Appendix C

Noise and Vibration

A. INTRODUCTION

This appendix provides further detail on the methodologies used to assess the potential for noise and vibration impacts from operation of the proposed HBLR project. Calculation spreadsheets, supporting the analysis results shown in the Environmental Assessment (EA) "Noise and Vibration" section, are also included.

B. NOISE FUNDAMENTALS, STANDARDS, AND IMPACT CRITERIA

AIRBORNE NOISE FUNDAMENTALS

Quantitative information on the effects of airborne noise on people is well documented. If sufficiently loud, noise may adversely affect people in several ways. For example, noise may interfere with human activities, such as sleep, speech communication, and tasks requiring concentration or coordination. It may also cause annoyance, hearing damage, and other physiological problems. Several noise scales and rating methods are used to quantify the effects of noise on people. These scales and methods consider such factors as loudness, duration, time of occurrence, and changes in noise level with time. However, all the stated effects of noise on people are subjective.

Sound pressure levels are measured in units called "decibels" (dB). The particular character of noise that we hear (a whistle compared with a French horn, for example) is determined by the rate, or "frequency," at which the air pressure fluctuates, or "oscillates." Frequency defines the oscillation of sound pressure in terms of cycles per second. One cycle per second is known as 1 Hertz (Hz). People can hear over a relatively limited range of sound frequencies, generally between 20 Hz and 20,000 Hz, and the human ear does not perceive all frequencies equally well. High frequencies (from a whistle, for example) are more easily discerned and therefore more intrusive than many of the lower frequencies (the lower notes on the French horn, for example).

"A"-Weighted Sound Level (dBA)

To bring a uniform noise measurement that simulates people's perception of loudness and annoyance, the decibel measurement is weighted to account for those frequencies most audible to the human ear. This is known as the A-weighted sound level, or "dBA," and it is the most often used descriptor of noise levels where community noise is the issue. As shown in **Table 1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (as in a library, for example) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of acceptable daily activity; levels above 70 dBA would be considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA. For most people to perceive an increase in noise, the increase must be at least 3 dBA. At 5 dBA, the change will be readily noticeable (Bolt, Beranek and Newman, 1973). An increase of 10 dBA is generally perceived as a doubling of loudness.

It is also important to understand that combinations of different sources are not additive in an arithmetic manner, because of the dBA scale's logarithmic nature. For example, two noise sources—for instance, a vacuum cleaner operating at approximately 72 dBA and a telephone ringing at approximately 58 dBA—do not combine to create a noise level of 130 dBA, the equivalent of a jet airplane or air raid siren (see **Table 1**). In fact, the noise produced by the telephone ringing may be masked by the noise of the vacuum cleaner and not be heard. The logarithmic combination of these two noise sources would yield a noise level of 72.2 dBA.

Table 1
Common Noise Levels

Sound Source	(dBA)
Military jet, air raid siren	130
Amplified rock music	110
Jet takeoff at 500 meters	100
Freight train at 30 meters	95
Train horn at 30 meters	90
Heavy truck at 15 meters	
Busy city street, loud shout	80
Busy traffic intersection	
Highway traffic at 15 meters, train	70
Predominantly industrial area	60
Light car traffic at 15 meters, city or commercial areas or residential areas close to industry	
Background noise in an office	50
Suburban areas with medium density transportation	
Public library	40
Soft whisper at 5 meters	30
Threshold of hearing	0

Note: A 10 dBA increase in level appears to double the loudness, and a 10 dBA decrease halves the apparent loudness.
Source: Cowan, James P. *Handbook of Environmental Acoustics*. Van Nostrand Reinhold, New York, 1994. Egan, M. David, *Architectural Acoustics*. McGraw-Hill Book Company, 1988.

Effects of Distance on Noise

Noise varies with distance. For example, highway traffic 50 feet away from a receptor (such as a person listening to the noise) typically produces sound levels of approximately 70 dBA. The same highway noise measures 66 dBA at a distance of 100 feet, assuming soft ground conditions. This decrease is known as "drop-off." The outdoor drop-off rate for line sources, such as traffic, is a decrease of approximately 4.5 dBA (for soft ground) for every doubling of distance between the noise source and receptor (for hard ground the outdoor drop-off rate is 3 dBA for line sources). Assuming soft ground, for point sources, such as amplified rock music, the outdoor drop-off rate is a decrease of approximately 7.5 dBA for every doubling of distance between the noise source and receptor (for hard ground the outdoor drop-off rate is 6 dBA for point sources).

Noise Descriptors Used in Impact Assessment

The sound-pressure level unit of dBA describes a noise level at just one moment, but since very few noises are constant, other ways of describing noise over more extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific period as if it were a steady, unchanging sound (i.e., as if it were averaged over that time period). For this condition, a descriptor called the "equivalent sound level," L_{eq}, can be computed. L_{eq} is the constant sound level that, in a given situation and period (e.g., 1 hour, denoted by $L_{eq(1)}$, or 24 hours, denoted as $L_{eq(24)}$), conveys the same sound energy as the actual time-varying sound.

