



## Memorandum

To: Kent Gonzales  
Northland Development

Date: March 28, 2019

Project #: 12239.00

From: Randall C. Hart  
Principal

Re: Expanded Revised Building Program  
Traffic Generation Memorandum  
The Northland Newton Development  
Needham Street  
Newton, Massachusetts

Matthew Duranleau, E.I.T.

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Vanasse Hangen Brustlin, Inc. has conducted an expanded analysis of the potential traffic generation involved with the Northland Newton Development on Needham Street in Newton, Massachusetts. A traffic memorandum dated February 12, 2019, was completed that evaluated the change in traffic projections and operations based on the revised building program for the Project. This memorandum expands the traffic generation discussion that was presented in the February 12, 2019 memorandum and includes the expected transit and walk/bike trips to be associated with the revised building program.

The following trip generation discussion follows the format presented in the Transportation Impact and Assessment (TIA) dated October 2018<sup>1</sup> for the Project. The document structure is the same as the trip generation section of the TIA to be consistent with the previous filing and allow for an easy comparison between this memorandum and the TIA, but all tables have been updated based on the revised building program.

### Trip Generation

The rate at which any development generates traffic is dependent upon the size, location, and concentration of surrounding developments. As mentioned in the TIAS, the Project is comprised of office, residential, and retail use. The ITE *Trip Generation Manual*<sup>2</sup> categorizes these land uses and provides weekday daily, weekday morning, weekday evening, Saturday daily, and Saturday midday peak hour unadjusted vehicle trip generation estimates for each use. The trip generation estimates for the proposed uses were projected using Land Use Code (LUC) 221 (Mid-Rise Residential), LUC 710 (General Office Building), and LUC 820 (Shopping Center). The trip generation analyses are presented below.

As discussed in the TIAS, the Project is expected to develop a transportation management plan including a robust shuttle service program that includes direct shuttle bus service to nearby transit stations and to key regional hubs in Cambridge and Boston. The inclusion of the shuttle bus service will alter the mode split for the Project, as it is expected that many residents, patrons, employees and some local residents in proximity to the site will take advantage of the shuttle system instead of driving. The level of use of the shuttle system will take time to materialize, but the expectation is that it will become a valuable and well used service in the area. As the actual use is unknown at this stage, trip generation analyses were conducted under two different scenarios in order to provide a thorough understanding of the trip generation potential; one scenario with a more robust shuttle service and potential usage

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<sup>1</sup> Transportation Impact and Access Study; The Northland Newton Development; Newton, MA; October 2018; Prepared by VHB.

<sup>2</sup> Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, Washington, D.C., 2017.

and one scenario with a less robust shuttle service (existing mode share) and potentially less usage. The results of both scenarios are presented below.

### **Project-Generated Trips**

Estimating future conditions volumes for the Site involved a review of the existing development on those parcels, along with the additional trip generation expected from the Project development.

### **Existing Site-Generated Traffic**

The planned development parcels currently are occupied by a shopping center containing approximately 62,600 sf of general retail space, the former mill building that contains approximately 180,000 sf of office space, and a vacant 257,000 sf manufacturing building. At the time of the traffic counts, it was estimated that the retail space was fully occupied while the office and manufacturing spaces were fully vacant. Based on discussions with Northland, it is understood that the office space could be tenanted without the Project while it is unlikely that the manufacturing space would be tenanted in the future. Based on that information, the potential site trip generation under the existing conditions was estimated using the ITE methodology. Table 1 summarizes the Project-related trips for the existing uses within the Project Site.

