Memorandum

To: Mr. Giancarlo Micozzi
Micozzi Management, Inc.
159 Cambridge Street
Arlington, MA 02134

Date: October 10, 2017

Project #: 14019.00

From: Randall C. Hart, Principal
Kathleen Keen, EIT

Re: Proposed Langley Road Redevelopment
Newton, Massachusetts

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## Introduction

VHB, Inc. has conducted a traffic impact and access study to assess the potential traffic impacts associated with the proposed redevelopment located at 392-404 Langley Road in Newton, Massachusetts. The proposed redevelopment Project will involve the demolition of one existing building and the construction of an approximately 20-unit residential building, supported by sub-surface parking.

This memorandum includes an evaluation of the existing traffic operations and safety; assessment of future conditions without the Project; an estimate of projected traffic volumes for the Project; and its potential impact on future traffic operations in the area. As detailed herein, the proposed Project is expected to have a minor impact on local traffic operations.

## Site Location and Proposed Development

The Project site is located at 392-404 Langley Road in Newton, Massachusetts. The site currently consists of four buildings accessed by three full-access driveways along Langley Road. The proposed redevelopment Project will involve the demolition of one existing building, located at 400 Langley Road, and the construction of an approximately 20-unit residential building with sub-surface parking, that will replace one existing building on-Site. The three other existing buildings will remain. As part of the Project, the existing full-access driveway to 400 Langley Road will be closed, and the two other existing driveways will remain. A conceptual site plan is included in the Attachments.

## Existing Conditions

The following sections provide a description of the existing roadway network, roadway/intersection geometry, traffic control, existing daily and peak hour traffic volumes, and traffic safety conditions.

### Study Area

The Project Site is located along Langley Road, which is described below.

- **Langley Road** is a north-south urban collector under City of Newton jurisdiction in the vicinity of the Site. Langley Road is a two-lane, undivided roadway with a posted speed limit of 25 miles per hour (mph). There are sidewalks along both sides of the roadway. Within the vicinity of the Site, on-street parking is allowed along the east side of Langley Road and no parking is allowed along the west side of Langley Road. The on-street parking along the east side of Langley Road is limited to two-hour parking from 7:00 AM to 7:00 PM, except weekends

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and holidays, south of the 392-396 Langley Road driveway, and to 15-minute parking from 6:00 AM to 9:00 PM north of the 392-396 Langley Road driveway. Land use consists of a mix of residential and commercial uses within the vicinity of the Site.

For the purposes of evaluating existing and future traffic conditions in the vicinity of the Site, a Project study area has been established and includes the following five intersections.

- Langley Road at John Street
- Langley Road at 392-396 Langley Road driveway
- Langley Road at 400 Langley Road driveway
- Langley Road at Jackson Street
- Langley Road at Route 9 (Boylston Street)

A figure showing the intersection lane geometry and traffic control at each study area intersection is included in the Attachments.

**Traffic Volumes**

To assess the existing operational conditions at study area intersections, automatic traffic recorder (ATR) counts were conducted from Tuesday, September 19, 2017 through Wednesday, September 20, 2017 along Langley Road in the vicinity of the Site. The average weekday traffic volume data are summarized below in Table 1 and the existing count data is included in the Attachments.

## Table 1 Existing Traffic Volume Summary

| | Weekday Daily | Weekday Morning Peak Hour | | | Weekday Evening Peak Hour | | |
|---|---|---|---|---|---|---|---|
| **Location** | **Vol (vpd) [a]** | **Vol (vph) [b]** | **K Factor [c]** | **Dir. Dist.** | **Vol (vph)** | **K Factor** | **Dir. Dist.** |
| Langley Road south of John Street | 6,200 | 505 | 8.1% | 53% SB | 500 | 8.0% | 58% SB |

Source Automatic Traffic Recorder (ATR) counts conducted by VHB in September 2017.
a Daily traffic expressed in vehicles per day.
b Peak hour volumes expressed in vehicles per hour.
c Percent of daily traffic, which occurs during the peak hour.