A descriptor for cumulative 24-hour exposure is the day-night sound level, abbreviated as L_{dn}. This is a 24-hour measure that accounts for the moment-to-moment fluctuations in A-weighted noise levels due to all sound sources during 24 hours, combined. Mathematically, the L_{dn} noise level is the energy average of all $L_{eq(1)}$ noise levels over a 24-hour period, where nighttime noise levels (10 PM to 7 AM) are increased by 10 dBA before averaging.

Following FTA guidance, either the maximum $L_{eq(1)}$ sound level or the L_{dn} sound level is used for impact assessment, depending on land use category as described below.

VIBRATION FUNDAMENTALS

Fixed railway operations have the potential to produce high vibration levels, since railway vehicles contact a rigid steel rail with steel wheels. Train wheels rolling on the steel rails create vibration energy that is transmitted into the track support system. The amount of vibrational energy is strongly dependent on such factors as how smooth the wheels and rails are and the vehicle suspension system. The vibration of the track structure "excites" the adjacent ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. As the vibration propagates from the foundation through the remaining building structure, certain resonant, or natural, frequencies of various components of the building may be excited.

The effects of ground-borne vibration may include discernible movement of building floors, rattling of windows, and shaking of items on shelves or hanging on walls. In extreme cases, the vibration can cause damage to buildings. The vibration of floors and walls may cause perceptible vibration, rattling of such items as windows or dishes on shelves. The movement of building surfaces and objects within the building can also result in a low-frequency rumble noise. The rumble is the noise radiated from the motion of the room surfaces, even when the motion itself cannot be felt. This is called ground-borne noise.

Vibrations consist of rapidly fluctuating motions in which there is no "net" movement. When an object vibrates, any point on the object is displaced from its initial "static" position equally in both directions so that the average of all its motion is zero. Any object can vibrate differently in three mutually independent directions: vertical, horizontal, and lateral. It is common to describe vibration levels in terms of velocity, which represents the instantaneous speed at a point on the object that is displaced. In a sense, the human body responds to an average vibration amplitude, which is usually expressed in terms of the root mean square (rms) amplitude.

All vibration levels in this document are referenced to $1x10^{-6}$ inches per second. "VdB" (referenced to $1x10^{-6}$ inches per second) is used for vibration decibels to reduce the potential for confusion with noise decibels.

Effect of Propagation Path

Vibrations are transmitted from the source to the ground, and propagate through the ground to the receptor. Soil conditions have a strong influence on the levels of ground-borne vibration. Stiff soils, such as some clay and rock, can transmit vibrations over substantial distances. Sandy soils, wetlands, and groundwater tend to absorb movement and thus reduce vibration transmission. Because subsurface conditions vary widely, measurement of actual vibration conditions, or transfer mobility, at the site can be the most practical way to address the variability of propagation conditions.

Human Response to Vibration Levels

Although the perceptibility threshold for ground-borne vibration is about 65 VdB, the typical threshold of human annoyance is 72 VdB. As a comparison, buses and trucks rarely create vibration that exceeds 72 VdB unless there are significant bumps (or discontinuities) in the road and these vehicles are operating at moderate speeds. Vibration levels for typical human and structural responses and sources are shown in **Table 2**. Background vibration is usually well below the threshold of human perception and is of concern only when the vibration affects very sensitive manufacturing or research equipment. Electron microscopes, high-resolution lithography equipment, recording studios, and laser and optical benches are typical of equipment that is highly sensitive to vibration.

Table 2
Typical Levels of Ground-Borne Vibration

Human/Structural Response	Velocity Level (VdB)	Typical Sources (at 50 feet)
Threshold, minor cosmetic damage fragile buildings	100	Blasting from construction projects
		Bulldozers and other heavy tracked construction equipment
Difficulty with vibration-sensitive tasks, such as reading a video screen	90	Locomotive powered freight train
Residential annoyance, infrequent events	80	Rapid Transit Rail, upper range

		Commuter Rail, typical range
Residential annoyance, frequent events		Bus or Truck over bump
	70	Rapid Transit Rail, typical range
Limit for vibration-sensitive equipment. Approximate threshold for human perception of vibration		Bus or truck, typical
	60	
		Typical background vibration
	50	

Source: U.S. Department of Transportation, FTA, *Transit Noise and Vibration Impact Assessment,* May 2006.

NOISE STANDARDS AND CRITERIA

Airborne Noise Standards and Criteria

The FTA guidance manual defines noise criteria based on the specific type of land use that would be affected, with explicit operational noise impact criteria for three land use categories. These impact criteria are based on either peak 1-hour L_{eq} or 24-hour L_{dn} values. **Table 3** describes the land use categories defined in the FTA report and provides noise metrics used for determining operational noise impacts. As described in **Table 3**, categories 1 and 3—which include land uses that are noise-sensitive, but where people do not sleep—require examination using the 1-hour L_{eq} descriptor for the noisiest peak hour. Category 2, which includes residences, hospitals, and other locations where nighttime sensitivity to noise is very important, requires examination using the 24-hour L_{dn} descriptor.