**Table 1 Existing Site Trip Generation**

	Retail <sup>a</sup>	Office <sup>b</sup>	Total Unadjusted Trips	Total Net Vehicle Trips <sup>c</sup>	Total Pass-By
<b>Weekday Daily</b>					
Enter	2,186	938	3,124	<b>2,154</b>	475
Exit	<u>2,186</u>	<u>938</u>	<u>3,124</u>	<u>2,154</u>	<u>475</u>
Total	4,372	1,877	6,249	<b>4,297</b>	950
<b>Weekday Morning</b>					
Enter	114	168	282	<b>221</b>	20
Exit	<u>70</u>	<u>27</u>	<u>97</u>	<u>56</u>	<u>20</u>
Total	183	196	379	<b>277</b>	40
<b>Weekday Evening</b>					
Enter	184	32	216	<b>120</b>	56
Exit	<u>200</u>	<u>167</u>	<u>367</u>	<u>248</u>	<u>56</u>
Total	384	199	583	<b>368</b>	112
<b>Saturday Daily</b>					
Enter	3,333	199	3,552	<b>2,380</b>	745
Exit	<u>3,333</u>	<u>199</u>	<u>3,552</u>	<u>2,376</u>	<u>745</u>
Total	6,666	398	7,064	<b>4,756</b>	1,490
<b>Saturday Midday</b>					
Enter	222	52	274	<b>186</b>	49
Exit	<u>205</u>	<u>44</u>	<u>249</u>	<u>163</u>	<u>49</u>
Total	428	95	523	<b>349</b>	98

- a Based on ITE LUC 820 (Shopping Center) for 62,600 sf
- b Based on ITE LUC 710 (General Office Building) for 180,000 sf
- c Net vehicle trips includes credit for internal capture, mode shares, and pass-by trips.

As shown in Table 1, the existing trip generation for the Site is able to take credit for shared trips, mode shares beyond vehicular travel, and pass-by trips. This is due to the availability of public transportation, shared trips within the multiple uses on Site, and the benefits of being located within an area with bicycle and pedestrian accommodations. In addition, a portion of the retail trips visiting the Site under existing conditions are assumed to be pass-by trips drawn from the traffic volume roadways adjacent to the Site, as noted in Table 1. The details of these assumed trip credits are discussed in greater detail later in this section.

**Unadjusted Project-Generated Traffic**

The proposed development will consist of a mixture of residential, office, and supporting retail uses. Specifically, the Site is proposed to include 800 residential units, 180,000 sf of office space to be located in the former mill building, and 115,000 sf of supporting restaurant/retail/active uses. An additional 4,000 sf of community center space is proposed to be provided on Site, but it is assumed that this space will be community oriented for the Site and the adjacent neighborhood and any vehicular traffic generated during the peak hours will be negligible.

As noted above, traffic associated with the residential units was estimated using ITE LUC 221 (Mid-Rise Residential), traffic associated with the office space was estimated using ITE LUC 710 (General Office Building), and traffic associated with the retail uses was estimated with ITE LUC 820 (Shopping Center). The retail uses are expected to be smaller, Main Street style businesses catering to the residential units on-Site and the adjacent neighborhoods as opposed to large big-box style retail stores. Potential uses will include small eating establishments, coffee shops, pharmacies, or gallery uses. While these do not fit the exact description of a traditional ITE "Shopping Center", retail traffic was estimated using this land use code, which results in an overly conservative analysis. The unadjusted vehicle trip estimates for are presented in Table 2.

**Table 2 Project Trip Generation – ITE Unadjusted Vehicle Trips**

	Residential <sup>a</sup>	Office <sup>b</sup>	Retail <sup>c</sup>	Total Unadjusted Vehicle Trips
<b>Weekday Daily</b>				
Enter	2,179	938	3,306	<b>6,423</b>
<u>Exit</u>	<u>2,179</u>	<u>938</u>	<u>3,306</u>	<u><b>6,423</b></u>
Total	4,358	1,877	6,611	<b>12,846</b>
<b>Weekday Morning</b>				
Enter	68	168	130	<b>366</b>
<u>Exit</u>	<u>194</u>	<u>27</u>	<u>80</u>	<u><b>301</b></u>
Total	263	196	209	<b>668</b>
<b>Weekday Evening</b>				
Enter	199	32	289	<b>520</b>
<u>Exit</u>	<u>127</u>	<u>167</u>	<u>313</u>	<u><b>608</b></u>
Total	326	199	603	<b>1,128</b>
<b>Saturday Daily</b>				
Enter	1,425	199	4,860	<b>6,483</b>
<u>Exit</u>	<u>1,425</u>	<u>199</u>	<u>4,860</u>	<u><b>6,483</b></u>
Total	2,849	398	9,719	<b>12,966</b>
<b>Saturday Midday</b>				
Enter	168	52	359	<b>579</b>
<u>Exit</u>	<u>175</u>	<u>44</u>	<u>332</u>	<u><b>550</b></u>
Total	343	95	691	<b>1,129</b>

