

Traffic Memorandum

Date: July 5, 2024

To: Mr. Benjamin Osgood
Ranger Engineering Group, Inc.

From: Ken Cram, P.E., – Director of Traffic Engineering

Subject: Proposed Medical Office Building
140 Haverhill Street
Andover, Massachusetts

This Traffic Memorandum has been prepared to compare the proposed traffic generation resulting from the redevelopment of 140 Haverhill Street in Andover, MA. This memorandum has developed trip generation projections for the existing building and the proposed project and reviewed the sight distances at the site driveways.

The traffic generation comparison shows that the redeveloped site will generate approximately twenty (20) percent fewer vehicle trips than the previous use, when it was at its peak during the peak commuter hours. The sight lines remain the same as originally observed and reported.

PROJECT DESCRIPTION

The site is located in the northwest corner of the intersection of Haverhill Street (Route 133) and High Street. Currently, the site consists of Doctors Park I and Doctors Park II. Two driveways currently serve the site, one from Haverhill Street and one from High Street.

The current development proposal consists of the demolition of Doctors Park I, a 25,000 gross square foot (gsf) medical office building and the construction of a 19,200 gsf building. Access would continue to be provided by way of the driveways to Haverhill Street and to High Street. Figure 1 shows the site location in relation to the surrounding area.



Figure 1
Site Location Map

TRIP GENERATION

Existing Site Traffic Generation

Site generated traffic was based on trip-generation data published by the ITE *Trip Generation* manual¹ for the existing house. Trip generation data for Land Use Code (LUC) 720 – Medical/Dental Office Building was reviewed. The trip generation for the existing medical building is summarized in the first column of Table 1. The trip generation worksheets are included in the Appendix.

Proposed Site Traffic Generation

Trip-generation data published by the ITE *Trip Generation* manual² was also reviewed for the proposed use. Again, trip generation data for LUC 720, Medical/Dental Office Building were reviewed. This data is summarized in the second column of Table 1.

¹*Trip Generation*, Eleventh Edition; Institute of Transportation Engineers; Washington, DC; 2021.

²Ibid.

**TABLE 1
EXISTING TRIP-GENERATION**

	<u>Existing 25,000 gsf Medical Building Trips^a</u>	<u>Proposed 19,200 gsf Medical Building Trips^a</u>	<u>Change in Trips</u>
AVERAGE WEEKDAY DAILY TRAFFIC	966	718	248
<i>Weekday Morning Peak Hour:</i>			
Entering	55	43	12
<u>Exiting</u>	<u>14</u>	<u>12</u>	<u>2</u>
Total	69	55	14
<i>Weekday Evening Peak Hour:</i>			
Entering	30	23	7
<u>Exiting</u>	<u>69</u>	<u>52</u>	<u>17</u>
Total	99	75	20

^aBased on ITE LUC 720, Medical/Dental Office Building.

The proposed project is expected to generate 248 fewer daily vehicle trips on an average weekday. During the weekday morning peak hour, the proposed project would generate fourteen (14) fewer vehicle trips, and, during the weekday evening peak hour, the proposed project would generate a total of 20 fewer vehicle trips.

SIGHT DISTANCE

Sight distance measurements were performed at the site driveway intersections with Haverhill Street and High Street in accordance with Massachusetts Department of Transportation (MassDOT) and American Association of State Highway and Transportation Officials (AASHTO) standards as part of the original traffic study. The access and egress for the site will remain the same.

Stopping sight distance (SSD) 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. Intersection sight distance (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. Table 2 presents the measured SSD at the site driveway intersections with Haverhill Street and High Street. The sight distance calculations are included in the Appendix.

TABLE 2
SIGHT DISTANCE SUMMARY

	Required Minimum (Feet) ^a	Measured (Feet)
<i>Haverhill Street and Site Driveway</i>		
<i>Stopping Sight Distance:</i>		
Haverhill Street approaching from the East	278	400+
Haverhill Street approaching from the West	236	300
<i>Intersection Sight Distance:</i>		
Site Driveway looking to the East	325 ^b /419 ^c	400+
Site Driveway looking to the West	363 ^b /375 ^c	250
<i>High Street and Site Driveway</i>		
<i>Stopping Sight Distance:</i>		
Haverhill Street approaching from the North	246	400
Haverhill Street approaching from the South	267	400
<i>Intersection Sight Distance:</i>		
Site Driveway looking to the North	411 ^b /474 ^c	300
Site Driveway looking to the South	392 ^b /452 ^c	300

^aRecommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*; American Association of State Highway and Transportation Officials (AASHTO); 2010 and based on 85th percentile speed for Haverhill Street and for High Street.

^bRecommended minimum value for vehicles turning right exiting a roadway under STOP-sign control.

^cRecommended minimum value for vehicles turning left exiting a roadway under STOP-sign control.

As can be seen in Table 2, the SSD measurements performed at the site driveway intersections with Haverhill Street and High Street indicate that the intersection exceeds the recommended minimum requirements based on the 85th percentile speeds. In accordance with the AASHTO manual, “*If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road.*” Accordingly, the ISD should be at least equal to the SSD, which would allow a driver approaching the minor road to safely stop. It is recommended that any proposed landscaping be less than three (3) feet in height and maintained for sightlines. Along the Haverhill Street frontage, it is recommended that no plantings occur within ten (10) feet of the travelled way to maintain sight lines.

