NOISE ANALYSIS SUMMARY MEMORANDUM

US 29 Bus Rapid Transit Improvements Project

From Burtonsville to Silver Spring Transit Center

Montgomery County, Maryland

GetOnBoardBRT
BUS RAPID TRANSIT IN MONTGOMERY COUNTY

June 2017

I. AFFECTED ENVIRONMENT

This memorandum presents the background, methodology, and results of the noise analysis for the US 29 Bus Rapid Transit (BRT) Improvements Project. A noise assessment was conducted in accordance with National Environmental Policy Act (NEPA) and the guidelines set forth by Federal Transit Administration (FTA). The operational effects were evaluated using the guidelines set forth by the FTA's Transit Noise and Vibration Assessment guidance manual, report FTA-VA-90-1003-06, dated May 2006.

The project proposes a new, 14-mile Bus Rapid Transit (BRT) service along US 29 from the Silver Spring Transit Center (SSTC) to the Burtonsville Park and Ride. The project includes new BRT service along existing travel lanes and shoulders; design and construction of eleven station stops along the corridor; implementation of Transit Signal Priority (TSP) at several signalized intersections; and improvements to landscapes, sidewalk, and bicycle facilities. The purpose of the project is to improve mobility options by accommodating a high frequency, reliable transit service operating within existing right-of-way (ROW) on US 29 between the SSTC and the Burtonsville Park and Ride.

This section provides background information on human perception of noise, the regulatory framework, and noise assessment methodology.

A. Human Perception of Noise

Per the Federal Transit Administration (FTA), noise is generally considered unwanted sound. Three factors generally affect the level of sound as perceived by the human ear: amplitude (quiet or loud), frequency (low or high pitch), and time pattern (variability). First, the loudness of sound is measured in decibels (dB) that can range from 0 dB (the threshold of hearing) to about 120 dB. Second, the number of times sound waves occur in one second is frequency, expressed in Hertz (Hz). Humans can typically detect noises ranging from 20 Hz to 20,000 Hz. The frequency of a noise will impact how it sounds. For example, a low-frequency noise is a rumble, and a high-frequency noise is a whistle. Third, the time pattern of noise sources can be characterized as: continuous, such as with a ventilation fan; intermittent, such as for trains passing by; or impulsive, such as pile-driving activities during construction.

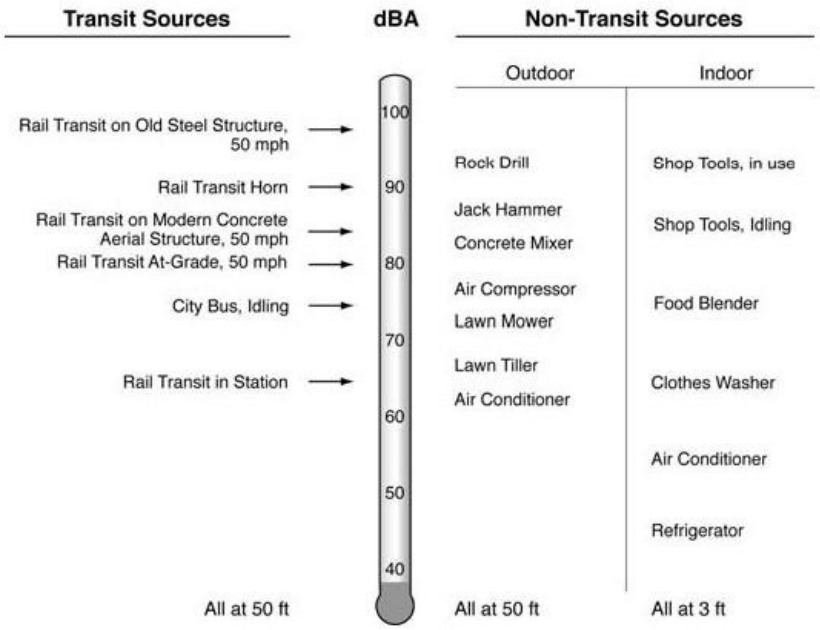
The amplitude and frequency of sound are affected by the distance between the source and receiver. That is, the observed sound level decreases as the distance between source and receiver increases. This reduction is due to several factors: divergence (spreading) of sound energy over a greater area; absorption of sound as it travels over sound-absorbing surfaces such as grass; and, shielding from building rows, noise barriers, or vegetation.

