Phoenix Noise & Vibration, LLC
5216 Chairmans Court, Suite 107
Frederick, Maryland 21703
301.846.4227 (phone)
301.846.4355 (fax)
www.phoenixnv.com

9 September 2021
(Originally Dated 31 March 2021)

Century – Amendment Lots 2, 3, & 4
Phase I Noise Analysis

Montgomery County, Maryland

Report No. 210331
Project No. RDC2001

For: Shamit Development, Inc.

By: Eamon Curley
Josh Curley

Acoustical Engineering Solutions.

1 EXECUTIVE SUMMARY

Phoenix Noise & Vibration has conducted an analysis of transportation noise impact upon Amendment Lots 2, 3, and 4 of the Century development in Montgomery County, Maryland. Amendment Lots 2, 3, and 4 will contain an office building (Building C1), an office building with a parking garage (Building C2), two hotels (Buildings D and E), and two residential buildings (Buildings G and H). This study addresses noise impact upon Buildings D, E, G, and H, as noise impact upon office buildings and parking garages (Buildings C1 and C2) is not regulated by Montgomery County, and was limited to noise impact from surrounding roadways, primarily Dwight D. Eisenhower Memorial Highway (I-270).

Noise impact throughout the Century development will change with elevation; therefore, impact upon Amendment Lots 2, 3, and 4 has been presented throughout the development at the ground level (5 feet above grade) and across each future building facade. Impact is presented in varying colors and building elevations, indicating future transportation noise levels throughout the site and upon each residential unit. The noise levels presented are due only to the surrounding transportation sources and do not account for noise from other sources such as construction, mechanical noise, environmental noise, etc.

All calculated noise levels are "mitigated," accounting for the presence of existing topography, surrounding buildings, and significant structures, as well as the future Amendment Lot 2, 3, and 4 topography and buildings. Structures along roadways act as noise barriers, providing protection from noise exposure and reducing the impact and extent of any potential mitigation required, if any, to comply with the noise regulations of Montgomery County.

Noise levels throughout the outdoor exercise areas and basketball court to the east of the buildings will be as high as 76 dBA Ldn due to the proximity to I-270. If these are outdoor areas in which the County will require noise levels to be maintained below 60 dBA Ldn, additional mitigation will be required.

Residential units located on the elevations facing I-270 will be exposed to future transportation noise levels greater than 60 dBA Ldn, with noise impact up to 77 dBA Ldn for the upper levels of the east elevation of Buildings E, G, and H. Noise impact on Building D will be slightly lower, with a maximum noise impact of 69 dBA Ldn. Most of the residential units located on the north and south elevations and a very small portion on the west elevations of each building will also be exposed to future transportation noise levels greater than 60 dBA Ldn. Further analysis on these units is required to determine whether the proposed building architecture will be able to maintain interior noise levels below 45 dBA Ldn.

This analysis can only be conducted once architectural plans for each building are available and cannot typically be completed until after the Design Development drawing submission. If necessary, interior noise levels can be kept below 45 dBA Ldn by using exterior building components (walls, windows, and doors) with higher STC ratings than typical standard components.

The remaining residential units, primarily living units on the west elevations, will not be exposed to future transportation noise levels above 60 dBA Ldn. Further analysis on these residential units is not required. The proposed standard building construction may be used without modification for these living units.

Please note that after construction of the buildings on Lots 2, 3, and 4 is complete, the transportation noise impact upon the townhomes and two-over-two condominiums at Century closest to I-270 will be slightly lower. Transportation noise impact upon the townhomes and two-over-two condominiums closest to Century Boulevard will not be affected.

2 NOISE TERMINOLOGY

2.1 Ldn

The day-night average noise level, or Ldn, is the equivalent sound pressure level (average over a 24-hour period) obtained by adding 10 dB to sound pressure levels measured from 10:00 p.m. to 7:00 a.m. This 10 dB "penalty" accounts for the added sensitivity caused by noise generated during the nighttime hours. The Ldn is not a measurement of the instantaneous noise level.

The Ldn is sometimes referred to as the "Ldn," however, both terms represent the same quantity. The Ldn is NOT a measurement of the instantaneous noise level. It is very possible to have several short term events (tractor trailer, emergency vehicle siren, car horn, etc.) which generate a relatively high noise level (e.g. 85 dBA) during a given time period, yet have a more moderate overall Ldn value (e.g. 65 dBA Ldn).