As shown in Table 1, Langley Road carries approximately 6,200 vehicles per day on a typical weekday, with 8.1-percent during the morning peak hour and 8.0-percent during the evening peak hour. Langley Road traffic is slightly heavier in the southbound direction during both peak hours.

In addition, peak hour turning movement counts (TMCs) were conducted concurrent with the ATR counts at the study area intersections in September 2017 during the weekday morning peak period from 7:00 AM to 9:00 AM and weekday evening peak period from 4:00 PM to 6:00 PM. Based on a review of the count data, the weekday morning

and weekday evening peak hours of vehicular activity were determined to be 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM, respectively. The traffic volume counts are provided in the Attachments.

## Seasonal Variation

The peak hour traffic data collected for the Project was obtained during the month of September. To quantify the seasonal variation of traffic volumes in the area, historic traffic data available from MassDOT were reviewed. According to published MassDOT weekday seasonal factors, September traffic counts are generally higher than average month conditions. To present a conservative analysis, the traffic volumes were not reduced to reflect average month conditions. The 2017 Existing peak hour traffic volume networks are provided in the Attachments.

**Crash Summary**

To identify potential vehicle crash trends in the study area, vehicular crash data for the study area intersections were obtained from Massachusetts Department of Transportation (MassDOT) for the most recent five-year period available, 2010 through 2014. A summary of the MassDOT vehicular crash history is provided in Table 2 and the detailed crash data is provided in the Attachments.

The current MassDOT average crash rates for signalized and unsignalized intersections in District 6 (the MassDOT district for Newton) are 0.70 crashes per million entering vehicles and 0.53 crashes per million entering vehicles, respectively. In other words, on average, 0.70 crashes occurred per million vehicles entering signalized intersections, and 0.53 crashes occurred per million vehicles entering unsignalized intersections throughout District 6. The crash rate worksheets are included in the Attachments.

As shown in Table 2, none of the study area intersections had calculated crash rates above the MassDOT District 6 average crash rates. The majority of crashes that occurred at the study area intersections were rear-end collisions resulting in property damage only. None of the crashes resulted in fatal injuries. Crashes involving non-motorists (bike, pedestrian) occurred at the intersections of Langley Road at Jackson Street (one crash) and Langley Road at Route 9 (one crash).

## Table 2 Vehicular Crash Data (2010 - 2014)

| | Langley Road at John Street | Langley Road at 392-396 Langley Road | Langley Road at 400 Langley Road | Langley Road at Jackson Street | Langley Road at Route 9 |
|---|---|---|---|---|---|
| Signalized? | No | No | No | No | Yes |
| MassDOT Average Crash Rate | 0.53 | 0.53 | 0.53 | 0.53 | 0.70 |
| Calculated Crash Rate | 0.10 | 0.20 | 0.00 | 0.37 | 0.37 |
| Exceeds Average Crash Rate? | No | No | No | No | No |
| **Year** | | | | | |
| 2010 | 1 | 0 | 0 | 1 | 6 |
| 2011 | 0 | 0 | 0 | 1 | 1 |
| 2012 | 0 | 1 | 0 | 1 | 4 |
| 2013 | 0 | 1 | 0 | 1 | 8 |
| 2014 | 0 | 0 | 0 | 1 | 6 |
| Total | 1 | 2 | 0 | 5 | 25 |
| Average | 0.20 | 0.40 | 0.00 | 1.00 | 5.00 |
| **Collision Type** | | | | | |
| Angle | 0 | 1 | 0 | 1 | 2 |
| Rear-end | 1 | 0 | 0 | 1 | 15 |
| Sideswipe, same direction | 0 | 0 | 0 | 2 | 7 |
| Single vehicle crash | 0 | 1 | 0 | 1 | 1 |
| **Crash Severity** | | | | | |
| Fatal injury | 0 | 0 | 0 | 0 | 0 |
| Non-fatal injury | 0 | 0 | 0 | 1 | 6 |
| Property damage only (none injured) | 0 | 2 | 0 | 2 | 19 |
| Not Reported | 1 | 0 | 0 | 2 | 0 |
| **Time of Day** | | | | | |
| Weekday, 7:00 AM - 9:00 AM | 0 | 0 | 0 | 1 | 1 |
| Weekday, 4:00 PM - 6:00 PM | 0 | 0 | 0 | 0 | 3 |
| Saturday, 11:00 AM - 2:00 PM | 0 | 1 | 0 | 0 | 1 |
| Weekday, other time | 0 | 1 | 0 | 4 | 18 |
| Weekend, other time | 1 | 0 | 0 | 0 | 2 |
| **Pavement Conditions** | | | | | |
| Dry | 1 | 2 | 0 | 4 | 20 |
| Wet | 0 | 0 | 0 | 1 | 5 |
| Ice | 0 | 0 | 0 | 1 | 0 |
| **Non-Motorist (Bike, Pedestrian)** | 0 | 0 | 0 | 1 | 1 |