Table 3
FTA's Land Use Category and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq(h)}$*	Tracts of land where quiet is an essential element in the intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels, where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq(h)}$*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

Note: * L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.
Source: *Transit Noise and Vibration Impact Assessment*, FTA, May 2006.

The FTA impact criteria are keyed to the noise level generated by the project (called "project noise exposure") in locations of varying existing noise levels. Two types of impacts—moderate and severe—are defined for each land use category, depending on existing noise levels. Thus, where existing noise levels are 40 dBA, for land use categories 1 and 2, the respective L_{eq} and L_{dn} noise exposure from the project would create moderate impacts if they were above approximately 50 dBA and would create severe impacts if they were above approximately 55 dBA. For category 3, a project noise exposure level above approximately 55 dBA would be considered a moderate impact and above approximately 60 dBA would be considered a severe impact (details see Figure 3-1 in the FTA Manual). The difference between "severe impact" and "moderate impact" is that a severe impact occurs when a change in noise level would be found annoying by a significant percentage of people, while a moderate impact occurs when a change in noise level would be noticeable to most people but not necessarily sufficient to result in strong adverse reactions from the community.

Vibration Standards and Criteria

With the construction of new rail transit systems in the past 20 years, considerable experience has been gained about how communities would react to various levels of building vibration. This experience, combined with the available national and international standards, represents a good foundation for predicting annoyance from ground-borne noise and vibration in residential areas. **Table 4** summarizes typical human or structural responses to various levels of vibration.

Table 4
Typical Levels of Ground-Borne Vibration

Human/Structural Response	Velocity Level (VdB)	Typical Sources (at 50 feet)
Threshold, minor cosmetic damage fragile	100	Blasting from construction projects

buildings		Bulldozers and other heavy tracked construction equipment
Difficulty with vibration-sensitive tasks, such as reading a video screen	90	Locomotive powered freight train
Residential annoyance, infrequent events	80	Rapid Transit Rail, upper range
		Commuter Rail, typical range
Residential annoyance, frequent events		Bus or Truck over bump
	70	Rapid Transit Rail, typical range
Limit for vibration-sensitive equipment. Approximate threshold for human perception of vibration	60	Bus or truck, typical
		Typical background vibration
	50	
Source: U.S. Department of Transportation, FTA, *Transit Noise and Vibration Impact Assessment,* May 2006.		

The FTA criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. The impact criteria as defined in the FTA guidance manual are shown in **Table 5**. The criteria for acceptable ground-borne vibration are expressed in terms of rms velocity levels in decibels, and the criteria for acceptable ground-borne noise are expressed in terms of A-weighted sound level. As shown in the table, the FTA methodology provides three different impact criteria: one for "infrequent" events, when there are fewer than 30 vibration events per day; one for "occasional" events, when there are between 30 and 70 vibration events per day; and one for "frequent" events, when there are more than 70 vibration events per day. It should be noted that these impacts would occur only if a project would cause ground-borne noise or vibration levels that are higher than existing vibration levels. Thus, if the vibration level for a building in category 1 is already 70 VdB (5 VdB above the 65 VdB threshold listed in **Table 5**) but the proposed project would not increase that level, then the proposed project would not be considered to have an impact.

Table 5
Ground-Borne Vibration (GBV) and Ground-Borne Noise (GBN) Impact Criteria for General Assessment

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch/sec)			GBN Impact Levels (dB re 20 micro Pascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[5]	N/A[5]	N/A[5]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Notes:
1 "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2 "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3 "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail systems.

4 This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the heating, ventilation, and air conditioning (HVAC) systems and stiffened floors.
5 Vibration-sensitive equipment is not sensitive to ground-borne noise.

The vibration limits are specified for the three land use categories defined below:

- **Category 1: High Sensitivity**—Buildings where low ambient vibration is essential for the operations within the building, which may be well below levels associated with human annoyance. Typical land uses are vibration-sensitive research and manufacturing, hospitals, and university research operations.
- **Category 2: Residential**—This category covers all residential land uses and any buildings where people sleep, such as hotels and hospitals. No differentiation is made between different types of residential areas. This is primarily because ground-borne vibration and noise are experienced indoors and building occupants have practically no means to reduce their exposure. Even in a noisy urban area, the bedrooms often will be quiet in buildings that have effective noise insulation and tightly closed windows. Hence, an occupant of a bedroom in a noisy urban area is likely to be just as sensitive to ground-borne noise and vibration as someone in a quiet suburban area.
- **Category 3: Institutional**—This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment but still have the potential for activity interference.

There are some buildings (such as concert halls, TV and recording studios, auditoriums, and theaters) that can be very sensitive to vibration and ground-borne noise but do not fit into any of these three categories. Special vibration level thresholds are defined for these land uses.