APPENDIX

TRIP GENERATION DATA

TRIP GENERATION DATA

140 Haverhill Street, Andover, MA Existing

**Land Use Code (LUC) 720 - Medical-Dental Office Building
Source: Institute of Transportation Engineers (ITE) - 11th Edition**

Average Vehicle Trips Ends vs: KSF
Independent Variable (X): 25.000 ksf

AVERAGE WEEKDAY DAILY

$T = 42.97 * (X) - 108.01$ 18 Studies, Avg size = 15 ksf
 $T = 42.97 * (25.000) - 108.01$ $R^2 = 0.92, AR = 36.00$ trips/ksf
 $T = 966.24$
 $T = 966$ vehicle trips 38.64
with 50% (483 vpd) entering and 50% (483 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$\ln T = 0.90 \ln (X) + 1.34$ 24 Studies, Avg size = 25 ksf
 $\ln T = 0.90 \ln (25.000) + 1.34$ $R^2 = 0.80 AR = 3.10$ trips/ksf
 $\ln T = 4.24$
 $T = 69.20$
 $T = 69$ vehicle trips
with 79% (55 vph) entering and 21% (14 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF GENERATOR

$T = 3.56 * (X) + 2.66$ 21 Studies, Avg size = 15 ksf
 $T = 3.56 * (25.000) + 2.66$ $R^2 = 0.74 AR = 3.74$ trips/ksf
 $T = 91.66$
 $T = 92$ vehicle trips
with 59% (54 vpd) entering and 31% (38 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$T = 4.07 * (X) - 3.17$ 30 Studies, Avg size = 23 ksf
 $T = 4.07 * (25.000) - 3.17$ $R^2 = 0.77 AR = 3.93$ trips/ksf
 $T = 98.58$
 $T = 99$ vehicle trips
with 30% (30 vpd) entering and 70% (69 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF GENERATOR

$T = 5.36 * (X) - 10.42$ 22 Studies, Avg size = 18 ksf
 $T = 5.36 * (25.000) - 10.42$ $R^2 = 0.95 AR = 4.79$ trips/ksf
 $T = 123.58$
 $T = 124$ vehicle trips
with 40% (50 vpd) entering and 60% (74 vpd) exiting.

140 Haverhill Street, Andover, MA Existing

Land Use Code (LUC) 720 - Medical-Dental Office Building
Source: Institute of Transportation Engineers (ITE) - 11th Edition

SATURDAY DAILY

$T = 13.78 * (X)$ 3 Studies, Avg size = 31 ksf
 $T = 13.78 * (25.000)$ $R^2 = NA$ AR = 13.78
 $T = 344.50$
 $T = 344$ vehicle trips
with 50% (172 vpd) entering and 50% (172 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$T = 3.02 * (X)$ 2 Studies, Avg size = 34 ksf
 $T = 3.02 * (25.000)$ $R^2 = NA$, AR = 3.02
 $T = 75.50$
 $T = 76$ vehicle trips
with 57% (43 vph) entering and 43% (33 vph) exiting.

140 Haverhill Street, Andover, MA

Proposed

Land Use Code (LUC) 720 - Medical-Dental Office Building

Source: Institute of Transportation Engineers (ITE) - 11th Edition

Average Vehicle Trips Ends vs: KSF
Independent Variable (X): 19.200 ksf

AVERAGE WEEKDAY DAILY

$T = 42.97 * (X) - 108.01$ 18 Studies, Avg size = 15 ksf
 $T = 42.97 * (19.200) - 108.01$ $R^2 = 0.92, AR = 36.00$ trips/ksf
 $T = 717.01$
 $T = 718$ vehicle trips 37.40
with 50% (359 vpd) entering and 50% (359 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$\ln T = 0.90 \ln (X) + 1.34$ 24 Studies, Avg size = 25 ksf
 $\ln T = 0.90 \ln (19.200) + 1.34$ $R^2 = 0.80 AR = 3.10$ trips/ksf
 $\ln T = 4.00$
 $T = 54.57$
 $T = 55$ vehicle trips
with 79% (43 vph) entering and 21% (12 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF GENERATOR

$T = 3.56 * (X) + 2.66$ 21 Studies, Avg size = 15 ksf
 $T = 3.56 * (19.200) + 2.66$ $R^2 = 0.74 AR = 3.74$ trips/ksf
 $T = 71.01$
 $T = 71$ vehicle trips
with 59% (42 vpd) entering and 31% (29 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$T = 4.07 * (X) - 3.17$ 30 Studies, Avg size = 23 ksf
 $T = 4.07 * (19.200) - 3.17$ $R^2 = 0.77 AR = 3.93$ trips/ksf
 $T = 74.97$
 $T = 75$ vehicle trips
with 30% (23 vpd) entering and 70% (52 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF GENERATOR

$T = 5.36 * (X) - 10.42$ 22 Studies, Avg size = 18 ksf
 $T = 5.36 * (19.200) - 10.42$ $R^2 = 0.95 AR = 4.79$ trips/ksf
 $T = 92.49$
 $T = 92$ vehicle trips
with 40% (37 vpd) entering and 60% (55 vpd) exiting.

140 Haverhill Street, Andover, MA

Proposed

Land Use Code (LUC) 720 - Medical-Dental Office Building

Source: Institute of Transportation Engineers (ITE) - 11th Edition

SATURDAY DAILY

$$T = 13.78 * (X)$$

3 Studies, Avg size = 31 ksf

$$T = 13.78 * (19.200)$$

R² = NA AR = 13.78

$$T = 264.58$$

$$T = 264 \text{ vehicle trips}$$

with 50% (132 vpd) entering and 50% (132 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 3.02 * (X)$$

2 Studies, Avg size = 34 ksf

$$T = 3.02 * (19.200)$$

R² = NA, AR = 3.02

$$T = 57.98$$

$$T = 58 \text{ vehicle trips}$$

with 57% (33 vph) entering and 43% (25 vph) exiting.