a Based on ITE LUC 221 (Mid-Rise Residential) for 800 residential units.  
 b Based on ITE LUC 710 (General Office Building) for 180,000 sf  
 c Based on ITE LUC 820 (Shopping Center) for 115,000 sf

## Person Trips

The unadjusted vehicle trips are converted into person trips by applying the average vehicle occupancy (AVO) of 1.13 for residential and office trips and of 1.78 for retail trips, as outlined by the U.S. Department of Transportation<sup>3</sup>. The unadjusted vehicle trips were converted into person trips in order to apply internal capture credits and applicable mode share credits, as described below. Applying these credits to person trips allows for estimates to be made for the total number of Site-generated transit users, walkers, and bicyclists in addition to the total number of Site-generated vehicles.

## Internal Capture Trips

Since the proposed development is a mixed-use project, the trip generation characteristics of the Site will be different from a single-use project. Some of the traffic to be generated by the proposed development will be contained on site as "internal" or "shared vehicle" trips. For example, workers at the office space on Site may patron the retail shops after work, or residents who live in the development may also work in the office on Site. While these shared trips represent new traffic to the individual uses, they would not show up as new vehicle trips on the surrounding roadway network.

As described in the ITE Trip Generation Handbook<sup>4</sup> "because of the complementary nature of these land uses, some trips are made among the on-site uses. This capture of trips internal to the site has the net effect of reducing vehicle trip generation between the overall development site and the external street system (compared to the total number of trips generated by comparable land uses developed individually on stand-alone sites) an internal capture rate can generally be defined as the percentage of total person trips generated by a site that are made entirely within the site. The trip origin, destination, and travel path are all within the site."

Based on the methodology outlined in the ITE Trip Generation Handbook, internal capture rates were applied to the gross person trips. The resulting peak-hour person trip estimates for the Project and are presented in Table 3.

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<sup>3</sup> Summary of Travel Trends: 2009 National Household Survey, US Department of Transportation, Federal Highway Administration, Washington D.C., 2009

<sup>4</sup> Trip Generation Handbook, 3rd Edition, Institute of Transportation Engineers, Washington, D.C., 2017.

**Table 3 Project Peak-Hour Person Trips**

	<b>Residential <sup>a</sup></b>	<b>Office <sup>a</sup></b>	<b>Retail <sup>a</sup></b>	<b>Total Person Trips</b>
<b>Weekday Morning</b>				
Enter	75	178	220	<b>473</b>
<u>Exit</u>	<u>214</u>	<u>22</u>	<u>132</u>	<u><b>368</b></u>
Total	289	200	352	<b>841</b>
<b>Weekday Evening</b>				
Enter	117	19	425	<b>561</b>
<u>Exit</u>	<u>86</u>	<u>147</u>	<u>443</u>	<u><b>676</b></u>
Total	203	166	868	<b>1,237</b>
<b>Saturday Midday</b>				
Enter	102	38	566	<b>706</b>
<u>Exit</u>	<u>126</u>	<u>39</u>	<u>492</u>	<u><b>657</b></u>
Total	228	77	1,058	<b>1,363</b>

<sup>a</sup> Person trip generation estimate with internal capture credits applied.

**Mode Share**

It is expected that residents, visitor, and commuters to the Site will use a variety of transportation options to reach the Site, including private vehicles, walking, bicycling, and public transportation. To determine the number of vehicle trips, walk/bike trips, and transit trips, mode shares have been applied to the Person trips presented in Table 3.