C. METHODOLOGY

AIRBORNE NOISE ANALYSIS METHODOLOGY

The noise/vibration analysis was performed according to procedures described in the Federal Transit Administration (FTA) guidance manual, *Transit Noise and Vibration Impact Assessment*, May 2006. In accordance with those guidelines this assessment is performed as a three-step analysis: a noise screening procedure, a general noise assessment methodology, and a detailed noise analysis methodology. The screening procedure is used to determine whether any noise-sensitive receivers are within distances where impacts are likely to occur. The general noise assessment methodology is used to determine locations where there is the potential for impacts. Lastly, the detailed noise analysis methodology is used to predict impacts and assess the effectiveness of mitigation, as necessary.

NOISE SCREENING PROCEDURE

The FTA methodology begins with a noise screening procedure to determine whether any noise-sensitive land uses are located within a distance of noise impact potential. The FTA screening method utilizes a distance of 750 feet from rail centerline for unobstructed potential noise-sensitive land uses along commuter rail lines, and 375 feet for obstructed noise-sensitive land uses. Potential noise effects from the proposed project were evaluated along all rail line segments. Based on information provided by land use assessment and aerial photographs, noise-sensitive land uses exist within 375 feet from the track centerline for the new rail line segment of the proposed project. This indicated the need for a general noise assessment analysis.

GENERAL NOISE ASSESSMENT

A general noise assessment analysis using FTA methodology was conducted to evaluate the proposed train noise. The noise impact assessment utilized in the FTA methodology evaluates project-generated $L_{eq(1)}$ noise levels for land used categories 1 and 3, and L_{dn} noise levels for land use category 2. The general noise assessment methodology consists of determining the project noise exposure at 50 feet from the centerline of track and comparing the calculated levels with allowable levels based land use categories. Based on the general assessment results, the project-generated $L_{eq(1)}$ noise levels for land use category 1 and the project-generated $L_{dn(1)}$ noise levels for land use category 2 would exceed FTA noise thresholds (details see **Appendix A-1**). This indicated the need for a detailed noise analysis.

DETAILED NOISE ANALYSIS

Since there is no land use category 1 in the study area, a detailed noise analysis using FTA methodology was conducted to evaluate the proposed train noise for land use category 2 only. The detailed noise analysis methodology consists of determining the project noise exposure at receptor locations and comparing the calculated levels with allowable levels based land use categories. The procedure of the detailed noise analysis is presented below.

VIBRATION ANALYSIS METHODOLOGY

The vibration analysis for the project alternatives was performed using the procedures described in the FTA guidance manual. To examine potential effects during operation, the FTA guidance document (similar to the approach for assessing noise) lays out a three-step approach for the analysis of vibration and ground-borne noise: a screening procedure, a general assessment, and a detailed analysis. The screening procedure is used to determine whether any noise-sensitive receptors are within distances where impacts are likely to occur; the general assessment is used to determine locations or rail segments where there is the potential for impacts; and the detailed analysis is used to predict impacts and evaluate the effectiveness of mitigation with greater precision than can be achieved with the general assessment.

VIBRATION SCREENING

The first step in the FTA vibration analysis is to determine if there is the potential for a vibration impact based on the type of project, the land use categories in the area of the project, and the distance to the nearest receptors of the land use categories. From these inputs, determination of the need for a general vibration and ground-borne noise assessment is made based on a screening distance as defined in **Table 6**.

Table 6
Screening Distances for Vibration Assessment

Type of Project	Critical Distances for Land Use Categories * Distance from Right-of-Way or Property Line (in feet)		
	Category 1	**Category 2**	**Category 3**
Conventional Commuter Railroad	600	200	120
Rail Rapid Transit	600	200	120
Light Rail Transit	450	150	100
Intermediate Capacity Transit	200	100	50
Bus Project (if not previously screened out)	100	50	N/A

Note:
* The land use categories are defined in Chapter 8 of the FTA Manual. Some vibration-sensitive land uses are not included in these categories. Examples include: concert halls and TV studios, which, for the screening procedure, should be evaluated as category 1; and theaters and auditoriums, which should be evaluated as category 2.

Source: *Transit Noise and Vibration Impact Assessment,* FTA, May 2006, pages 9-1 through 9-4.

The proposed project consists of steel wheel/steel rail with light rail transit. The screening analysis assumed critical distances of 450 feet for category 1, 150 feet for category 2, and 100 feet for category 3. The new rail segment of the proposed project includes land use categories 2 and 3 that are located within these screening distances, indicating the need for a general assessment.

