

MEMORANDUM

TO: Ms. Rachna D. Balakrishna
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FROM: Mr. F. Giles Ham, P.E *and*
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DATE: January 9, 2020

RE: 7276

SUBJECT: Trip Generation Update
1180 Boylston Street in Brookline, Massachusetts

Vanasse & Associates, Inc. (VAI) has prepared this supplemental memorandum in support of the Mixed-use development to be located at 1180 Boylston Street in Brookline, Massachusetts (the "Project"). Specifically, the development program has been revised from 50 age-restricted (55+) apartments to 50 non-age restricted apartment and this memorandum updates the traffic generation changes.

UPDATED TRIP GENERATION

The project entails the development of 50 housing units and 6,424 sf of retail. In order to develop the traffic characteristics of the proposed project, trip-generation statistics published by the Institute of Transportation Engineers (ITE)¹ for LUC 221, Multifamily Housing -Mid Rise and LUC 820, Shopping Center were used to develop the traffic characteristics of the project. Vehicle trip estimates were adjusted to account for transit trips, walk trips, and pass-by trips for the retail use. A summary of the updated vehicle trip generation is present in Tables 1 and 2.

¹*Trip Generation Manual*, Tenth Edition; Institute of Transportation Engineers; Washington, DC; 2017.



Table 1
TRIP GENERATION SUMMARY: RETAIL

| Time Period | ITE Retail Trips 6,424 sf ^a | Mode Share | | | | | | | |
|-----------------------------------|---|--------------------------------|--------------|---------------------------------|-------------------------------|------------------|-------------------|---------------------|-------------------|
| | | Vehicle Occupancy ^b | Person Trips | Transit Trips (5%) ^b | Walk Trips (30%) ^b | New Person Trips | New Vehicle Trips | Pass-By Trips (25%) | New Vehicle Trips |
| Average Weekday Daily Traffic | 242 | 1.78 | 430 | 22 | 130 | 278 | 156 | 40 | 116 |
| <i>Weekday Morning Peak Hour:</i> | | | | | | | | | |
| Entering | 10 | 1.78 | 18 | 1 | 5 | 12 | 7 | 1 | 6 |
| Exiting | <u>6</u> | 1.78 | <u>10</u> | <u>0</u> | <u>3</u> | <u>7</u> | <u>4</u> | <u>1</u> | <u>3</u> |
| Total | 16 | 1.78 | 28 | 1 | 8 | 19 | 11 | 2 | 9 |
| <i>Weekday Evening Peak Hour:</i> | | | | | | | | | |
| Entering | 23 | 1.78 | 41 | 2 | 12 | 27 | 15 | 4 | 11 |
| Exiting | <u>24</u> | 1.78 | <u>43</u> | <u>2</u> | <u>13</u> | <u>28</u> | <u>16</u> | <u>4</u> | <u>12</u> |
| Total | 47 | 1.78 | 84 | 4 | 25 | 55 | 31 | 8 | 23 |

^aBased on ITE LUC 820, Shopping Center.

^bBased on Traffic Analysis Zone 752 data obtained from Central Transportation Planning Staff.

Table 2
TRIP GENERATION SUMMARY: RESIDENTIAL

| Time Period | Residential Trips (50-unit) Trips ^a | Mode Share | | | | | |
|-----------------------------------|--|------------------------|--------------|------------------------------------|---------------------------------|--------------------------|-------------------|
| | | Occupancy ^b | Person Trips | Transit Trips (28.7%) ^c | Walk Trips (11.4%) ^c | New Person/Vehicle Trips | New Vehicle Trips |
| Average Weekday Daily Traffic | 270 | 1.1 | 297 | 85 | 34 | 178 | 162 |
| <i>Weekday Morning Peak Hour:</i> | | | | | | | |
| Entering | 5 | 1.1 | 6 | 2 | 0 | 4 | 4 |
| Exiting | <u>13</u> | 1.1 | <u>14</u> | <u>4</u> | <u>2</u> | <u>8</u> | <u>7</u> |
| Total | 18 | 1.1 | 20 | 6 | 2 | 12 | 11 |
| <i>Weekday Evening Peak Hour:</i> | | | | | | | |
| Entering | 13 | 1.1 | 14 | 4 | 2 | 8 | 7 |
| Exiting | <u>9</u> | 1.1 | <u>10</u> | <u>3</u> | <u>1</u> | <u>6</u> | <u>6</u> |
| Total | 22 | 1.1 | 24 | 7 | 3 | 14 | 13 |

^aBased on ITE LUC 221, Multifamily Housing- Mid Rise

^bBased on Traffic Analysis Zone 752 data obtained from Central Transportation Planning Staff.