Various sound metrics are used to quantify noise from transit sources. The A-weighted decibel (abbreviated "dBA") is used to describe the overall noise level and closely matches the human ear's response to audible frequencies. Typical A-weighted sound levels from transit and other common sources are shown in **Figure 1**. The following A-weighted noise metrics are used to describe impacts from transit related sources:

- L_{max} – The maximum noise level that occurs during an event (such as a train pass-by);
- L_{eq} – The equivalent sound level, which is the level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a given time interval (such as one hour); and

- L_{dn} – The 24-hour day-night average sound level, an average sound level which includes a 10-decibel penalty added between 10:00 pm and 7:00 am to account for greater nighttime sensitivity to noise.
- SEL – The sound exposure level that converts the cumulative noise energy of an event into one second.

Figure 1: Typical A-Weighted Sound Levels



Source: *Transit Noise and Vibration Impact Assessment*, Federal Transit Administration, Washington, DC, May 2006.

B. Regulatory Framework and Evaluation Criteria

1. Operational Noise Criteria

The FTA's guidance manual, *Transit Noise and Vibration Impact Assessment*, presents the basic concepts, methods and procedures for evaluating the extent and severity of noise impacts from transit projects. Transit noise impacts are assessed based on land use categories and sensitivity to noise from transit sources under the FTA guidelines. The FTA land use categories and required noise metrics are shown in **Table 1**.

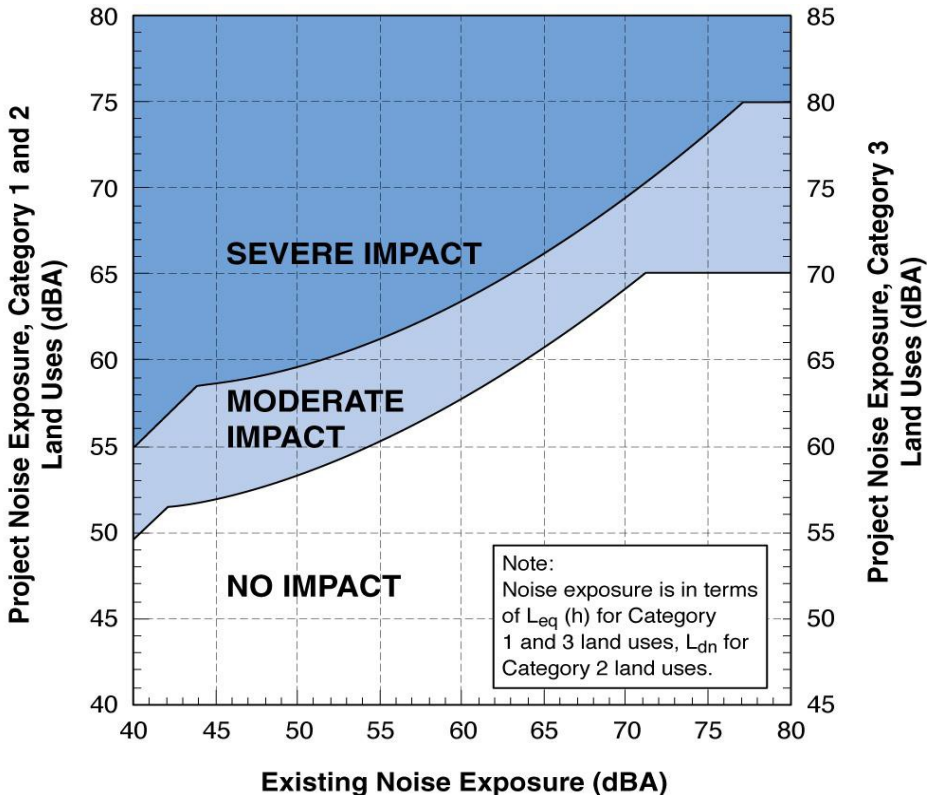
Table 1: FTA Land Use Categories and Noise Metrics

Land-Use Category	Noise Metric	Description
1	$L_{eq}(h)$	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and historic landmarks.
2	L_{dn}	Buildings used for sleeping such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance.
3	$L_{eq}(h)$	Institutional land uses with primarily daytime and evening uses including schools, libraries, churches, museums, cemeteries, historic sites, and parks, and certain recreational facilities used for study or meditation.

Source: *Transit Noise and Vibration Impact Assessment*, Federal Transit Administration, Washington, DC, May 2006.