GENERAL VIBRATION AND GROUND-BORNE NOISE ASSESSMENT

The procedures outlined in the FTA guidance manual for preparing a general vibration and ground-borne noise assessment were used for this impact analysis. The general vibration assessment estimates the vibration level at specific locations, based on generalized ground surface vibration curves that yield vibration levels as a function of distance from the track centerline, and a series of adjustment factors affecting the vibration source (i.e., train speed, crossovers and other special trackwork, type of transit structure, etc.), factors affecting the vibration path (i.e., geologic conditions that affect vibration propagation), and factors affecting the vibration receiver (i.e., floor-to-floor attenuation, amplification due to resonances of floors, walls, and ceilings, and radiated sound). In order to determine ground-borne noise, these vibration velocity levels are converted to A-weighted sound levels.

For the general vibration and ground-borne noise assessment, the following assumptions regarding track conditions, track treatments, transit structure, and generalized receiver construction, which affect the adjustment factors applied to the source vibration levels as a function of distance, were made:

- The rail lines of the proposed project would include special trackwork between Route 440 and the new station (+10 dB adjustment factor);
- Some rail segments include elevated structure (-10 dB adjustment factor);
- No geological assumptions were utilized due to unknown soil conditions;
- Residential buildings along the new rail segment are 2-story to 4-story construction (-5 dB adjustment factor for wood frame was used conservatively); and

- Mid-span slabs and wall centers may experience amplification due to resonance (+6 dB adjustment factor).

The procedure of the detailed noise analysis is presented below. The results of general vibration assessment indicated that impacts would not occur at receptors adjacent to the new rail segment. Consequently, no need for a detailed vibration analysis would be performed.

D. EXISTING CONDITIONS

Two sensitive receptor locations (e.g., residential uses nearest to the alignment of the Preferred Alternative) were selected for noise monitoring. Site 1 is located on West side station condominiums on Mallory Avenue, and Site 2 is located on the dead end of Grand Avenue. **Figure 3-8** shows the locations of the two noise monitoring sites. These locations were selected based on a consideration of areas where maximum impacts of the Proposed Action may be likely to occur, and on locations where sensitive land uses exist. **Table 7** shows receptor information on measured location, land use category, and type of measurement.

Table 7
Noise Receptor Sites and Existing Noise Levels

Receptor Site	Measurement Location	Land Use Category	Distance to Receptor in feet	Type of Measurement
1	West side station condominiums on Mallory Avenue	2-Residential	100	24-hour
2	Residents on the dead end of Grand Avenue	2-Residential	115	AM/MD/PM/LN 20 minute[1]

Notes:
[1] AM = morning peak hour; MD = midday; PM = evening peak hour; LN = late night
[2] Ldn computed by measured values

Measurements were performed using one Brüel & Kjær Sound Level Meter (SLM) Type 2260 and one Brüel & Kjær SLM Type 2250, Brüel & Kjær ½ inch microphones Type 4189, and Brüel & Kjær Sound Level Calibrators Type 4231. The Brüel & Kjær SLM is a Type 1 instrument according to ANSI Standard S1.4-1983 (R2006). The microphone was mounted at a height of approximately five feet above the ground surface on a tripod and at least six feet away from any large, sound-reflecting surface to avoid major interference with sound propagation. The SLM was calibrated before and after readings with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. Measurements at each location were made on the A-scale (dBA). The data were digitally recorded by the sound level meter and displayed at the end of the measurement period in units of dBA. Measured quantities included L_{eq}, L_1, L_{10}, L_{50}, and L_{90} levels. A windscreen was used during all sound measurements except for calibration. All measurement procedures were based on the guidelines outlined in ANSI Standard S1.13-2005.

Existing noise levels were measured for 24-hour at Site 1 and 20-minute at Site 2 for AM, Midday, PM, and late night periods on May 30, and June 1, 2012. The existing noise monitoring levels are summarized in **Table 8**.

Table 8
Measured Existing Noise Levels in dBA

Time	Receptor 1		Receptor 2	
	Leq	Ldn*	Leq	Ldn*
1:00 AM	46.6	62.4		62.4
2:00 AM	49.9			
3:00 AM	50.8			
4:00 AM	54.2			
5:00 AM	58.3			
6:00 AM	57.7			
7:00 AM	61.4			
8:00 AM	57.4		59.9	
9:00 AM	58.3			
10:00 AM	58.6			
11:00 AM	59.7			
Noon	56.1		59.0	
1:00 PM	56.1			
2:00 PM	56.7			
3:00 PM	57			
4:00 PM	56.5			
5:00 PM	56.3		58.9	
6:00 PM	56.1			
7:00 PM	58.2			
8:00 PM	55.7			
9:00 PM	53.5			
10:00 PM	54			
11:00 PM	52.4			
Midnight	49.9		57.8	

Note:
Field measurements were performed by AKRF on May 31 and June 1, 2012.
* Ldn computed by measured values based on FTA methodology.

Existing HBLR line service includes 96 trains during the daytime (7:00 AM to 10:00 PM), 23 passenger trains during the nighttime (10:00 PM to 7:00 AM). **Table 9** shows the HBLR train movement information.

