SECTION 10

TRAFFIC IMPACT ASSESSMENT

MEMORANDUM

TO: Mr. Victor L.H. Sheen
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Brookline, MA 0244

FROM: Mr. Jeffrey S. Dirk, P.E., PTOE, FITE
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DATE: July 23, 2018

RE: 7971

SUBJECT: Proposed Mixed-Use Development
445 Harvard Street
Brookline, Massachusetts

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in support of the proposed mixed-use development to be located at 445 Harvard Street in Brookline, Massachusetts (hereafter referred to as the "Project"). This assessment provides an existing conditions context for the Project with regard to its interface with the transportation infrastructure and includes: i) traffic volume projections for the Project; ii) an assessment of potential impacts; iii) a review of lines of sight at the proposed driveway; and iv) recommendations with regard to the design and operation of the driveway that will serve the Project.

Based on this evaluation, we have determined that the Project will represent an overall reduction in traffic over the current use that occupies the Project site (gasoline/service station) and, as such, the Project would not result in a material impact (increase) on motorist delays or vehicle queuing over existing conditions. Further, lines of sight to and from the Project site driveway intersection with Thorndike Street exceed or can be made to exceed the recommended minimum distances for safe operation based on the appropriate speed of traffic approaching the driveway and with consideration of the urban environment in which the Project is located. Accordingly, we have concluded that the transportation infrastructure affords sufficient capacity to accommodate the Project in a safe manner.

The following details our assessment of the Project.

PROJECT DESCRIPTION AND EXISTING CONDITIONS CONTEXT

Project Description

The Project will entail the construction of a five-story, 25-unit, multi-family residential community with 4,380± square foot (sf) of ground-floor commercial space to be located at 445 Harvard Street in Brookline, Massachusetts. The Project site encompasses approximately 0.23 ± acres of land that is situated on the southeast corner of the intersection of Harvard Street at Thorndike Street and is currently occupied by a gasoline/service station with associated appurtenances that will be removed to accommodate the Project. Access to the Project site will be provided by way of a new driveway that will

intersect the south side of Thorndike Street approximately 90 feet east of Harvard Street. The existing driveways that serve the Project site on both Harvard Street and Thorndike Street that are proximate to the Harvard Street/Thorndike Street intersection will be closed in conjunction with the Project thereby improving both traffic operations and safety. On-site parking will be provided for 20 vehicles in a below-grade parking garage, with one (1) short-term parking space to be provided adjacent to the car elevator.

Existing Conditions Context

The following provides an existing conditions context for Harvard Street and Thorndike Street in the vicinity of the Project site:

Harvard Street:

- Two-lane, urban principal arterial roadway that is under Town jurisdiction
- Provides two 12-foot wide travel lanes per direction that are separated by a double-yellow centerline with marked bicycle lanes and metered, on-street parking provided where not otherwise prohibited
- Additional travel lanes are provided at major intersections
- Sidewalks are provided along both sides of the roadway
- A posted speed limit is not provided; statutory speed limit is 25 miles per hour (mph)[1] excepting within the school zone for the Kehillath Israel Nursery School where the speed limit is 20 mph when school is in session

Thorndike Street:

- Two-lane urban collector roadway that is under Town jurisdiction
- Provides a 24-foot wide traveled-way that accommodates two-way travel with no marked centerline and 2-hour on-street parking along the south side except where otherwise prohibited
- Sidewalks are provided along both sides of the roadway
- While the roadway width is not sufficient width to support bicycle travel in a shared traveled-way configuration,[2] the roadway can function as a shared-use facility given the relatively low traffic volumes
- A posted speed limit is not provided; statutory speed limit is 25 mph
- Forms a four-legged intersection with Harvard Street that is under STOP-sign control with marked crosswalks for crossing all legs of the intersection

Motor Vehicle Crash Data

A review of motor vehicle crash data provided by the Massachusetts Department of Transportation (MassDOT) Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2011 through 2015, inclusive) indicated that a total of six (6) motor vehicle crashes were

[1] In April 2018, the Town of Brookline adopted a town-wide statutory speed limit of 25 mph pursuant to MGL c. 90 § 17C on roadways in a thickly settled or business district without a speed regulation established pursuant to MGL c. 90 § 18.

[2] A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.

reported to have occurred at or in the vicinity of the Harvard Street/Thorndike Street intersection over the five-year review period, or an average of approximately one (1) crash per year. Of the six (6) crashes, four (4) involved pedestrians and two (2) involved bicyclists, and the crashes were evenly divided between property damage and personal injury. Improvements are planned for the Harvard Street/Thorndike Street intersection in conjunction with the redevelopment project at 455 Harvard Street that include: i) the installation of curbline extensions (bump-outs) on the corners of the intersection to reduce pedestrian crossing distances and improve sight lines to/from pedestrians waiting to cross the intersection; and ii) enhanced signs and pavement markings at and approaching the intersection.