The FTA noise impact criteria are defined by two curves, as shown in **Figure 2**. The noise impact criteria are delineated into two categories: *moderate* and *severe* impact. The *moderate* impact threshold defines areas where the change in noise is noticeable but may not be sufficient to cause a strong, adverse community reaction. The *severe* impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site is established by comparing the predicted future Project noise level at the site to the existing noise level at the site.

Figure 2: Noise Impact Criteria for Transit Projects



Source: *Transit Noise and Vibration Impact Assessment*, Federal Transit Administration, Washington, DC, May 2006.

The L_{dn} is used to characterize noise exposure for FTA Category 2 residential areas in this study. The L_{dn} metric describes a receiver's cumulative noise exposure from all events over 24 hours. For Category 3 noise sensitive land uses, the average hourly equivalent sound level $L_{eq}(h)$ is used to represent the peak operating hour.

No Category 1 land uses were identified with this project.

II. EXISTING CONDITIONS

To establish existing noise levels in vicinity of the project, a noise monitoring program was conducted from April 12 to April 13, 2017 to document existing conditions at representative sensitive receptors along the study corridor. See **Figure 3** for measurement locations.

The noise monitoring was conducted near residences on Sligo Creek Parkway, Sonata Way and Wexhall Drive. Measured noise levels at these receptor locations were used to estimate noise levels at other nearby noise sensitive sites with similar proximities to existing and proposed facilities in the area. The most significant existing noise source in the study corridor was determined to be vehicular traffic on US 29.

As summarized in **Table 2**, measured day-night noise levels range from 63 to 67 dBA. Loudest one-hour noise levels range from 62 to 66 dBA.

Table 2: Existing Noise Levels

Receptor Location	Distance from Source to Receptor (ft)	FTA Land Use Category	FTA Description	24-Hour L_{dn} (dBA)	Loudest One-Hour $L_{eq(h)}$ (dBA)
Sligo Creek Parkway	170	2	Residential	63	62
Sonata Way	95	2	Residential	67	66
Wexhall Drive	90	2	Residential	67	66

III. FUTURE BUILD CONDITIONS

A. Operational Noise

1. General Assessment of the Proposed Project

In the southern portion of the study corridor, some first-row residences were found to be significantly closer in proximity to US 29 than the Sligo Creek Parkway receptor location, with distances as short as 40 feet in some cases. Therefore, a noise level adjustment was made so that analysis of these residences would account for existing noise levels that are greater than those measured at Sligo Creek. This adjustment follows the line source rule, which is a +3dB adjustment for each instance the distance is halved between the roadway and receiver. The adjustment from 170 feet to 40 feet is +6 dB, and is reflected in the data from this point forward. Receptor locations at Sonata Way and Wexhall Drive are reasonably representative of the distances between first-row residences and the roadway in the middle and northern sections of the corridor, 95 feet and 90 feet respectively, therefore no such adjustment is needed.

Noise impacts were assessed using the FTA General Assessment methodology for Category 2 (residential) and Category 3 (commercial) land uses. The offset distance is to the closest building observed along that section of roadway, and is representative of the worst case scenario, closest to the proposed station stop study areas. The Category 2 analysis is based upon L_{dn}, while Category 3 is uses L_{eq}. For Category 2 land uses, L_{dn} noise levels generated by the project-only are predicted to range from 49 to 57 dBA. Since these noise levels are significantly lower than the impact criteria for each receptor, the project is predicted to create no impact at any Category 2 land use adjacent to US 29 in the study corridor. For Category 3, predicted project-only L_{eq} noise levels range from 45 to 54 dBA, which also indicate no impact.

Table 3 shows the service plan data used for the analysis. **Tables 4** and **5** summarize the results of the operational effects analysis for each land use category.

