



December 17, 2013

James Lambert
Development Associate
Mill Creek Residential
15 New England Executive Park
Suite 1010
Burlington, MA 01803

Subject: Traffic Noise Measurements and Analysis
Mill Creek Residential Trust – Needham
Needham, MA
Acentech Project No. 624127

Dear Jim:

The following is a report on our sound level measurements from 10/21/13 to 10/23/13 at the future site of the Needham Mews project at 692-744 Greendale Avenue. Based on our observations and measurements, the major noise source is Interstate 95, which is approximately 475 ft. away (measured from Greendale Ave.) Construction of residential projects adjacent to, or nearby, noise sources like highways is common and there are design and construction methods that can attenuate noise impacts. This letter summarizes the applicable guidelines for this project, the site noise measurements and our findings and recommendations.

NOISE GUIDELINES

The noise policy of the U.S. Department of Housing and Urban Development (HUD) sets a residential day-night average interior noise level (L_{dn}) goal for allowable noise of 45 dBA. (dBA is a sound level measurement that is frequency-weighted to correspond to the frequency dependent sensitivity of human hearing. dBA discounts low frequency contributions like truck rumble and emphasizes mid and high frequency contributions like tire noise.) This goal of 45 L_{dn} corresponds to energy average (L_{eq}) levels of 45 dBA during the day (between 7 AM and 10 PM) and 35 dBA at night (between 10 PM and 7 AM). The text of this guideline is in 24 CFR 51, Section 51.101 and is on the web at:

http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/environment/trainin/g/guidebooks/noise

MEASUREMENTS

Noise readings were taken from various locations, as the project site slopes from Greendale Avenue approximately 30-40 feet down to I-95. Sound levels vary based on the elevation the sound receptor is located above the sound generator (in this case I-95), so it is appropriate to take readings at different locations and elevations. A combination of handheld short-term sound measurements and long-term noise monitor measurements were taken.

On 10/21/13 (Monday), we set up a noise monitor to record levels for up to 24 hours at the site. The location of the long term measurement is shown as Position X on Figure 1, which corresponds to the approximate location shown on the site plan attached as Exhibit A. The 24-hour monitor was located within the project site at the approximate elevation of the surface of the I-95 roadway and corresponds to the future lower garage level of Buildings A and B.

We also conducted measurements with a handheld sound level meter to check the sound levels in front of a few residences along Greendale Avenue. As shown in Figure 1, the handheld monitoring locations included Position A in front of 721 Greendale Ave, Position B in front of 623 Greendale Ave, and Position C in front of 527 Greendale Ave. The measurements were taken on the I-95 side of Greendale Avenue.

Greendale Avenue is approximately 30 to 40 ft. higher than I-95 at all three measurement locations, which corresponds to the future 1st level of the Townhomes and the 2nd level of Buildings A and B.