Public Transportation Services

Public transportation services are provided along Harvard Street by the Massachusetts Bay Transportation Authority (MBTA) by way of Route 66, *Harvard Square – Dudley Station*, which provides service between Harvard Square and Dudley Square, with connections to the Red Line (Harvard Station), the Green Line ("B", "C", "D" and "E" branches at Harvard Avenue, Coolidge Corner, Brookline Village and Brigham Circle, respectively), the Silver Line (Dudley Square Station) and other MBTA bus routes. The closest bus stop to the Project site for the Route 66 bus is located at the Harvard Street/Coolidge Street intersection, which is within a 1-minute walking distance.

PROJECT-GENERATED TRAFFIC

In order to determine the traffic characteristics of the Project, trip-generation methodologies established by the Institute of Transportation Engineers (ITE)[3] were used. The ITE provides trip-generation information for various types of land uses developed as a result of scientific studies that have been conducted over the past 50 plus years, the most recent update of which was published in September 2017. As proposed, the Project will entail the removal of an existing gasoline/service station and the construction of a five-story, 25-unit, multi-family residential community with 4,380± sf of ground-floor commercial space. Based on the defined characteristics of the Project and a review of the ITE trip-generation database, ITE Land Use Codes (LUC) 221, *Multifamily Housing (Mid-Rise)*, and 820, *Shopping Center*, were determined to be the most appropriate land use to develop the traffic characteristics of the Project.

Table 1 summarizes the trip-generation calculations for the Project using the above methodology and compares the traffic volumes to those of the existing gasoline/service station that occupies the Project site.

[3] *Trip Generation*, 10th Edition; Institute of Transportation Engineers; Washington, DC; 2017.

Table 1
TRIP GENERATION SUMMARY AND COMPARISON
PROPOSED MIXED-USE DEVELOPMENT

Time Period/Direction	Vehicle Trips (A) Proposed Mixed-Use Development[a]	(B) Existing Gasoline/ Service Station[b]	(A – B) Difference
Average Weekday Daily:			
Entering	151	344	
Exiting	151	344	
Total	302	688	-386
Weekday Morning Peak Hour:			
Entering	4	21	
Exiting	9	21	
Total	13	42	-29
Weekday Evening Peak Hour:			
Entering	15	28	
Exiting	14	28	
Total	29	56	-27

[a]Based on ITE LUCs 221, *Multifamily Housing (Mid-Rise) (25 units)*, and 820, *Shopping Center* (4,380± sf and using the average trip rate).
[b]Based on ITE LUC 944, *Gasoline/Service Station* (4 vehicle fueling positions).

Project-Generated Traffic Summary

As can be seen in Table 1, without adjustment to account for the use of public transportation and pedestrian/bicycle trips, the Project is expected to generate approximately 302 vehicle trips on an average weekday (two-way, 24-hour volume, or 151 vehicles entering and 151 exiting), with 13 vehicle trips (4 vehicles entering and 9 exiting) expected during the weekday morning peak-hour and 29 vehicle trips (15 vehicles entering and 14 exiting) expected during the weekday evening peak-hour.

In comparison to the existing gasoline/service station that occupies the Project site, the Project is expected to result in 386 fewer vehicle trips on an average weekday (an approximate 56 percent reduction), with 29 fewer vehicle trips expected during the weekday morning peak-hour (an approximate 69 percent reduction) and 27 fewer vehicle trips expected during the weekday evening peak-hour (an approximate 48 percent reduction). Accordingly and with consideration of the use of public transportation and pedestrian/bicycle trips, it can be concluded that ***the Project represents a significant reduction in traffic over the current use of the property and, as such, would not result in a material impact (increase) in motorist delays or vehicle queuing over existing conditions.***

SIGHT DISTANCE ASSESSMENT

Sight distance measurements were performed at the Project site driveway intersection with Thorndike Street in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[4] requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 2 presents the measured SSD and ISD at the subject intersection.

Table 2
SIGHT DISTANCE MEASUREMENTS[a]

	Feet		
Intersection/Sight Distance Measurement	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Thorndike Street at the Project Site Driveway			
Stopping Sight Distance:			
Thorndike Street approaching from the east	155	--	392
Thorndike Street approaching from the west	80	--	90+[c]
Intersection Sight Distance:			
Looking to the east from the Project Site Driveway	155	240/280	36/175[d]
Looking to the west from the Project Site Driveway	80	145/170	29/90[d]

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2011; and based on a 25 mph speed on Thorndike Street approaching from the east (westbound) and 15 mph approaching from the west (eastbound).
[b]Values shown are the intersection sight distance for a vehicle turning right/left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.
[c]Clear line of sight is provided to/from Harvard Street.
[d]With the removal of on-street parking adjacent to the driveway.