^cBased on journey to work data for Brookline obtained from the United States Census Bureau in 2000.



Table 3 summarizes the trip generation estimates with age-restricted in comparison to the non-age restricted.

Table 3
TRIP GENERATION COMPARISON TO PRIOR ESTIMATIONS

| Time Period | Mixed Used development with Age-Restricted Apartments ^a | | | Mixed Used development with Non-Age Restriction | | | Net Increase |
|-----------------------------------|--|--|-----------------------|---|---------------------------|-----------------------|--------------|
| | Residential Trips (A) ^b | Proposed Retail Trips (B) ^c | Total New Trips (A+B) | Residential Trips (A) ^d | Proposed Retail Trips (B) | Total New Trips (A+B) | |
| Average Weekday Daily Traffic | 110 | 116 | 226 | 162 | 116 | 278 | 60 |
| <i>Weekday Morning Peak Hour:</i> | | | | | | | |
| Entering | 3 | 6 | 9 | 4 | 6 | 10 | 1 |
| Exiting | <u>3</u> | <u>3</u> | <u>6</u> | <u>7</u> | <u>3</u> | <u>10</u> | <u>4</u> |
| Total | 6 | 9 | 15 | 11 | 9 | 20 | 5 |
| <i>Weekday Evening Peak Hour:</i> | | | | | | | |
| Entering | 4 | 11 | 15 | 7 | 11 | 18 | 3 |
| Exiting | <u>4</u> | <u>12</u> | <u>16</u> | <u>6</u> | <u>12</u> | <u>18</u> | <u>2</u> |
| Total | 8 | 23 | 31 | 13 | 23 | 36 | 5 |

^a Obtained from VAI April 3, 2019 Trip Generation update letter.

^b Based on ITE LUC 252, Senior Adult Housing with transit reduction adjustments.

^c Based on ITE LUC 820, Shopping Center with transit reduction and pass-by adjustments.

^d Based on ITE LUC on ITE LUC 221, Multifamily Housing- Mid Rise

As shown in Table 3, the revised development program will add 5 peak hour trips and will not change any of the study conclusions or recommendations.

cc: File



APPENDIX

TRIP GENERATION

50 Apartment units

50 Age-restricted Estimates



50 Apartment units



Institute of Transportation Engineers (ITE)
 Trip Generation, 10th Edition
 Land Use Code (LUC) 221 - Multifamily Housing (Mid-Rise)

Vehicle Trips Ends vs: Dwelling Units
 Independent Variable (X): 50

| R ² | Equation | Rate |
|----------------|--|--|
| 0.77 | AVERAGE WEEKDAY DAILY $T = 5.45 * X - 1.75$ $T = 5.45 * 50 - (1.75)$ $T = 270.75$ T = 270 vehicle trips with 50% (135 vpd) entering and 50% (135 vpd) exiting. | AVERAGE WEEKDAY DAILY T = 5.44 * (X) T = 5.44 * 50 T = 272.00 T = 272 vehicle trips with 50% (136 vpd) entering and 50% (136 vpd) exiting. |
| 0.67 | WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC $\ln T = 0.98 * \ln(X) - 0.98$ $\ln T = 0.98 * \ln 50 - (0.98)$ $\ln T = 2.85$ T = 17.35 T = 17 vehicle trips with 26% (4 vph) entering and 74% (13 vph) exiting. | WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC T = 0.36 * (X) T = 0.36 * 50 T = 18.00 T = 18 vehicle trips with 26% (5 vph) entering and 74% (13 vph) exiting. |
| 0.72 | WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC $\ln T = 0.96 * \ln(X) - 0.63$ $\ln T = 0.96 * \ln 50 - (0.63)$ $\ln T = 3.13$ T = 22.77 T = 23 vehicle trips with 61% (14 vph) entering and 39% (9 vph) exiting. | WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC T = 0.44 * (X) T = 0.44 * 50 T = 22.00 T = 22 vehicle trips with 61% (13 vph) entering and 39% (9 vph) exiting. |
| 0.73 | SATURDAY DAILY $T = 3.04 * X + 417.11$ $T = 3.04 * 50 + (417.11)$ $T = 569.11$ T = 570 vehicle trips with 50% (285 vpd) entering and 50% (285 vpd) exiting. | AVERAGE SATURDAY T = 4.91 * (X) T = 4.91 * 50 T = 245.50 T = 246 vehicle trips with 50% (123 vpd) entering and 50% (123 vpd) exiting. |
| 0.89 | SATURDAY MIDDAY PEAK HOUR OF GENERATOR $T = 0.42 * X + 6.73$ $T = 0.42 * 50 + (6.73)$ $T = 27.73$ T = 28 vehicle trips with 49% (14 vph) entering and 51% (14 vph) exiting. <i>(same distribution split as ITE LUC 210 during the Saturday midday peak hour of generator)</i> | SATURDAY MIDDAY PEAK HOUR OF GENERATOR T = 0.44 * (X) T = 0.44 * 50 T = 22.00 T = 22 vehicle trips with 49% (11 vph) entering and 51% (11 vph) exiting. |