Source: MassDOT vehicle crash data, accessed October 2017.

**Sight Distance**

A sight distance analysis, in conformance with guidelines of the American Association of State Highway and Transportation Officials (AASHTO) was performed at the unsignalized intersection of Langley Road at the 392-396 Langley Road driveway. Sight distance considerations are generally divided into two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD). Stopping Sight Distance (SSD) is the distance required for a vehicle approaching an intersection from either direction to perceive, react and come to a complete stop before colliding with an object in the road, in this case the exiting vehicle from a driveway. In this respect, SSD can be considered as the minimum visibility criterion for the safe operation of an unsignalized intersection.

Intersection Sight Distance (ISD) is based on the time required for perception, reaction and completion of the desired critical exiting maneuver once the driver on a minor street or driveway approach decided to execute the maneuver. Calculation for the critical ISD includes the time to (1) turn left, and to clear the half of the intersection without conflicting with the vehicles approaching from the left; and (2) accelerate to the operating speed of the roadway without causing approaching vehicles to unduly reduce their speed. In this context, ISD can be considered as a desirable visibility criterion for the safe operation of an unsignalized intersection. Essentially, while SSD is the minimum distance needed to avoid collisions, ISD is the minimum distance needed so that mainline motorists will not have to substantially reduce their speed due to turning vehicles. To maintain the safe operation of an unsignalized intersection, ISD only needs to be equal to the stopping sight distance, though it is desirable to meet ISD requirements by themselves.

To calculate the required SSD and ISD at the unsignalized intersection of Langley Road and 392-396 Langley Road driveway the 85$^{th}$ percentile speed measured by the ATR count described above was utilized. The 85$^{th}$ percentile speed along Langley Road was observed to be 29 mph northbound and 31 mph southbound. The posted speed limit along Langley Road is 25 mph in both the directions. Table 3 summarizes the sight distance analysis and the sight distance worksheets are included in the Attachments.

## Table 3 Sight Distance Analysis Summary

| | Stopping Sight Distance (ft) [a] | | | Intersection Sight Distance (ft) [a] | | |
|---|---|---|---|---|---|---|
| **Location** | **Traveling** | **Required** | **Measured** | **Looking** | **Desired** | **Measured** |
| Langley Road at 392-396 Langley Road Driveway | Northbound | 190 | 280 | Left (south) | 345 | 215 |
| | Southbound | 210 | 270 | Right (north) | 345 | 475 |

a Based on guidelines established in A Policy on the Geometric Design of Highways and Streets, Sixth Edition, American Association of State Highway and Transportation Officials (AASHTO), 2011 for an 85$^{th}$ percentile speed of 29 mph northbound and 31 mph southbound.

As shown in Table 3, at the unsignalized intersection of Langley Road at the 392-396 Langley Road driveway the required stopping sight distance is exceeded in both directions. The desired intersection sight distance is exceeded when looking right (north). The desired intersection sight distance is not met when looking left (south), however the measured intersection sight distance does exceed the required stopping sight distance, which is considered the minimum intersection sight distance.