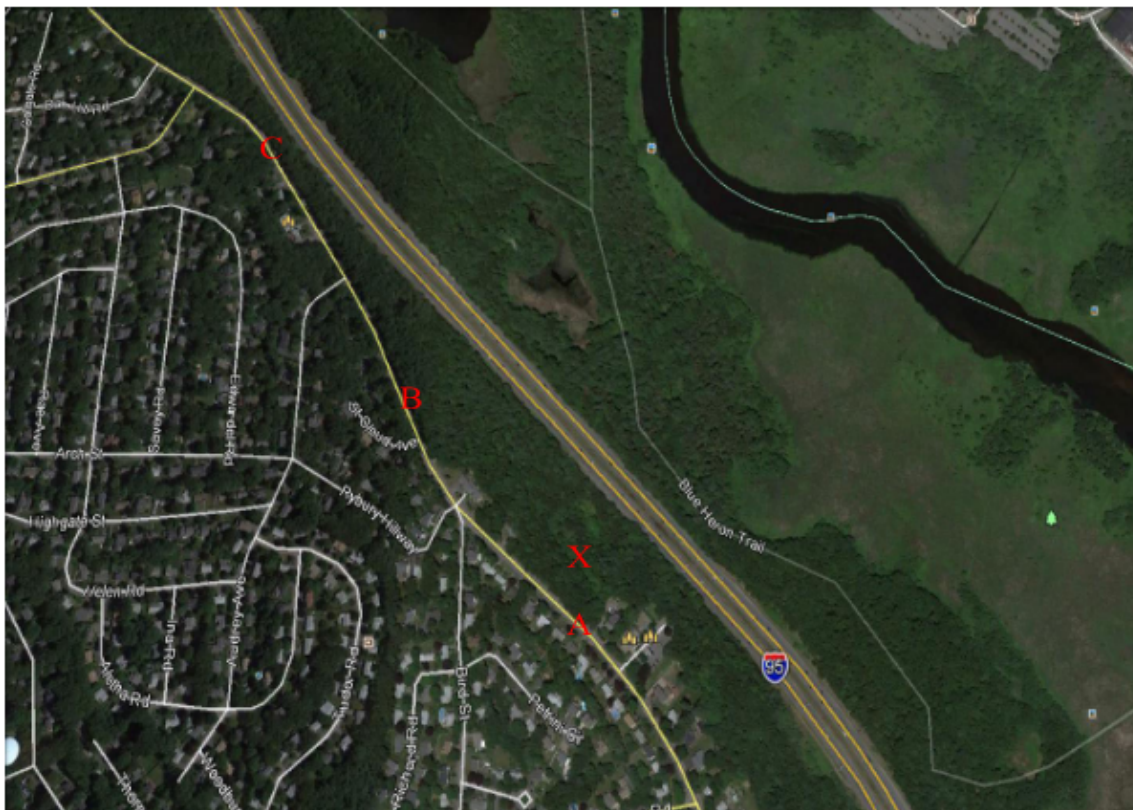


Figure 1: Overall sound survey map. Handheld locations labeled A, B and C. Long term location labeled X.

Handheld Measurements (Locations A, B, and C)

We measured the following 5-minute L_{eq} levels starting at the times listed below at the three locations noted in Figure 1, along Greendale Avenue. These levels were due primarily to the traffic from Greendale Ave. and I-95. Also of note was that the traffic was much heavier on Greendale Ave during the morning of 10/23 than on the afternoon of 10/21, thus elevating the handheld measurements taken along Greendale Ave.

Measurement Position	Start Time of Measurement	Measured 5-minute L_{eq}
A	1:30 PM	68 dBA
B	1:43 PM	68 dBA
C	1:54 PM	73 dBA

Table 1: Measurements taken on 10/21/13

Measurement Position	Start Time of Measurement	Measured 5-minute L_{eq}
A	8:04 AM	72 dBA
B	8:17 AM	74 dBA
C	8:28 AM	76 dBA

Table 2: Measurements taken on 10/23/13

Automated Noise Monitor Measurements (Location X)

Figure 2 attached shows the continuously measured 5-minute L_{eq} values for the measurement Position X. This graph indicates that the highest levels were between 63 and 65 dBA between 7 and 9 AM on the mornings of 10/22/13 and 10/23/13. There also appeared to be some anomaly in our measurements on 10/22/13 between 12:00PM and 4:00PM, which we suspected was construction noise rather than traffic.

Evaluation of the Measurements

It appears that the readings are higher at Locations A, B and C than Location X. This is most likely because Locations A, B and C were at the same elevation as Greendale Avenue, with direct line-of-sight to both I-95 and Greendale Ave traffic.

Although Location X was located closer to the highway, this location is at least 20 ft. lower than Greendale Avenue. This change in elevation shielded some traffic noise from Greendale Avenue to the future project site.

To be more conservative in our analysis, we will use the handheld measurements taken at Locations A, B, and C along Greendale Ave. as our reference sound levels rather than the long term monitor measurements at Location X.

MEASUREMENTS AND PREDICTION ANALYSIS

Noise Impact of Foliage

Of particular interest to us was whether or not the foliage between Greendale Avenue and I-95 played a significant role in attenuating traffic noise from the highway. The three selected handheld measurement locations had significant variations in the amount of foliage, but all three locations are similar in elevation relative to the highway.