As mentioned previously and described in detail later in the report, the Project will include a robust shuttle service program that includes direct shuttle bus service to nearby transit stations and to regional mobility hubs in Cambridge and Boston. The inclusion of the shuttle bus service will affect the mode split for the Project, as it is expected that many residents, employees, patrons, and the general public will use the shuttle bus service for trips to and from the Site. The level of use of the shuttles by the residents and workers will take time to materialize and the overall usage is not known at this time. As the exact usage will vary and is not known at this time, analysis for two levels of potential mode share has been conducted. To provide a complete understanding of the trip generation potential, two different mode splits were applied to the person trips to develop two different Build scenarios.

The first Build scenario, referred to as “Build Condition with Robust Shuttle Service” assumes a robust shuttle service that includes frequent peak and off-peak connections between the Site, nearby transit stations, and downtown Boston with strong usage expected. Mode shares were estimated with an assumption that there will be strong demand for residents and workers to use the shuttle service.

The second Build scenario, referred to as “Build Condition with Existing Mode Share” assumes that existing mode shares are realized. Mode shares for the Project under this scenario were based on the existing mode shares in the City of Newton according to Journey to Work data from the 2010 US Census, as in this scenario it is assumed that the shuttle service would be used with a similar frequency to transit options that currently exist within the City of Newton. While it is expected that the shuttle service in-place will be robust and will provide frequent peak and off-peak connections, this scenario presents a conservative “worst-case” trip-generation estimate.

The peak hour/peak direction mode share estimates, by use, are presented in Table 4. It should be noted that the level of robustness for the shuttle service was assumed to directly affect the residential and office mode shares, and the retail mode shares but to a lesser degree. It is estimated that patrons to the retail uses onsite will not change their pattern of travel as significantly based on the availability and service levels of the shuttle service. Under both conditions it is assumed that the shuttle service will account for approximately 5% of all retail trips, which includes both patrons to the retail uses and employees of the retail uses. It should also be noted that the walk/bike mode share is expected to be higher with the shuttle service in place as well, as residents and workers will be less likely to have a vehicle on Site with the shuttle service, so for shorter trips in the immediate area they will be more likely to walk or bike than to drive or take transit.

**Table 4 Project Mode Share**

<b>Use</b>	<b>Vehicle</b>	<b>Transit</b>	<b>Walk/Bike</b>
<b>Build Condition with Robust Shuttle Service <sup>a</sup></b>			
Residential	60%	30%	10%
Office	60%	30%	10%
Retail	90%	5%	5%
<b>Build Condition with Existing Mode Share <sup>b</sup></b>			
Residential	82%	13%	5%
Office	88%	7%	5%
Retail	90%	5%	5%

a Peak hour/peak direction mode share estimates developed with the assumption that there will be a strong usage (expected) of the shuttle system

b Peak hour/peak direction mode share estimates based on Journey to Work data from the 2010 US Census data for the City of Newton

The mode shares discussed above were applied to the net-new person trips to generate the adjusted Project trips by mode for the Build Condition with Existing Mode Share and the Build Condition with Robust Shuttle Service, respectively. The local average vehicle occupancy based US Census data for each primary use was then applied to the vehicle mode to reflect the number of vehicle trips generated by the Site.

**Pass-By Trips**

While the ITE rates provide estimates for all the traffic associated with each land use, not all of the traffic generated by the Project will be new to the area roadways. A portion of the vehicle-trips generated by the retail land use will likely be drawn from the traffic volume roadways adjacent to the Project Site. For example, someone traveling on Needham Street may choose to deviate from their original travel path to visit the site retail, before heading back to continue to their final destination. For this evaluation, ITE pass-by rates for LUC 820 (Shopping Center) were utilized for the retail trip generation and applied to existing trips on Needham Street and Oak Street. Specifically, 34-percent and 26-percent of the Site trip generation was assumed to be drawn from the surrounding roadway network during the weekday evening and Saturday midday peak hours, respectively, as outlined in the ITE Trip Generation Handbook. For all other time periods studied, a 25-percent pass-by rate was assumed.