## Future Conditions

To determine the impacts of the site-generated traffic volumes in the vicinity of the site, future traffic conditions were evaluated. A seven-year horizon (2024) was used for the evaluation consistent with MassDOT TIA requirements.

Traffic growth on area roadways is a function of the expected land development, environmental activity, and changes in demographics. A frequently used procedure is to identify estimated traffic generated by planned developments that would be expected to affect the project study area roadways. An alternative procedure is to estimate an annual percentage increase and apply that increase to study area traffic volumes. For this evaluation, ***both*** procedures were used. The following summarizes this traffic forecasting process.

### Historic Growth

Based on a review of recent studies in the vicinity of the Site and discussions with the City of Newton planning department, a growth rate of one-percent per year was determined to be appropriate for the study.

### Planned Developments

In addition to accounting for background growth, the traffic associated with other planned and/or approved developments near the Site was considered. Based on discussions with the City of Newton, it was determined that there is one in the vicinity of the site that are likely to influence traffic conditions.

- **Chestnut Hill Square:** The project is located at 200 Boylston Street (Route 9) to the east of Langley Road. Phase 2 of the project includes approximately 91 residential units and is expected to begin construction in 2018.

### Background Transportation Projects

In assessing future traffic conditions, proposed roadway improvements within the study area were considered. Based on discussions with the City of Newton, there are no transportation projects that would impact the Project study area within the seven-year horizon.

### No-Build Traffic Volumes

The 2024 No-Build traffic volumes were generated by consideration of the above described factors. The resulting 2024 No-Build peak hour traffic volume networks are provided in the Attachments.

### Trip Generation

The proposed redevelopment Project will involve the construction of an approximately 20-unit residential building that will replace an existing building on-Site. To estimate the site-generated traffic, the Institute of Transportation Engineers' (ITE) publication *Trip Generation, 10th Edition*[1] was utilized. The number of vehicle trips generated by the proposed project were estimated based on ITE land use code (LUC) 221 (Mid-Rise Residential). Table 4 provides a trip generation summary and the worksheet is included in the Attachments.

[1] *Trip Generation Manual, 10th Edition*, Institute of Transportation Engineers, Washington D.C., 2017.

## Table 4 Trip Generation Summary

| Time Period | Direction | New Residential Trips [a] |
|---|---|---|
| Weekday Daily | Enter | 54 |
| | Exit | 54 |
| | Total | 108 |
| Weekday Morning | Enter | 2 |
| | Exit | 5 |
| | Total | 7 |
| Weekday Evening | Enter | 6 |
| | Exit | 4 |
| | Total | 10 |

a Trip generation estimate based on ITE LUC 221 (Mid-Rise Residential) for 20 units

As shown in Table 4, the proposed Project is expected to increase vehicle trips to the site by approximately 7 (2 entering/5 exiting) vehicle trips during the weekday morning peak hour and approximately 10 (6 entering/4 exiting) vehicle trips during the weekday evening peak hour.

### Trip Distribution

The directional distribution of the traffic approaching and departing the Site is a function of population densities, the location of employment opportunities, existing travel patterns, and the efficiency of the roadway system. Trips made from and to the Site during the peak hours are expected to be predominantly home-to-work and work-to-home trips in the weekday morning and weekday evening peak hours, respectively. Accordingly, the trip distribution for the proposed Project has been derived based on 2010 U.S. Census data. Table 5 summarizes the trip distribution. A figure and detailed trip distribution calculations are provided in the Attachments.

## Table 5 Trip Distribution

| Travel Route | Direction (from/to) | Percent Site Traffic |
|---|---|---|
| Langley Road | north | 49% |
| Route 9 | west | 29% |
| Route 9 | east | 22% |
| Total | | 100% |

### Build Traffic Volumes

The project-related traffic volumes shown in Table 4 are assigned to the study area roadway network based on the trip distribution patterns shown in Table 5 and added to the 2024 No-Build peak hour traffic volume networks to develop the 2024 Build peak hour traffic volume networks. The 2024 Build peak hour traffic volume networks and the Site-generated traffic volume networks are provided in the Attachments.