Measured traffic sound levels will vary based on the distance between the sound source and the measurement location. For comparison, we calculated the predicted highway traffic sound levels at three measurement locations as if they were equidistant to the highway but with different foliage density.

For example, Position C had the least amount of foliage and was useful as a comparison because the project site (which includes Location X in Figure 1) will clear many of the existing trees. The sound levels are calculated based on the logarithmic spreading of a line source (highway traffic), and summarized below in Table 3.

Foliage density	Approximate distance to the highway from measurement location	Measured Leq at location and indicated distance	Calculated Leq at 475 ft. away for each foliage condition
A-Most Foliage	475 ft.	68 dBA	68 dBA
B-Moderate Foliage	355 ft.	68 dBA	66 dBA
C-Least Foliage	125 ft.	73 dBA	67 dBA

Table 3: Calculated Leq with various foliage conditions

The calculations show that the three foliage densities (A, B, and C) would have had very similar anticipated sound levels (within 3 dB), confirming that the reduction in foliage would have minimal impact to the project site. The results were consistent for the two handheld measurement visits.

Traffic Noise Impact to Apartments

To help estimate the interior noise levels due to the exterior levels reported in preceding report sections, we have estimated the traffic noise reduction from the currently planned wall and window constructions.

To determine expected interior levels as suggested by HUD, subtract the traffic noise reduction (due to the exterior wall/glazing construction) from the expected exterior levels.

Determination of Day-Night Average Noise Level (Expected Exterior Levels)

We have determined from the long-term and short-term noise measurements that traffic noise from both I-95 and Greendale Avenue impact the project site. The overall sound levels are best represented by the handheld measurements taken along Greendale Avenue (Locations A, B, and C). The exterior day-night average noise level, Ldn, for the project site is **72 dBA**. This is the highest Ldn level determined at the site, and assumes that all the apartments will be impacted by traffic noise from both Greendale Avenue and I-95. Actual exterior Ldn levels with the project buildings in place may vary depending on the orientation of the unit as it relates to I-95 and Greendale Ave. In many cases, the new exterior Ldn may be lower than the currently determined

Ldn based on the orientation of the unit and potential shielding by other project buildings (i.e., does the unit has a direct line of sight to I-95 or Greendale Ave.?).

Noise Reduction

While there are different design and construction methodologies that can be employed to attenuate exterior noise impacts, the currently planned exterior wall construction is a wood stud wall with a 1/2- inch thick layer of gypsum board on the interior side, 7/16-inch OSB wood sheathing and vinyl or Hardie fiber cement siding on the exterior, and 3-1/2 inches of Kraft faced glass fiber batt insulation in the cavity. The glazing construction for the windows and doors is a double-pane, insulated system with a minimum 5/8 -inch overall thickness. We expect the composite performance of the exterior wall and glazing to provide about **25 dBA** of traffic noise reduction.

As the construction design progress, we understand Mill Creek will explore additional façade design and construction methodologies to obtain an anticipated noise reduction with a goal of meeting the HUD noise guidelines summarized above.

Expected Interior Levels

To determine the expected interior levels, we have to subtract the noise reduction from the expected exterior levels. Based on the determined exterior Ldn level and the currently planned exterior wall construction, the expected interior Ldn level will be **47 dBA**, which is only slightly over the HUD requirement for interior Ldn. Based on the discussion in the earlier section about variability in exterior Ldn due to orientation of the apartment unit as they relate to the roadways, the expected interior Ldn will also vary and likely be lower than 47 dBA for many of the apartment units that do not have a direct line of sight to both I-95 or Greendale Avenue.

As noted above for units that will have an expected interior Ldn level of 47 dBA, the façade design and construction methodologies will be refined as the construction design progresses to achieve a noise reduction sufficient to meet the goals of the HUD guidelines. However, for most apartment units and townhomes, the expected interior Ldn level will be within 45 dBA HUD guidelines with the currently planned exterior wall construction.

* * * * *

I trust this letter provides the information that you need at this time. If you have questions, please call me on my direct line at 617.499.8080.

