway will operate at Level of Service E, with the southbound traffic experiencing the longest delays. The exit driveway will operate at Level of Service C, with the high school exit experiencing the longest delays.

The Bryant Associates analysis shows a Level of Service F for the left turns into the high school, with a volume 54% greater than the capacity for this turn – even with the new traffic signals. However, as detailed above, my projections show the traffic volume for these left turns being 169 vehicles greater than what Bryant Associates calculated. In my opinion, this left turn will experience very long delays, with queues extending well south of the high school, potentially spilling into the Lexington Street/Lincoln Street intersection.

I do have concerns about the two separate signals for the new high school driveways. By operating with two signals, with a couple hundred feet in between, this introduces additional delay as the stored vehicles in between the signals are processed. There is more chance that vehicles will block the intersection, especially during the morning rush hour when the bulk of the traffic arrives. In my opinion, the traffic would work more efficiently if the access and egress were consolidated into one traffic signal.

2. Lexington Street/Jacks Way (existing entrance to high school)

The capacity analysis from the traffic study indicates that the intersection of Lexington Street/Jacks Way will operate at Level of Service A with the new high school and middle school. Although I project more traffic on Lexington Street, I agree that this signal will operate well.

3. Lexington Street/Existing High School Egress

The capacity analysis from the traffic study indicates that the intersection of Lexington Street/High School Egress will operate at Level of Service D with the new high school and middle school, with signal timings adjusted. The egress road will experience the longest delays.

My analysis shows fewer vehicles using this egress road, since I only assume 15% of the high school traffic using Woodcliff Drive, rather than 40%. So I would expect this signal to operate better than shown in the report.



4. Lexington Street/Lake Street/Bishops Forest Drive

With traffic signal timing adjustments, the study projects that the Lexington Street/Lake Street intersection will operate at Level of Service F during the morning peak hour, with Lake Street and southbound traffic experiencing the longest delays.

5. Lexington Street/Totten Pond Road/Bacon Street (Piety Corner)

The capacity analysis in the traffic study indicates that, even with the reconstruction of the intersection, Piety Corner will become a Level of Service F with the new high school and middle school traffic added. Very long delays are forecast for each approach.

In my opinion, the operations will be even worse than forecast, since I do not agree with the assumption that 40% of the high school traffic will use Woodcliff Drive. More traffic will be added to the intersection than assumed in the study. Queues will extend in each direction, possibly causing gridlock along Lexington Street between this intersection and the new high school.

6. Forest Street/Woodcliff Drive

The traffic study suggests that widening Woodcliff Drive to allow for a separate left turn lane and right turn lane is recommended. With that widening, the intersection is projected to operate at Level of Service F.

However, I believe the traffic study overstates how many vehicles will be on Woodcliff Drive. I do not expect such poor operation of this intersection with the proposed high school and middle school. I do not recommend a widening of Woodcliff Drive.



### Summary

Since the June draft traffic study, two changes have been incorporated, each of which will mitigate the traffic impacts along the Lexington Street corridor:

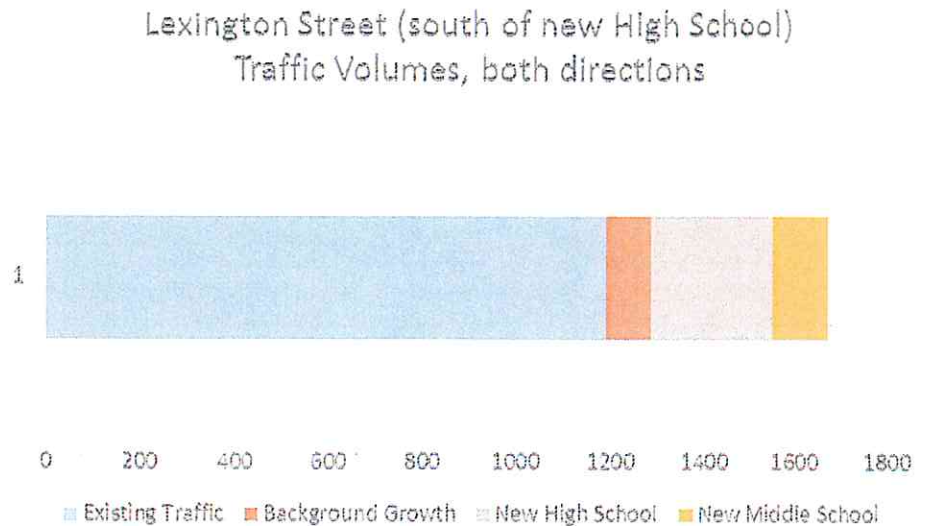
1. The access drive between Woodcliff Drive and Jacks Way will remain open, even with the new high school relocated to 554 Lexington Street.
2. Instead of a K-8 school proposed for the existing high school building, the revised proposal is for a middle school only, which will reduce the amount of traffic generated.