2.2 dB vs. dBA

While the standard unit of measurement for sound is the decibel (dB), discussions of noise impacting the human ear use "dBA." The "A" refers to a frequency weighting network used to simulate the human ear's unequal sensitivity to different frequencies. The A-weighted noise level is therefore more representative of a human's perception of a noise environment than the unweighted overall noise level in dB and is currently used in most all environmental noise studies.

2.3 Summing Noise Levels

Noise levels from multiple sources do not add arithmetically, i.e. when two noise sources generate 60 dB individually, they do not produce 120 dB when combined. Noise levels are measured using a logarithmic scale; therefore, they must be summed logarithmically. In the decibel scale, two identical, non-coherent noise sources having the same noise level produce a 3 dB increase above the condition of one source alone (i.e. two 80 dB lawnmowers running at the same time generates 83 dB).

Similarly, two different noise sources with a difference of 10 dB in their individual levels results in no measurable increase in noise when they are combined. Put another way, the quieter noise source does not increase the overall noise generated by the louder source; i.e. adding an 80 dB lawnmower into a noise environment where a 90 dB lawnmower is already running does not increase the noise level above 90 dB.

3 NOISE REGULATIONS

Traffic noise impact for proposed residential developments in Montgomery County is governed by Table 2-1 (reprinted in Table 1) on page 8 of the *Staff Guidelines for the Consideration of Transportation Noise Impacts In Land Use Planning and Development* (June 1983). Accompanying this table is Map 2-1 (see Figure 1), indicating outdoor noise level requirements not to be exceeded throughout the County.

Table 1: Maximum Levels for Exterior Noise & Building Line[1] For Noise Sensitive Land Uses (Table 2-1).