Table 9
Existing HBLR Train Movements

Receptor Site	Segment Description	Operator	Number of Trains			Number of Cars per Train	Max Speed (mph)
				10pm-7am	7am-10pm		
1 and 2	Route 440 and the new station	HBLR		96	23	2	35

Note: The information on existing train movements in this table is based on data from New Jersey Transit (http://www.njtransit.com/pdf/bus/T0100.pdf).

E. PROBABLE IMPACTS OF THE PREFERRED ALTERNATIVE

NOISE

As indicated in the general assessment, the project-generated $L_{dn(1)}$ noise levels for land use category 2 would exceed FTA noise thresholds. A detailed noise analysis was performed to determine whether noise levels would exceed FTA impact criteria at receptor sites 1 and 2 (i.e., the closest possible sensitive residential uses to the Preferred Alternative alignment). Using the FTA detailed noise analysis methodology**, Table 10** shows the results of the noise impact assessment performed for the Proposed Action. Based upon the analysis results, moderate impacts would occur at locations within 75 feet from rail centerline, and severe impacts would occur at locations within 30 feet from rail centerline (details see **Appendix A-2**). The project exposure levels at the selected receptors, which are located 100 and 115 feet from the rail centerline respectively, would not exceed the FTA impact thresholds. Consequently, the Preferred Alternative would not result in any significant impacts at any of the existing receptor sites.

Table 10
Impact Evaluation of Noise

Receptor Site	FTA Land Use Category[1]	Noise Descriptor	Distance to Receptor	Existing Noise Level (dBA)	FTA Impact Criteria[2]		Action Noise Exposure (dBA)	Impact?	Distance from Rail Centerline to Onset of Impact (ft)	
					Moderate Impact	Severe Impact			Moderate Impact	Severe Impact
1	2	L_{dn}	100	62.4	59.2	64.7	57	No	75	30
2	2	L_{dn}	110	62.4	59.2	64.7	56	No	75	30

Note:
1 See Table 3-2 in "*Transit Noise and Vibration Impact Assessment*" for a description of FTA Land Uses.
2 See Table 3-1 in "*Transit Noise and Vibration Impact Assessment*" for thresholds of FTA Impact Criteria.
3 Future residence receptor.
4 Existing noise levels estimated per measured values at Receptor 1.

VIBRATION

The proposed project alignment extending an east-westerly direction through the study area to the Hackensack River would result in potential vibration impacts for both existing residences and future residences along the new rail segment. A vibration assessment was conducted in accordance with methodologies set forth in *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration, May 2006) to examine potential impacts generated by HBLR operations.

Using the FTA general vibration assessment methodology, **Table 11** shows the results of the vibration impact assessment performed for the Proposed Action. Based upon the assessment results, ground-born vibration impacts would occur at locations within 60 feet from rail centerline, and ground-born noise impacts would occur at locations within 80 feet from rail centerline. The project exposure levels at the selected receptors, which are located 100 and 110 feet from the rail centerline respectively, would not exceed the FTA impact thresholds. Consequently, the Proposed Action would not result in any significant impacts at any of the existing receptor sites.

Table 11
Impact Evaluation of Vibration

Receptor Site	FTA Land Use Category[1]	Track Condition	FTA Impact Criteria[2]		Project Exposure Level		Threshold Exceeded	Impact Distance in feet	
			Vibration (VdB)	Noise (dBA)	Vibration (VdB)	Noise (dBA)		Ground-Born Vibration (VdB)	Ground-Born Noise (dBA)
1	2	Elevated	72	35	68	33	No	60	80
2	2	Elevated	72	35	67	32	No	60	80

Notes:
[1] See page 8-2 in "*Transit Noise and Vibration Impact Assessment"* for a description of FTA Land Uses
[2] See Table 8-1 in "*Transit Noise and Vibration Impact Assessment"* for thresholds of FTA Impact Criteria
[3] Future residences locations

In summary, the Preferred Alternative would not result in any significant adverse noise impacts in study area.

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General Noise Assessment - Land Use Category 1

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**1. Outdoor Quiet**
Existing Noise (Measured or Generic Value):	**59 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		Source 1
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Noisiest hr of Activity During Sensitive hrs	**Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Number of Events/hr	13
Distance	**Distance from Source to Receiver (ft)**	50
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Leqh:	59 dBA
Total Project Leqh:	61 dBA
Total Noise Exposure:	63 dBA
Increase:	4 dB
Impact?:	**Moderate**

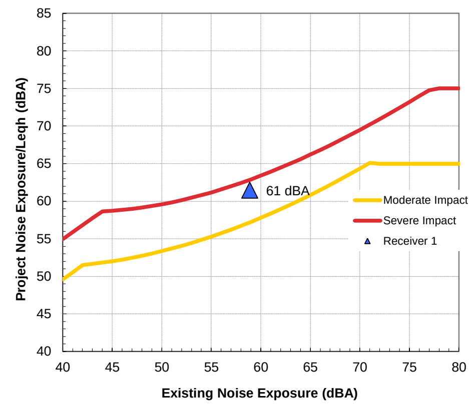
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	103 ft
Dist to Sev. Impact Contour (Source 1):	43 ft