As can be seen in Table 2, the available lines of sight at the Project site driveway intersection with Thorndike Street were found to exceed or could be made to exceed the recommended minimum sight distances to function in a safe manner (SSD) based on the appropriate approach speed along Thorndike Street with consideration of the reduce travel speed of vehicles transitioning from Harvard Street to Thorndike Street and the urban environment in which the Project site is located. Specifically, motorists exiting the Project site driveway will: i) look for pedestrians that may be crossing the driveway within the sidewalk area; ii) proceed to enter the sidewalk area when clear of pedestrians; and iii) look for an approaching vehicle on Thorndike Street; before entering the traveled-way.

[4]*A Policy on Geometric Design of Highway and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2011.

SUMMARY

VAI has prepared a TIA in support of the proposed mixed-use development to be located at 445 Harvard Street in Brookline, Massachusetts. This assessment has provided an existing conditions context for the Project with regard to its interface with the transportation infrastructure and included: i) traffic volume projections for the Project; ii) an assessment of potential impacts; iii) a review of lines of sight at the proposed driveway; and iv) recommendations with regard to the design and operation of the driveway that will serve the Project, a discussion of which follows.

Based on this evaluation, we have determined that the Project will represent an overall reduction in traffic over the current use that occupies the Project site (gasoline/service station) and, as such, the Project would not result in a material impact (increase) on motorist delays or vehicle queuing over existing conditions. Further, lines of sight to and from the Project site driveway intersection with Thorndike Street exceed or can be made to exceed the recommended minimum distances for safe operation based on the appropriate speed of traffic approaching the driveway and with consideration of the urban environment in which the Project is located. Accordingly, we have concluded that the transportation infrastructure affords sufficient capacity to accommodate the Project in a safe manner. This conclusion is predicated on implementation of the following specific recommendations that should be advanced as a part of the Project:

1. The Project site driveway should be a minimum of 20-feet in width or as required to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle as defined by the Brookline Fire Department to the extent that emergency vehicles will be entering the driveway.

2. Vehicles exiting the Project site should be placed under STOP-sign control with marked STOP-lines provided.

3. All signs and pavement markings to be installed within the Project site shall conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[5]

4. On-street parking adjacent to the Project site driveway should be prohibited within 20-feet of the driveway.

5. Consideration should be given to designating a portion of the curbside area along the Project site frontage on Thorndike Street as a short-term loading zone for deliveries, tenant moves and resident drop-off/pick-up.

6. The existing stockade fence along the east property line should be removed or modified as it approaches Thorndike Street (approximately 4-feet of the last section of fencing) to improve lines of sight exiting the driveway.

7. Signs and landscape features to be installed within the site triangle areas of the Project site driveway shall be designed and maintained so as not to restrict lines of sight.

8. Snow windrows along the Project site frontage within the sight triangle areas of the Project site driveway shall be promptly removed where such accumulations would inhibit sight lines.

[5] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

In addition, a comprehensive Transportation Demand Management (TDM) program should be an integral part of the Project that would include the following measures to encourage the use of alternative modes of transportation to single-occupant vehicles:

- The owner or property manager should contact MassRIDES to obtain information on facilitating and encouraging healthy transportation options for residents and employees of the Project, and should become a MassRIDES employer partner;

- Information regarding public transportation services, maps, schedules and fare information should be posted in a central location and/or otherwise made available to residents and employees of the Project;

- A "welcome packet" should be provided to new residents and employees detailing available public transportation services, bicycle and walking alternatives, and commuter options available through MassRIDES' and their NuRide program which rewards individuals that choose to walk, bicycle, carpool, vanpool or that use public transportation to travel to and from work;

- Residents and employees should be made aware of the Emergency Ride Home (ERH) program available through MassRIDES, which reimburses employees of a participating MassRIDES employer partner worksite that is registered for ERH and that carpool, take transit, bicycle, walk or vanpool to work;

- Pedestrian accommodations should be incorporated within the Project site consisting of connections between the proposed building and the sidewalks along both Harvard Street and Thorndike Street;

- The Project site driveway should be constructed as a "pan-type" driveway such that the sidewalk continues across driveway at the same elevation (i.e., wheelchair ramps are not required to cross the driveway);

- A mail drop should be provided in a central location; and

- Secure bicycle parking should be provided consisting of weather protected bicycle parking located in a secure area within the building and an exterior bicycle rack conveniently located for patrons and visitors.

With implementation of the above recommendations, safe and efficient vehicular, pedestrian and bicycle access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

cc: File