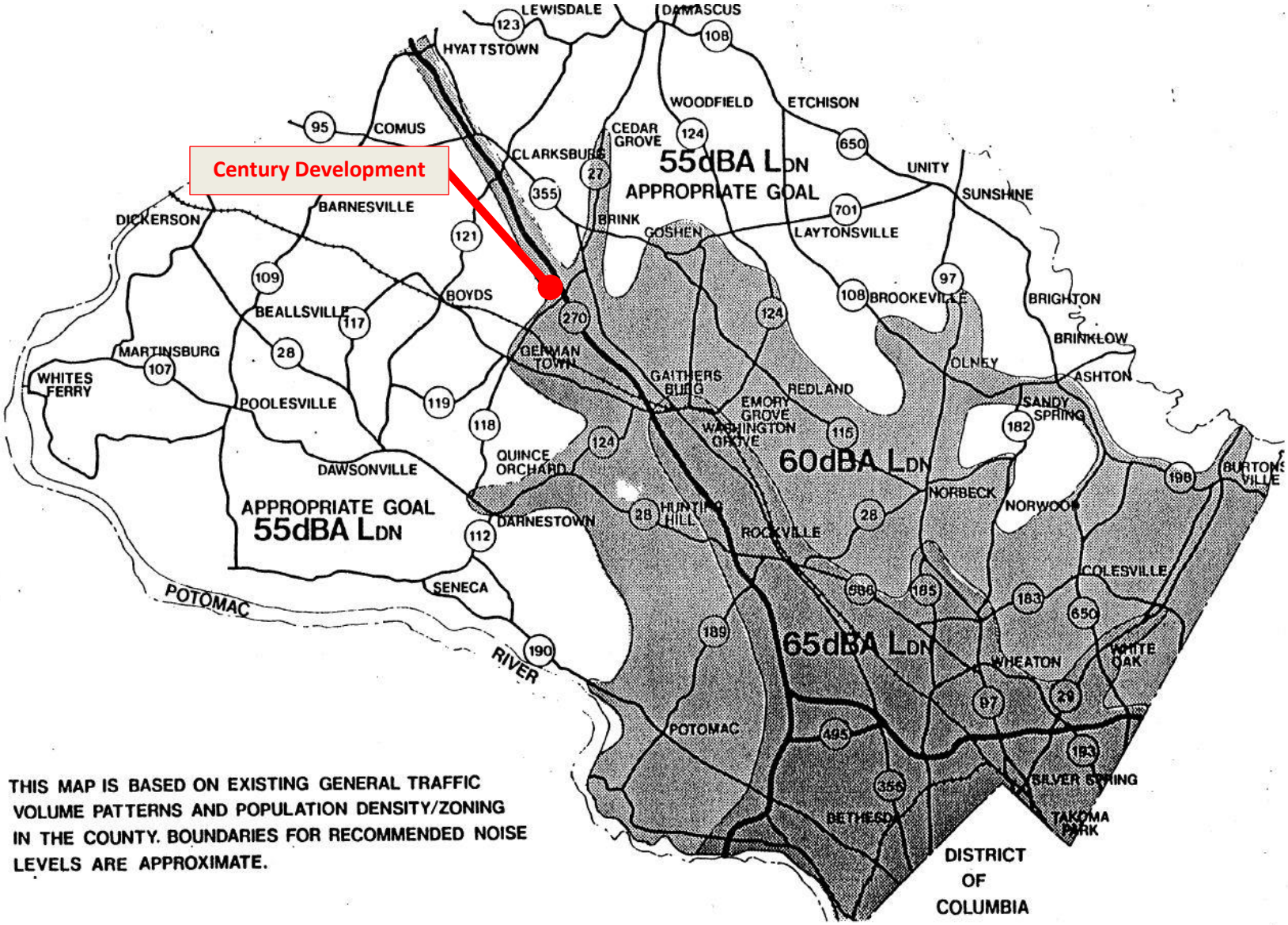
Guideline Value	Area of Application
Ldn = 55 dBA	This guideline is suggested as an appropriate goal in permanent rural areas of the County where residential zoning is for five or more acres per dwelling unit and background levels are low enough to allow maintenance of a 55 dBA Level. This guideline is consistent with Federal, State, and County goals for residential areas.
Ldn = 60 dBA	This is the basic residential noise guideline which will be applied in most areas of the County where suburban densities predominate. Maintenance of this level will protect health and substantially prevent activity interference both interiors and outdoors. Noise attenuation measures will be recommended to allow attainment of this level.
Ldn = 65 dBA	This guideline will generally be applied in the urban ring, freeway, and major highway corridor areas, where ambient levels are such that application of a stricter guideline would be infeasible or inequitable. Significant activity interference will occur outdoors and interiors if windows are partially opened, but available evidence indicates hearing is adequately protected. Noise attenuation measures will be strongly recommended to attain this level.

[1] Building line as used here refers to habitable structures only. It does not include garages, sheds, or recreational accessory buildings.

According to Map 2-1, the Century development is located within the 60 dBA Ldn noise zone, indicating that noise levels in the building's outdoor activity areas should be maintained at 60 dBA Ldn. Any outdoor area exposed to future transportation noise levels above 60 dBA Ldn typically requires further analysis to determine the mitigation designs necessary to comply with this requirement.

When outdoor noise levels exceed 60 dBA Ldn in this zone, Montgomery County also requires an analysis of interior noise levels in residential buildings. According to Sections 2.2.2 and 2.2.3 of the *Staff Guidelines*, any residential building impacted by noise levels above 60 dBA Ldn must be evaluated to certify that the building structure will be capable of maintaining interior noise levels at 45 dBA Ldn.

Figure 1: Map 2-1 from *Staff Guidelines for the Consideration of Transportation Noise Impacts In Land Use Planning and Development* (June 1983).