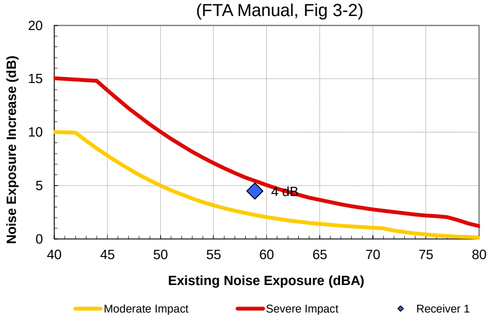
Source 1 Results

Leqh:	61.5 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



General Noise Assessment - Land Use Category 2

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		Source 1
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	50
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Ldn:	62 dBA
Total Project Ldn:	62 dBA
Total Noise Exposure:	65 dBA
Increase:	3 dB
Impact?:	**Moderate**

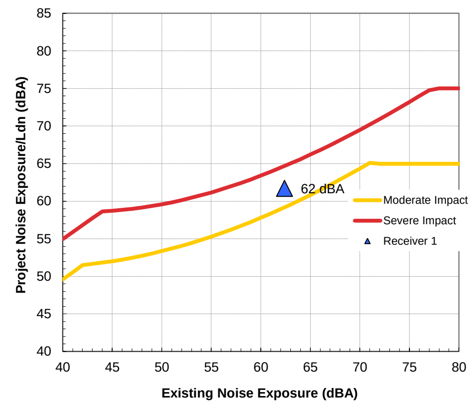
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	76 ft
Dist to Sev. Impact Contour (Source 1):	33 ft

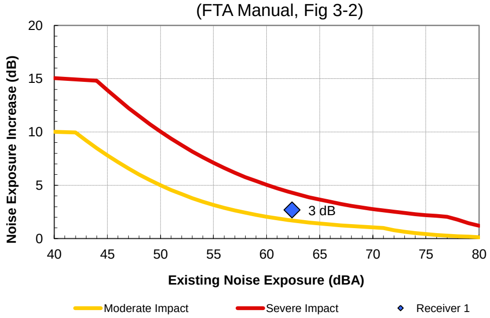
Source 1 Results

Leq(day):	58.4 dBA
Leq(night):	54.5 dBA
Ldn:	61.7 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



General Noise Assessment - Land Use Category 3

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**3. Institutional**
Existing Noise (Measured or Generic Value):	**59 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		Source 1
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Noisiest hr of Activity During Sensitive hrs	**Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Number of Events/hr	13
Distance	**Distance from Source to Receiver (ft)**	50
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Leqh:	59 dBA
Total Project Leqh:	61 dBA
Total Noise Exposure:	63 dBA
Increase:	4 dB
Impact?:	None

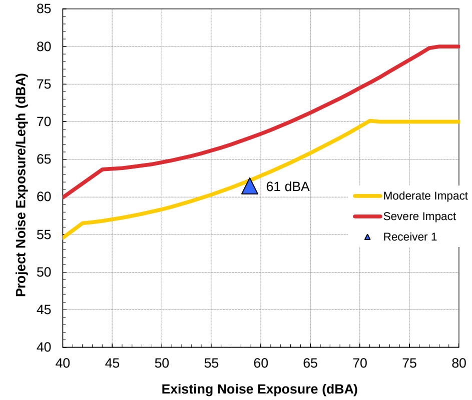
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	48 ft
Dist to Sev. Impact Contour (Source 1):	20 ft

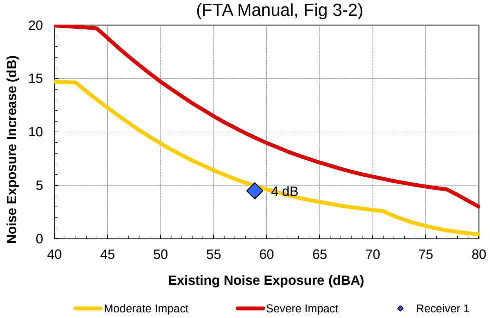
Source 1 Results

Leqh:	61.5 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Detailed Noise Analysis - Receptor Site 1

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		**Source 1**
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	100
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Ldn:	62 dBA
Total Project Ldn:	57 dBA
Total Noise Exposure:	64 dBA
Increase:	1 dB
Impact?:	None

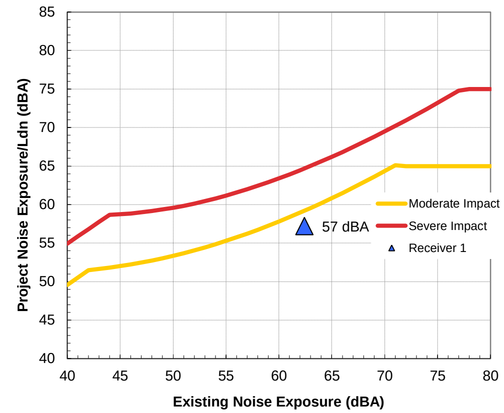
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	76 ft
Dist to Sev. Impact Contour (Source 1):	33 ft