50 Age-restricted Estimates

Table 1
TRIP GENERATION SUMMARY: RETAIL

| Time Period | 6,424 sf | | Vehicle Trips | | | | | | |
|-----------------------------------|---------------------------|------------------------|---------------|---------------------------------|-------------------------------|------------------|-------------------|---------------------|-------------------|
| | Retail Trips ^a | Occupancy ^b | Person Trips | Transit Trips (5%) ^b | Walk Trips (30%) ^b | New Person Trips | New Vehicle Trips | Pass-By Trips (25%) | New Vehicle Trips |
| Average Weekday Daily Traffic | 242 | 1.78 | 430 | 22 | 130 | 278 | 156 | 40 | 116 |
| <i>Weekday Morning Peak Hour:</i> | | | | | | | | | |
| Entering | 10 | 1.78 | 18 | 1 | 5 | 12 | 7 | 1 | 6 |
| <u>Exiting</u> | <u>6</u> | 1.78 | <u>10</u> | <u>0</u> | <u>3</u> | <u>7</u> | <u>4</u> | <u>1</u> | <u>3</u> |
| Total | 16 | 1.78 | 28 | 1 | 8 | 19 | 11 | 2 | 9 |
| <i>Weekday Evening Peak Hour:</i> | | | | | | | | | |
| Entering | 23 | 1.78 | 41 | 2 | 12 | 27 | 15 | 4 | 11 |
| <u>Exiting</u> | <u>24</u> | 1.78 | <u>43</u> | <u>2</u> | <u>13</u> | <u>28</u> | <u>16</u> | <u>4</u> | <u>12</u> |
| Total | 47 | 1.78 | 84 | 4 | 25 | 55 | 31 | 8 | 23 |

^aBased on ITE LUC 820, Shopping Center.

^bBased on Traffic Analysis Zone 752 data obtained from Central Transportation Planning Staff.

Table 2
TRIP GENERATION SUMMARY: RESIDENTIAL

| Time Period | Residential | | Person Trips | Transit Trips (28.7%) ^c | Walk Trips (11.4%) ^c | Vehicle Trips | |
|-----------------------------------|--------------------|------------------------|--------------|------------------------------------|---------------------------------|------------------|-------------------|
| | Trips ^a | Occupancy ^b | | | | New Person Trips | New Vehicle Trips |
| Average Weekday Daily Traffic | 186 | 1.1 | 204 | 58 | 24 | 122 | 110 |
| <i>Weekday Morning Peak Hour:</i> | | | | | | | |
| Entering | 4 | 1.1 | 4 | 1 | 0 | 3 | 3 |
| <u>Exiting</u> | <u>6</u> | 1.1 | <u>7</u> | <u>2</u> | <u>1</u> | <u>4</u> | <u>3</u> |
| Total | 10 | 1.1 | 11 | 3 | 1 | 7 | 6 |
| <i>Weekday Evening Peak Hour:</i> | | | | | | | |
| Entering | 7 | 1.1 | 8 | 2 | 1 | 5 | 4 |
| <u>Exiting</u> | <u>6</u> | 1.1 | <u>6</u> | <u>2</u> | <u>0</u> | <u>4</u> | <u>4</u> |
| Total | 13 | 1.1 | 14 | 4 | 1 | 9 | 8 |

^aBased on ITE LUC 252, Senior Adult Housing - Attached.

^bBased on Traffic Analysis Zone 752 data obtained from Central Transportation Planning Staff.

^cBased on journey to work data for Brookline obtained from the United States Census Bureau in 2000.