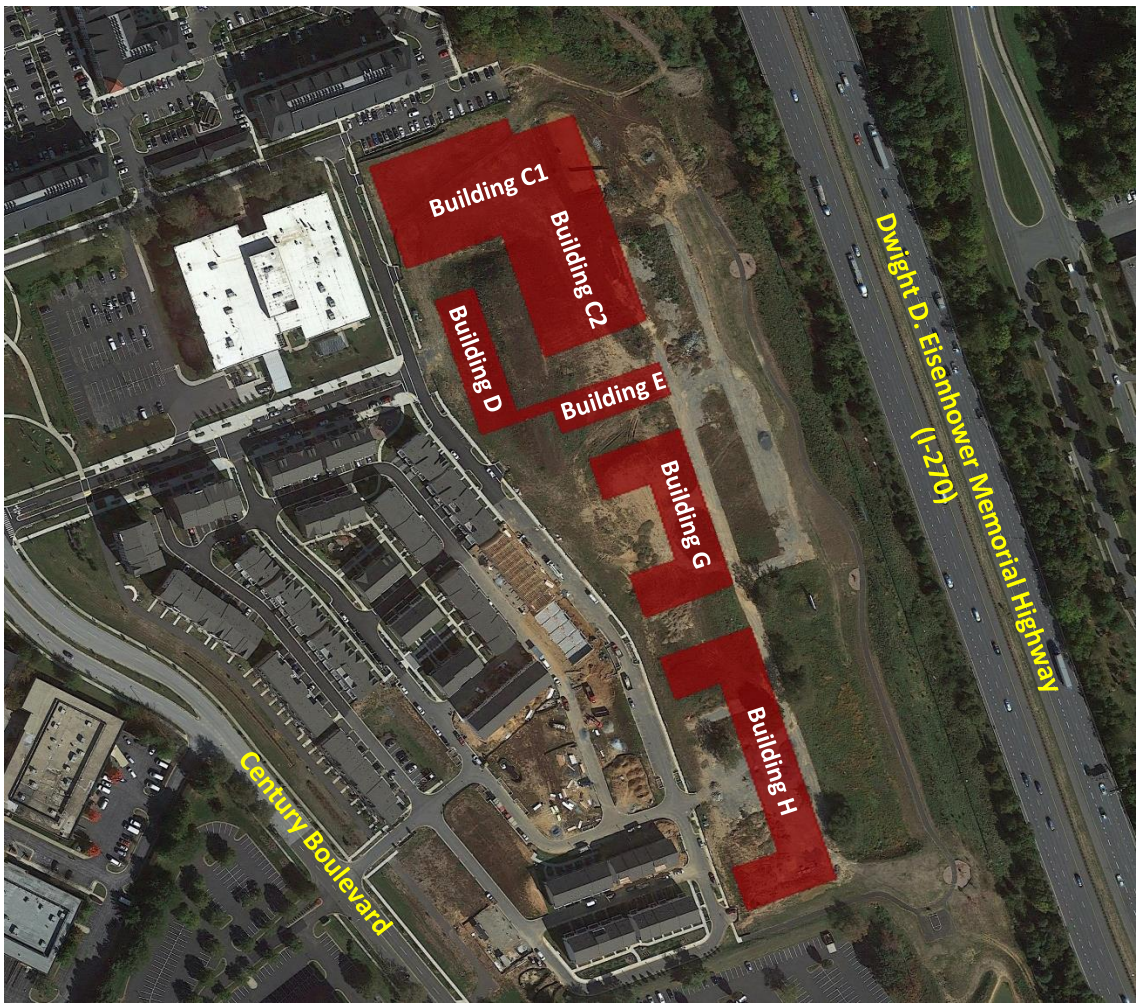


4 SITE CONDITIONS

Lots 2, 3, and 4 of the Century development (see Figure 2) are located west of Dwight D. Eisenhower Memorial Highway (I-270) and northeast of Century Boulevard. Near the site, I-270 is composed of four northbound and four southbound travel lanes. Century Boulevard is composed of two northbound and two southbound travel lanes.

Building C1 will be an office building. Building C2 will be an office building with parking. Buildings D and E will be hotels. Buildings G and H will be residential buildings.

Figure 2: The buildings of Lots 2, 3, and 4 of the Century development (outlined in red) and surroundings. Aerial image (dated October 8, 2020) courtesy of Google Earth.



5 BACKGROUND

Phoenix Noise & Vibration previously completed a Phase I Noise Analysis for the Century development[1] which addressed noise impact upon the townhome and two-over-two condominium portion of the site. As part of that Phase I Noise Analysis, noise measurements were taken on September 17-18, 2015, and a computer model was developed to determine the future transportation noise impact upon the townhomes and two-over-two condominiums within the site. The buildings on Lots 2, 3, and 4 were included in the analysis (as planned at the time) to account for the noise reduction they will provide to the townhomes and two-over-two condominiums; however, the noise impact upon the Lot 2, 3, and 4 buildings was not evaluated.