## Traffic Operations Analysis

To assess quality of flow, intersection capacity analyses were conducted with respect to 2017 Existing, 2024 No-Build, and 2024 Build traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels-of-service.

The evaluation criteria used to analyze the signalized study area intersection in this traffic study is based on the percentile-delay method (SYNCHRO results). The evaluation criteria used to analyze the unsignalized study area intersections is based on the *2010 Highway Capacity Manual* (HCM)[2]. Level–of-service (LOS) is the term used to denote the different operating conditions that occur on a given roadway segment under various traffic volume loads. It is a qualitative measure that considers a number of factors including roadway geometry, speed, travel delay, freedom to maneuver, and safety. Level-of-service provides an index to operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

### Intersection Capacity Analysis

Levels-of-service analyses were conducted for the 2017 Existing, 2024 No-Build, and 2024 Build conditions for the study area intersections. Tables 6 and 7 summarize the capacity analysis results for the signalized and unsignalized study area intersections, respectively. The capacity analyses worksheets are included in the Attachments.

As shown in Tables 6 and 7, the Project is expected to have minimal impacts on traffic operations at the study area intersections. No changes to overall or individual movement level-of-service are expected between 2024 No-Build and 2024 Build conditions during both peak hours.

2 Highway Capacity Manual, Transportation Research Board, Washington D.C., 2010.

## Table 6 Signalized Intersection Capacity Analysis

| Location / Movement | 2017 Existing Conditions | | | | | 2024 No-Build Conditions | | | | | 2024 Build Conditions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | v/c [a] | Del [b] | LOS [c] | 50 Q [d] | 95 Q [e] | v/c | Del | LOS | 50 Q | 95 Q | v/c | Del | LOS | 50 Q | 95 Q |
| **Langley Road at Route 9 (Boylston Street)** | | | | | | | | | | | | | | | |
| *Weekday Morning* | | | | | | | | | | | | | | | |
| EB T/R | 0.59 | 12 | B | 79 | #330 | 0.67 | 13 | B | 94 | #400 | 0.67 | 13 | B | 94 | #401 |
| WB T | 0.62 | 12 | B | 84 | #357 | 0.72 | 14 | B | 105 | #447 | 0.72 | 14 | B | 105 | #448 |
| SB L | 0.44 | 23 | C | 34 | 105 | 0.45 | 23 | C | 35 | 113 | 0.45 | 23 | C | 35 | 115 |
| SB L/T | 0.44 | 23 | C | 34 | 105 | 0.45 | 23 | C | 35 | 113 | 0.45 | 23 | C | 35 | 114 |
| SB R | 0.24 | 7 | A | 0 | 30 | 0.23 | 7 | A | 0 | 34 | 0.23 | 7 | A | 0 | 33 |
| **Overall** | | **13** | **B** | | | | **14** | **B** | | | | **14** | **B** | | |
| *Weekday Evening* | | | | | | | | | | | | | | | |
| EB T/R | 0.48 | 10 | B | 58 | 231 | 0.56 | 12 | B | 73 | 282 | 0.56 | 12 | B | 73 | 282 |
| WB T | 0.63 | 13 | B | 86 | #372 | 0.73 | 15 | B | 110 | #475 | 0.73 | 15 | B | 110 | #475 |
| SB L | 0.44 | 23 | C | 34 | 112 | 0.45 | 23 | C | 37 | 117 | 0.45 | 23 | C | 37 | 117 |
| SB L/T | 0.44 | 23 | C | 35 | 113 | 0.46 | 23 | C | 37 | 120 | 0.46 | 23 | C | 37 | 120 |
| SB R | 0.29 | 7 | A | 0 | 38 | 0.30 | 7 | A | 0 | 39 | 0.30 | 7 | A | 0 | 39 |
| **Overall** | | **12** | **B** | | | | **14** | **B** | | | | **14** | **B** | | |

a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, in feet.
# 95th percentile volume exceeds capacity, queue may be longer.