**Project-Generated Trips – Build Condition with Existing Mode Share**

The mode share and local average vehicle occupancy rates were applied to convert the person trips into net new transit trips, walk/bike trips, and vehicle trips for the Build Condition with Existing Mode Share. A pass-by reduction was applied to the vehicle trips generated by the retail portion of the Site. Tables 5 and 6 summarize the net new trips by mode and net new vehicle trips by use, respectively.

**Table 5 Project-Generated Peak-Hour Trips by Mode – Build Condition with Existing Mode Share**

	<b>Vehicle Trips <sup>a</sup></b>	<b>Transit Trips</b>	<b>Walk/Bike Trips</b>
<b>Weekday Morning</b>			
Enter	282	33	26
<u>Exit</u>	<u>213</u>	<u>37</u>	<u>25</u>
Total	495	70	51
<b>Weekday Evening</b>			
Enter	238	37	31
<u>Exit</u>	<u>326</u>	<u>43</u>	<u>36</u>
Total	564	80	67
<b>Saturday Midday</b>			
Enter	318	44	38
<u>Exit</u>	<u>299</u>	<u>44</u>	<u>37</u>
Total	617	88	75

a Net vehicle trips not including pass-by trips associated with the retail portion.

As shown in Table 5, without a robust shuttle service in place the Project is expected to generate between 70 and 88 transit trips, between 51 and 75 walk/bike trips, and between 495 and 617 vehicle trips during the peak hours studied (including trip generated by the existing Project Site uses). The breakdown of the vehicle trips by use are summarized below in Table 6.

**Table 6 Project-Generated Peak-Hour Vehicle Trips by Use – Build Condition with Existing Mode Share**

	<b>Residential<sup>a</sup></b>	<b>Office<sup>b</sup></b>	<b>Retail<sup>c</sup></b>	<b>Pass-By<sup>d</sup></b>	<b>Total Net Vehicle Trips<sup>e</sup></b>	<b>Existing Vehicle Trips<sup>f</sup></b>	<b>Total Net New Vehicle Trips</b>
<b>Weekday Morning</b>							
Enter	53	140	89	22	282	221	<b>61</b>
<u>Exit</u>	<u>151</u>	<u>17</u>	<u>45</u>	<u>22</u>	<u>213</u>	<u>56</u>	<u><b>157</b></u>
Total	204	157	134	44	495	277	<b>218</b>
<b>Weekday Evening</b>							
Enter	83	15	140	75	238	120	<b>118</b>
<u>Exit</u>	<u>61</u>	<u>116</u>	<u>149</u>	<u>75</u>	<u>326</u>	<u>248</u>	<u><b>78</b></u>
Total	144	131	289	150	564	368	<b>196</b>
<b>Saturday Midday</b>							
Enter	72	30	216	70	318	186	<b>132</b>
<u>Exit</u>	<u>89</u>	<u>31</u>	<u>179</u>	<u>70</u>	<u>299</u>	<u>163</u>	<u><b>136</b></u>
Total	161	61	395	140	617	349	<b>268</b>

Note: Table 8 only presents the Project-generated vehicle trips. The Project-generated transit trips and walk/bike trips are presented in Table 7.

- a New vehicle trips with internal capture and mode share credits applied.
- b New vehicle trips with internal capture and mode share credits applied.
- c New vehicle trips with internal capture, mode share, and pass-by credits applied.
- d Pass-by Credits of 25%, 34%, and 26% applied to weekday morning, weekday evening, and Saturday midday peak hour retail trip generation, respectively.
- e Sum of columns a through c.
- f Net vehicle trips that can be generated by the Site under existing conditions (from Table 3).

As shown in Table 6, the Project without a robust shuttle service in place is expected to generate a total 495, 564, and 617 vehicle trips during the respective weekday morning, weekday evening, and Saturday midday peak hours. However, these totals include traffic already being generated by the Project Site under existing conditions (as shown in Table 3). After considering this existing traffic generation, the Project without a robust shuttle service in place will result in an additional 218, 196, and 268 vehicle trips compared to existing conductions during the weekday morning, weekday evening, and Saturday midday peak hours, respectively.