Figure 3: Noise Measurement Locations

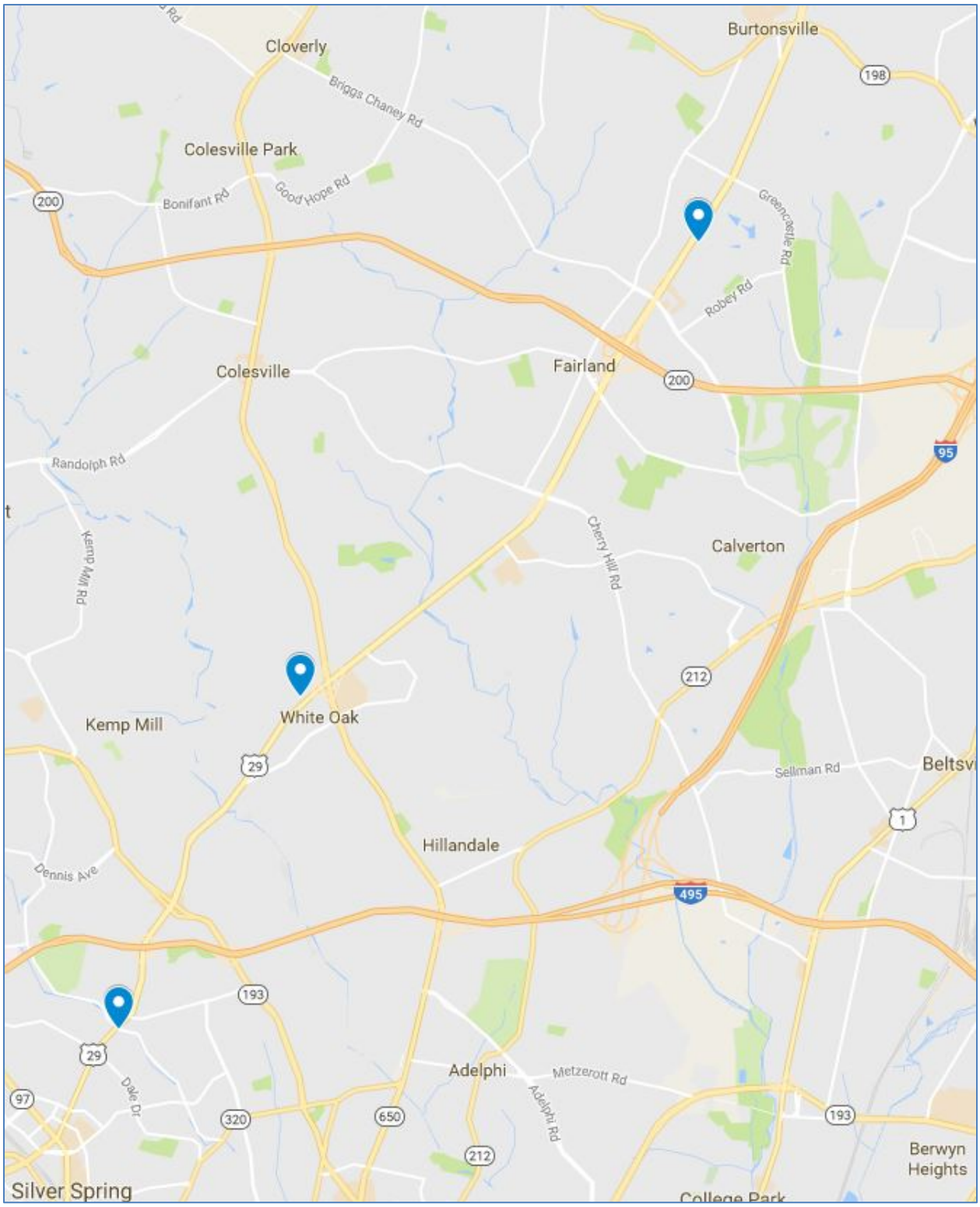


Table 3: US 29 BRT Service Plan

Monday – Friday	Burtonsville Park and Ride directly to Silver Spring Transit Center	Briggs Chaney Park and Ride to Silver Spring Transit Center via Lockwood Drive/ Stewart Lane
5:00 am – 6:00 am	30 minute headway	30 minute headway
6:00 am – 9:00 am	15 minute headway	15 minute headway
9:00 am – 3:30 pm	none	15 minute headway
3:30 pm – 6:30 pm	15 minute headway	15 minute headway
6:30 pm – 9:00 pm	30 minute headway	15 minute headway
9:00 pm - midnight	none	30 minute headway
Saturday	**Burtonsville Park and Ride directly to Silver Spring Transit Center**	**Briggs Chaney Park and Ride to Silver Spring Transit Center via Lockwood Drive/ Stewart Lane**
7:00 am to 9:00 am	None	20 minute headway
9:00 am – 7:00 pm	None	15 minute headway
7:00 pm - midnight	None	20 minute headway
Sunday	**Burtonsville Park and Ride directly to Silver Spring Transit Center**	**Briggs Chaney Park and Ride to Silver Spring Transit Center via Lockwood Drive/ Stewart Lane**
7:00 am – 9:00 am	None	20 minute headway
9:00 am – 7:00 pm	None	15 minute headway
7:00 pm - midnight	None	20 minute headway

Note: Service plan is current as of March 15, 2017. Service plan is subject to change.