6 COMPUTER MODELING

Since the completion of the previous Phase I Noise Analysis, the Lot 2, 3, and 4 site plan has been modified to include two additional multifamily buildings, two hotels, an office building, and an office building with a parking garage within the development. The computer model developed for the townhome and two-over-two condominium analysis was updated to include the latest future topography and buildings for Lots 2, 3, and 4, and used to calculated noise impact throughout the site.

The site was computer-modeled using the CadnaA software program, a three-dimensional noise propagation model capable of determining noise impact from multiple noise sources across vertical and horizontal surfaces while accounting for factors such as topography, buildings, barriers, surface reflections, and roadway data (traffic volumes, speeds, and vehicle classifications, etc.). Noise levels can be presented either in spot locations or as noise contours of equal value throughout a defined surface area.

Roadway data for I-270 was also updated in the model to account for 20 years from the date of this analysis. The Maryland State Highway Administration (MDSHA does not typically provide future traffic data; therefore, a conservative, 2% increase in traffic compounded annually until 2041 was assumed.[2]

Traffic volumes for the future Century Boulevard alignment were based upon a traffic study completed for the development[3] which calculated future morning and evening peak hour traffic volumes for the various sections of the roadway along the site's western property boundary. The traffic study did not calculate an AAWDT for Century Boulevard; therefore, it was assumed that

[1] Century Phase I Noise Analysis, Report #150929, dated 9 November 2015.

[2]Montgomery County typically requires that roadway noise impact studies be conducted using the projected traffic volumes 20 years from the date of the study.

[3] Report by Integrated Transportation Solutions, Inc. dated July 2015 prepared for Century Technology Campus, LLC.

the peak hour volume represented 8% of the total AAWDT.[4] The traffic study also did not provide estimated nighttime or truck volumes; thus these were taken from the current MDSHA data. All necessary traffic data for both roadways is provided in Table 2.

Table 2: Roadway traffic data used in the computer models.

Roadway	2014 AAWDT	2041 AAWDT	Nighttime Volume %	Truck %	Posted Speed Limit (mph)
I-270	121,392	207,202	18.6%	14%	55
Century Boulevard	3,412	15,675 to 21,750	7.0%	3%	30

Table 2 Notes:

A. All values are based upon MDSHA roadway data other than the future AAWDT for Century Boulevard.
B. The AAWDT for the future Century Boulevard varies depending upon the roadway section, with volumes increasing traveling north to south along the roadway.

The updated future model then calculated noise levels throughout the outdoor exercise areas and basketball court as shown on Drawing 1 of the Appendix. Noise levels presented within these areas were calculated at a height of 5 feet above the ground.

The future model also calculated the projected noise levels across all future building facades (shown on Drawing 2 of the Appendix). The varying colors on the building elevations on Drawing 2 represent the future noise impact at that location. Note how the noise level changes with respect to height and orientation to the roadways.

All noise levels presented on Drawings 1 and 2 are "mitigated" noise levels, calculated in the presence of the future buildings and topography, as well as all existing surrounding buildings, topography, and significant structures. Mitigated noise levels account for the effect of buildings and other significant structures in reducing and reflecting roadway noise propagation and are more representative of the actual noise level experienced at a specific location.

[4] Based upon a recommendation from C. Craig Hedberg, President of Integrated Transportation Solutions. According to Mr. Hedberg, in his experience the peak hour typically represents 8% to 9% of the AAWDT for roadways in Montgomery County. The 8% value was used to remain slightly conservative in the analysis.

7 FUTURE NOISE IMPACT

Drawing 1 of the Appendix indicates that noise levels throughout the outdoor exercise areas and basketball courts will be above 60 dBA Ldn and higher than 75 dBA Ldn in certain areas. If these are outdoor areas in which the County will require noise levels to be maintained below 60 dBA Ldn, additional mitigation will be required.

Future transportation noise levels were calculated across each future building elevation (see Drawing 2 of the Appendix). Noise impact upon the residential buildings within Lots 2, 3, and 4 is summarized in Table 3.

Table 3: Noise impact upon Lots 2, 3, and 4 of the Century development.