**Table 7 Unsignalized Intersection Capacity Analysis**

| Location / Movement | 2017 Existing Conditions | | | | | 2024 No-Build Conditions | | | | | 2024 Build Conditions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D [a] | v/c [b] | Del [c] | LOS [d] | 95 Q [e] | D | v/c | Del | LOS | 95 Q | D | v/c | Del | LOS | 95 Q |
| **Langley Road at John Street** | | | | | | | | | | | | | | | |
| *Weekday Morning* | | | | | | | | | | | | | | | |
| WB L/R | 5 | 0.02 | 13 | B | 3 | 5 | 0.01 | 13 | B | 0 | 5 | 0.01 | 13 | B | 0 |
| SB L | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 |
| *Weekday Evening* | | | | | | | | | | | | | | | |
| WB L/R | 5 | 0.03 | 12 | B | 3 | 5 | 0.01 | 12 | B | 0 | 5 | 0.01 | 12 | B | 0 |
| SB L | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 |
| **Langley Road at 392-396 Langley Road Driveway** | | | | | | | | | | | | | | | |
| *Weekday Morning* | | | | | | | | | | | | | | | |
| WB L/R | 5 | 0.03 | 13 | B | 3 | 5 | 0.01 | 13 | B | 0 | 10 | 0.03 | 13 | B | 3 |
| SB L | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 |
| *Weekday Evening* | | | | | | | | | | | | | | | |
| WB L/R | 10 | 0.03 | 11 | B | 3 | 10 | 0.02 | 11 | B | 3 | 10 | 0.02 | 11 | B | 3 |
| SB L | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 | 5 | 0.00 | 8 | A | 0 |
| **Langley Road at 400 Langley Road Driveway** | | | | | | | | | | | | | | | |
| *Weekday Morning* | | | | | | | | | | | | | | | |
| WB L/R | neg | 0.01 | 12 | B | 0 | neg | 0.01 | 12 | B | 0 | *Intersection does not exist under 2024 Build conditions* | | | | |
| SB L | neg | 0.00 | 8 | A | 0 | neg | 0.00 | 8 | A | 0 | | | | | |
| *Weekday Evening* | | | | | | | | | | | | | | | |
| WB L/R | neg | 0.01 | 9 | A | 0 | neg | 0.00 | 10 | A | 0 | | | | | |
| SB L | neg | - | 0 | A | 0 | neg | - | 0 | A | 0 | | | | | |
| **Langley Road at Jackson Street** | | | | | | | | | | | | | | | |
| *Weekday Morning* | | | | | | | | | | | | | | | |
| EB L/R | 90 | 0.20 | 14 | B | 18 | 100 | 0.23 | 15 | B | 23 | 100 | 0.23 | 15 | B | 23 |
| WB L/T/R | 260 | 0.32 | 11 | B | 35 | 280 | 0.35 | 11 | B | 40 | 280 | 0.35 | 11 | B | 40 |
| *Weekday Evening* | | | | | | | | | | | | | | | |
| EB L/R | 95 | 0.18 | 13 | B | 18 | 105 | 0.22 | 14 | B | 20 | 105 | 0.22 | 14 | B | 20 |
| WB L/T/R | 275 | 0.37 | 12 | B | 43 | 295 | 0.42 | 13 | B | 53 | 300 | 0.42 | 13 | B | 53 |

a Demand, in vehicles
b Volume to capacity ratio.
c Average total delay, in seconds per vehicle.
d Level-of-service.
e 95th percentile queue, in feet.

## Conclusions

VHB has conducted a traffic impact and access study to assess the potential traffic impacts associated with the proposed redevelopment located at 392-404 Langley Road in Newton, Massachusetts. The proposed redevelopment Project will involve the demolition of one existing building and the construction of an approximately 20-unit residential building, supported by sub-surface parking.

The proposed redevelopment is expected to increase vehicle trips to the site by approximately 7 (2 entering/5 exiting) vehicle trips during the weekday morning peak hour and approximately 10 (6 entering/4 exiting) vehicle trips during the weekday evening peak hour.

Based on the intersection capacity analysis, it was determined that the project will have minimal impact upon intersection operations at the existing study area intersections.