Bryant Associates has revised the traffic study to reflect these changes. Although I agree with the calculated trip generation numbers presented in the study, I disagree with the trip assignments (which routes the traffic will take to and from the school).

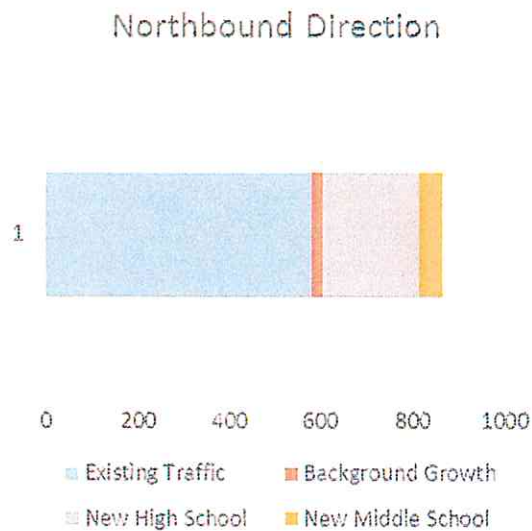
Namely, Bryant Associates assumes that 40 percent of the traffic for the new high school will utilize the access road by way of Woodcliff Drive. The traffic counts we conducted for the existing school indicate that 33% of today's high school traffic uses the access road. By moving the location of the high school further away from Woodcliff Drive, it only makes sense that the percentage of the new high school traffic that will use this route will be lower than today's 33 percent. Based on my assumptions, I forecast that about 15 percent of the new high school traffic will use Woodcliff Drive and the access road, as opposed to 40 percent.



The graph below shows the extent of the projected increase in traffic on Lexington Street, between Lincoln Street and the new high school, in the AM peak hour:



When looking at only traffic in the northbound direction at this location, the graph looks like this:



As shown, we can expect significant increases in traffic volumes on Lexington Street. In the combination of both directions, traffic volumes are expected to be 41% higher than today's traffic volumes. In just the northbound direction on Lexington Street, traffic volumes are expected to be 50% higher than today's traffic volumes.

For each of the 180 days of the school year, there is a good chance of gridlock (even worse than today) on Lexington Street in the AM peak hour (7:00 – 8:00).



Construction traffic impacts indicate that the initial site clearing will take about 12 months, with 70 fifty-ton trucks per day (about seven trucks per hour) hauling material from the site. Once the site is cleared, the remainder of the construction of the building, which will require fewer large trucks, will take about 36 months.

**RECOMMENDATION:** Traffic Commission has no required obligation for this project, since it does not involve a Special Permit.

I recommend that any reservations that Traffic Commission has, regarding the traffic related to this proposal for a new high school and middle school, be communicated to the City as a whole.

In my view, the reservations should boil down to the fact that without a second access drive, a high school at the proposed location will significantly increase traffic on Lexington Street, to a point where it is likely the existing street can not accommodate the increased traffic.

Another recommendation is for the architect to reconsider having two traffic signals for the high school (one for entering traffic and one for exiting traffic). In my view, this will only add to the delays and congestion to be expected here. From a traffic flow perspective, a single traffic signal work work better.