	Future Noise Impact (dBA Ldn)			
Elevation	**Building D**	**Building E**	**Building G**	**Building H**
North	<60	<60 to 73	66 to 74	67 to 74
East	<60 to 69	74 to 77	74 to 77	74 to 77
South	<60 to 65	65 to 73	67 to 74	69 to 74
West	≤60	≤60	<60 to 66	<60 to 65

Residential units located on the elevations facing I-270 will be exposed to future transportation noise levels greater than 60 dBA Ldn, with noise impact up to 77 dBA Ldn for the upper levels of the east elevation of Buildings E, G, and H. Noise impact on Building D will be slightly lower, with a maximum noise impact of 69 dBA Ldn.

The majority of the residential units located on the north and south elevations and a small portion of the west elevations of each building will also be exposed to future transportation noise levels greater than 60 dBA Ldn. Further analysis on these units is required to determine whether the proposed building architecture will be able to maintain interior noise levels below 45 dBA Ldn.

The remaining residential units will not be exposed to future transportation noise levels above 60 dBA Ldn. These residences require no further analysis or modifications to comply with the residential noise regulations of Montgomery County.

8 MITIGATION

According to Montgomery County's noise regulations for residential development in this area of the county, residential sites and buildings impacted by noise levels above 60 dBA Ldn (at any height) require further analysis to determine the mitigation measures necessary to maintain noise levels in outdoor activity areas and interior living spaces below 60 and 45 dBA Ldn, respectively.

8.1 Outdoor Noise Levels

Noise levels throughout the outdoor exercise areas and basketball court to the east of the buildings will be as high as 76 dBA Ldn due to the proximity to I-270. If these are outdoor areas in which the County will require noise levels to be maintained below 60 dBA Ldn, additional mitigation will be required.

8.2 Interior Noise Levels

Residential buildings exposed to noise levels above 60 dBA Ldn require further analysis to determine whether the proposed building construction will be capable of maintaining interior noise levels below 45 dBA Ldn. This evaluation, or "building shell analysis," calculates a room's interior noise level based upon its exterior noise level, the Sound Transmission Class (STC) ratings[5] of its various building components, the amount of exposed exterior wall area, and the room's size and finish.

Modifications to standard building construction may not be necessary for all units impacted by future noise levels above 60 dBA Ldn. It is possible that the proposed standard building construction will provide enough noise reduction to maintain the required 45 dBA Ldn interior noise level, particularly for units with noise impact below 65 dBA Ldn.

When architectural drawings are available for each residential building (typically during the Design Development phase), noise impact will be analyzed on an elevation-by-elevation, floor-by-floor basis for each individual residential unit impacted by transportation noise levels above 60 dBA Ldn. Likewise, mitigation requirements will also be provided for each individual residential unit. Calculating minimum STC ratings specific to each unit reduces "overbuilding" (i.e. installing windows/doors with unnecessarily high STC ratings).

[5] The STC rating is a single number value which describes a building element's (wall, window, door, roof, etc.) ability to reduce noise transmission from one side of the partition to the other.

9 CONCLUSION

Buildings D, E, G, and H of the proposed Century development will be exposed to future transportation noise levels above 60 dBA Ldn and up to 77 dBA Ldn. While this represents a high level of noise impact, compliance with Montgomery County's residential noise regulations can be achieved through modifications to proposed building plans.

Noise levels throughout the outdoor exercise areas and basketball court to the east of the buildings will be as high as 76 dBA Ldn. If these are outdoor areas in which the County will require noise levels to be maintained below 60 dBA Ldn, additional mitigation will be required.

Residential units located on the elevations facing I-270 will be exposed to future transportation noise levels greater than 60 dBA Ldn, with noise impact up to 77 dBA Ldn for the upper levels of the east elevations of Buildings E, G, and H. Noise impact on Building D will be slightly lower, with a maximum noise impact of 69 dBA Ldn. Further analysis on these units is required to determine whether the proposed building architecture will be able to maintain interior noise levels below 45 dBA Ldn.

Residential units which will not be exposed to future transportation noise levels above 60 dBA Ldn, primarily those on the west elevations, require no further analysis. The proposed standard building construction may be used without modification for these living units.

Please note that after construction of Buildings C1, C2, D, E, G, and H, the transportation noise impact upon the townhomes and two-over-two condominiums at Century closest to I-270 will be slightly lower; however, transportation noise impact upon the townhomes and two-over-two condominiums closest to Century Boulevard will not be affected.

APPENDIX