**Project-Generated Trips – Build Condition with Robust Shuttle Service**

Similar to the Build Condition with Existing Mode Share, the mode share and local average vehicle occupancy rates were applied to the person trips to estimate the net new trips by mode for the Build Condition with Robust Shuttle Service, and then a pass-by reduction was applied to the vehicle trips generated by the retail portion of the Site. Tables 7 and 8 summarize the net new trips by mode and net new vehicle trips by use, respectively.

**Table 7 Project-Generated Peak-Hour Trips by Mode – Build Condition with Robust Shuttle Service**

	<b>Vehicle Trips <sup>a</sup></b>	<b>Transit Trips</b>	<b>Walk/Bike Trips</b>
<b>Weekday Morning</b>			
Enter	224	87	37
<u>Exit</u>	<u>172</u>	<u>78</u>	<u>30</u>
Total	396	165	67
<b>Weekday Evening</b>			
Enter	213	62	35
<u>Exit</u>	<u>274</u>	<u>92</u>	<u>46</u>
Total	487	154	81
<b>Saturday Midday</b>			
Enter	291	70	42
<u>Exit</u>	<u>267</u>	<u>75</u>	<u>42</u>
Total	558	145	84

<sup>a</sup> Net vehicle trips not including pass-by trips associated with the retail portion.

As shown in Table 7, with a robust shuttle service in place the Project is expected to generate between 145 and 165 transit trips, between 67 and 84 walk/bike trips, and between 396 and 558 vehicle trips during the peak hours studied (including trip generated by the existing Project Site uses). The breakdown of the vehicle trips by use are summarized below in Table 8.

**Table 8 Project-Generated Peak-Hour Vehicle Trips by Use – Build Condition with Robust Shuttle Service**

	<b>Residential <sup>a</sup></b>	<b>Office <sup>b</sup></b>	<b>Retail <sup>c</sup></b>	<b>Pass-By <sup>d</sup></b>	<b>Total Net Vehicle Trips <sup>e</sup></b>	<b>Existing Vehicle Trips <sup>f</sup></b>	<b>Total Net New Vehicle Trips</b>
<b>Weekday Morning</b>							
Enter	53	140	89	22	224	221	3
<u>Exit</u>	<u>151</u>	<u>17</u>	<u>45</u>	<u>22</u>	<u>172</u>	<u>56</u>	<u>116</u>
Total	204	157	134	44	396	277	119
<b>Weekday Evening</b>							
Enter	83	15	140	75	213	120	93
<u>Exit</u>	<u>61</u>	<u>116</u>	<u>149</u>	<u>75</u>	<u>274</u>	<u>248</u>	<u>26</u>
Total	144	131	289	150	487	368	119
<b>Saturday Midday</b>							
Enter	72	30	216	70	291	186	105
<u>Exit</u>	<u>89</u>	<u>31</u>	<u>179</u>	<u>70</u>	<u>267</u>	<u>163</u>	<u>104</u>
Total	161	61	395	140	558	349	209

Note: Table 6 only presents the Project-generated vehicle trips. The Project-generated transit trips and walk/bike trips are presented in Table 5.

- a New vehicle trips with internal capture and mode share credits applied.
- b New vehicle trips with internal capture and mode share credits applied.
- c New vehicle trips with internal capture, mode share, and pass-by credits applied.
- d Pass-by Credits of 25%, 34%, and 26% applied to weekday morning, weekday evening, and Saturday midday peak hour retail trip generation, respectively.
- e Sum of columns a through c.
- f Net vehicle trips that can be generated by the Site under existing conditions (from Table 3).

As shown in Table 8, the Project is expected to generate a total 396, 487, and 558 new vehicle trips during the respective weekday morning, weekday evening, and Saturday midday peak hours with a robust shuttle service in place. However, these totals include traffic already being generated by the Project Site under existing conditions (as shown in Table 3). After considering this existing traffic generation, the Project will result in an additional 119, 119, and 209 vehicle trips compared to existing conductions during the weekday morning, weekday evening, and Saturday midday peak hours, respectively.