Table 4: Operational Effects Analysis for US 29 Land Use Category 2 (Residential)

Receptor Location	Offset Distance	Noise Metric	Existing Noise Level	Project Noise Impact Criteria		Project Noise Levels	Impact Type
				Moderate	Severe		
Sligo Creek Parkway	42’	L_{dn}	69	64	69	57	None
Sonata Way	95’	L_{dn}	67	62	67	49	None
Wexhall Drive	90’	L_{dn}	67	62	67	50	None

Table 5: Operational Effects Analysis for US 29 Land Use Category 3 (Commercial)

Receptor Location	Offset Distance	Noise Metric	Existing Noise Level	Project Noise Impact Criteria		Project Noise Levels	Impact Type
				Moderate	Severe		
Sligo Creek Parkway	42’	L_{eq}	68	68	73	54	None
Sonata Way	95’	L_{eq}	66	66	72	45	None
Wexhall Drive	90’	L_{eq}	66	66	72	46	None

An analysis was also performed for the proposed station stops along Stewart Lane and Lockwood Drive. This portion of the study corridor consists of a 2-lane roadway with primarily Category 2 residential land use, in addition to some Category 3 use. Noise measurements were not recorded along this study corridor portion; however existing noise levels can be estimated to range from 55 to 60 dBA per the FTA guidance manual, **Table 5-7**, Estimating Existing Noise Exposure for General Assessment for typical community L_{dn} levels. See **Figures 4 and 5** for FRA guidance on typical L_{dn} and L_{eq} existing noise levels.

Using a Category 2 land use analysis, the project L_{dn} is predicted to be 52 dBA at 40 feet. At this predicted project L_{dn} noise level, in order to be considered impacted, the existing community L_{dn} noise level would need to be 47 dBA, which is much lower than the actual typical range of 55 to 60 dBA for this environment. Therefore, no impact is predicted. Similarly, no impact is predicted for Category 3 land uses given a project L_{eq} of 51 dBA, which would require an existing community L_{eq} noise level of only 35 dBA to create an impact.

Table 6 shows the results of the operational effects analysis for each land use category on Stewart Lane and Lockwood Drive. **Table 7** shows the FTA Noise Impact Criteria for each land use category.

Table 6: Operational Effects Analysis for Stewart Lane / Lockwood Drive

Receptor Location	Analysis Type	Noise Metric	Typical Existing Noise Level	Existing Noise Level Necessary to Trigger Impact	Project Noise Levels	Impact Type
Stewart Ln / Lockwood Dr	Category 2	L_{dn}	55-60	47	52	None
Stewart Ln / Lockwood Dr	Category 3	L_{eq}	50-60	35	51	None