Sincerely,
ACENTECH INCORPORATED



Rose Mary Su
Senior Consultant

cc: Roberto Gomez – Acentech, Inc.
Encl: Figure 2 – Long-term noise monitoring data

J:\624xxx\6241xx\624127 - MC - Needham Res complex\01r-rms-MC-MillCreek Needham Traffic Report.docx

Figure 2
Mill Creek Needham Residential Project
Variations in A-Weighted Sound Levels Measured for 5-Minute Intervals During 21-23
October 2013

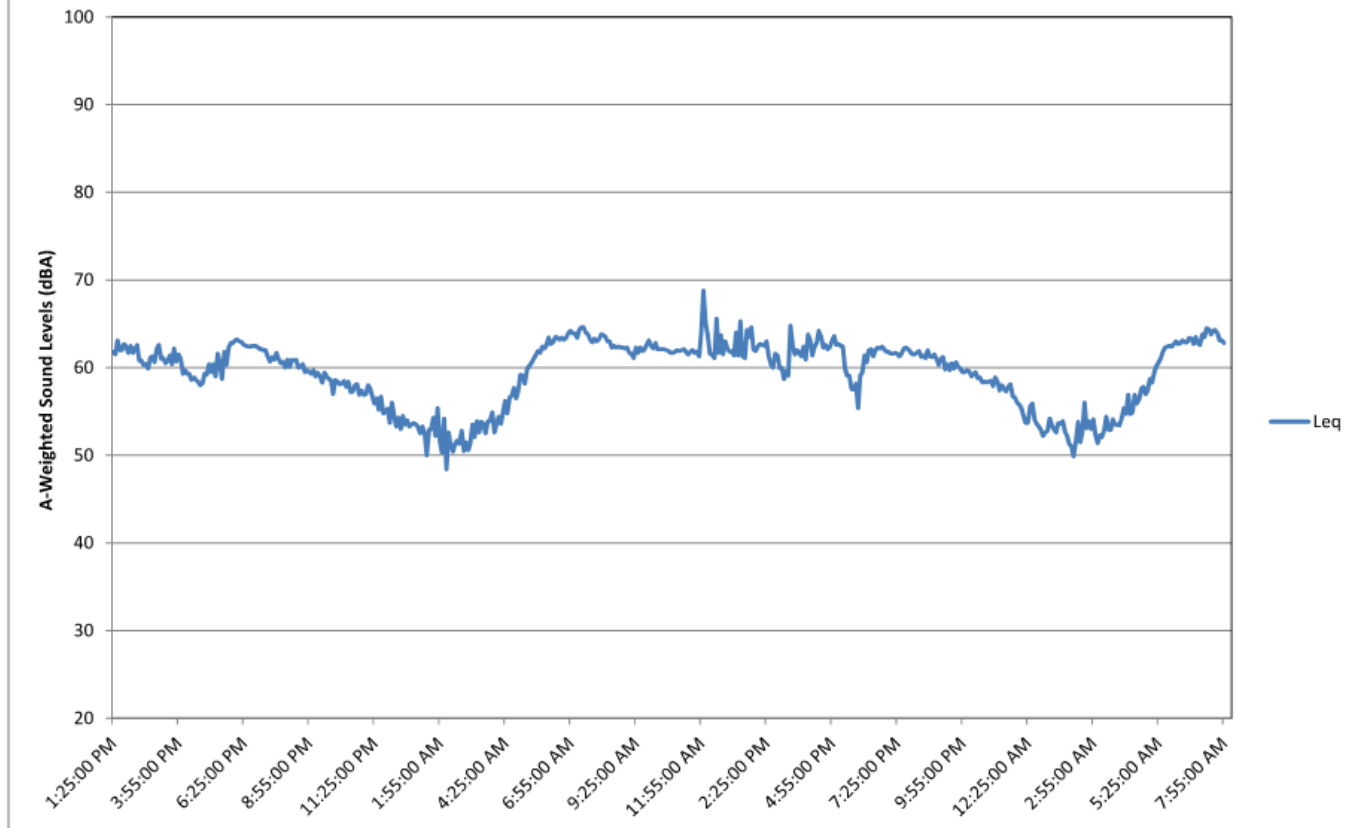


EXHIBIT A – SITE PLAN WITH PROPOSED BUILDINGS