Figure 4: Day-Night Sound Levels in Typical Environments

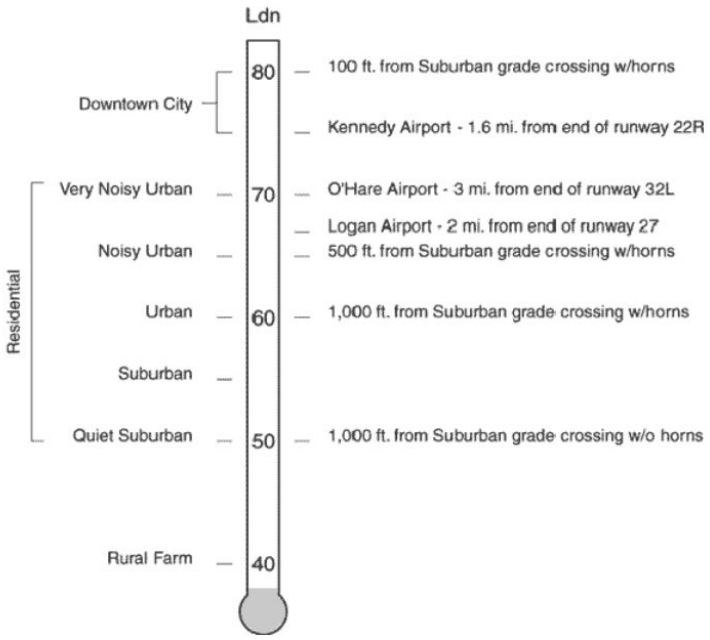


Figure 5: Equivalent Hourly Sound Levels in Typical Environments

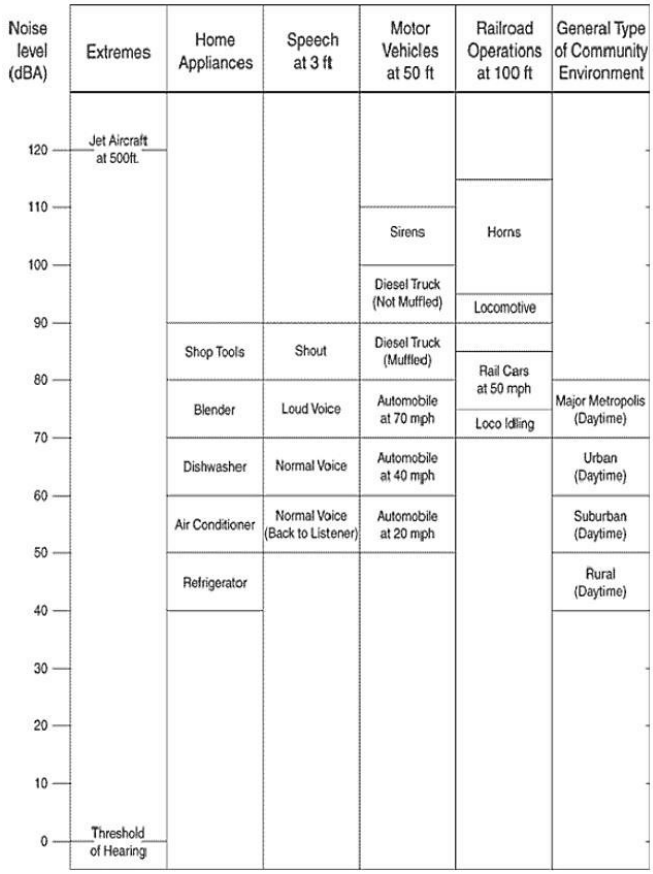


Table 7: FTA Noise Impact Criteria

Existing Noise Exposure Leq or Ldn	Project Noise Exposure Impact Thresholds, Leq or Ldn (dBA)			
	Category 1 or 2 Land Uses		Category 3 Land Uses	
Moderate Impact	Moderate Impact	Severe Impact	Moderate Impact	Severe Impact
<43	Ambient+10	Ambient+15	Ambient+15	Ambient+20
43	52	58	57	63
44	52	58	57	63
45	52	58	57	63
46	53	59	58	64
47	53	59	58	64
48	53	59	58	64
49	54	59	59	64
50	54	59	59	64
51	54	60	59	65
52	55	60	60	65
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57	57	62	62	67
58	57	62	62	67
59	58	63	63	68
60	58	63	63	68
61	59	64	64	69
62	59	64	64	69
63	60	65	65	70
64	61	65	66	70
65	61	66	66	71
66	62	67	67	72
67	63	67	68	72
68	63	68	68	73
69	64	69	69	74
70	65	69	70	74
71	65	70	71	75
72	66	71	71	76
73	66	71	71	76
74	66	72	71	77
75	66	73	71	78
76	66	74	71	79
77	66	74	71	79
>77	66	75	71	80

Source*: FTA Guidance Manual,* May 2006, Ref. 1.

Notes:

1. *Ldn is used for land uses where nighttime sensitivity is a factor; maximum one hour Leq is used for land use involving only daytime activities. All values in this table are rounded up to the nearest integer.*
2. *Impact thresholds are rounded up to the nearest decibel.*

B. Construction Noise

Land uses that are sensitive to transportation noise are also sensitive to construction noise. Temporary noise impacts may occur from construction activity related to the proposed BRT station stops. Areas around the construction zones will experience varied periods and degrees of noise that differ from that of surrounding ambient community noise levels. The contractor's operations should be performed in such a manner that noise levels should not substantially impact nearby noise sensitive activities.

Generally, increased noise and vibration are limited to areas within 300 feet of the source. To limit the effects, construction activities would be executed in accordance with the Montgomery County Noise Control Ordinance. The ordinance contains certain standards specific to construction noise, and the Department of Environmental Protection has several tools available to help mitigate and regulate this potential source of disturbance.

IV. CONCLUSION

Using the FTA General Assessment methodology, the project is predicted to create no impact to Category 2 or 3 land uses in the project corridor; therefore, no mitigation is warranted.