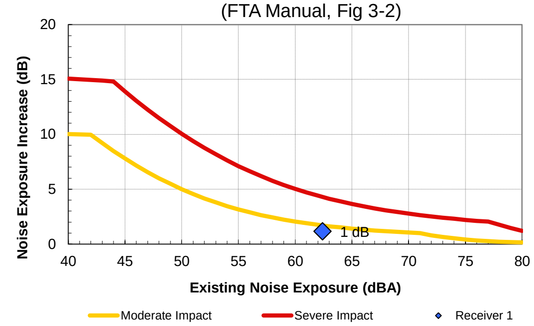
Source 1 Results

Leq(day):	53.9 dBA
Leq(night):	49.9 dBA
Ldn:	57.2 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Detailed Noise Analysis - Receptor Site 2

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		**Source 1**
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	115
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Ldn:	62 dBA
Total Project Ldn:	56 dBA
Total Noise Exposure:	63 dBA
Increase:	1 dB
Impact?:	None

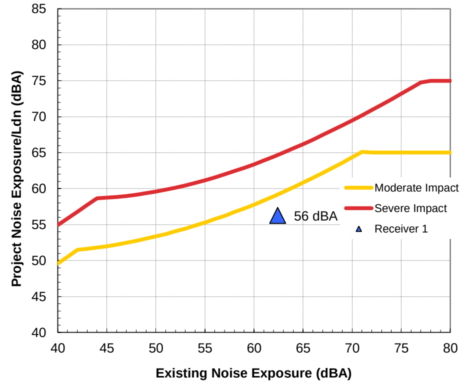
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	76 ft
Dist to Sev. Impact Contour (Source 1):	33 ft

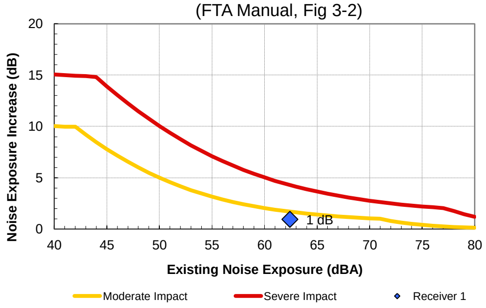
Source 1 Results

Leq(day):	52.9 dBA
Leq(night):	49.0 dBA
Ldn:	56.3 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Detailed Noise Analysis - Severe Impact Distance at Site 1

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		**Source 1**
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	30
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Ldn:	62 dBA
Total Project Ldn:	65 dBA
Total Noise Exposure:	67 dBA
Increase:	5 dB
Impact?:	**Severe**

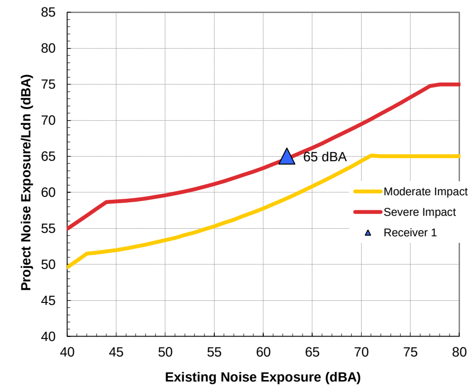
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	76 ft
Dist to Sev. Impact Contour (Source 1):	33 ft

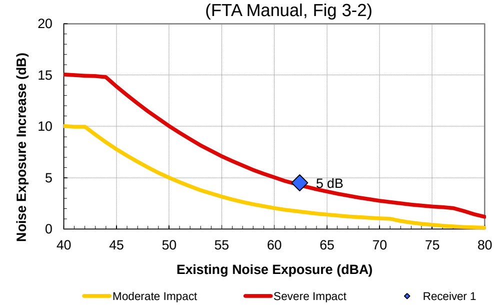
Source 1 Results

Leq(day):	61.7 dBA
Leq(night):	57.8 dBA
Ldn:	65.0 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Detailed Noise Analysis - Moderate Impact Distance at Site 1

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		Source 1
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	75
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	No
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Ldn:	62 dBA
Total Project Ldn:	59 dBA
Total Noise Exposure:	64 dBA
Increase:	2 dB
Impact?:	**Moderate**

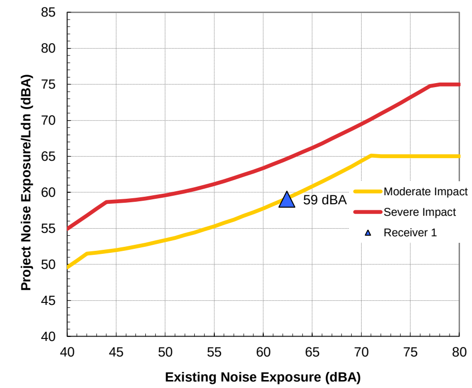
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	76 ft
Dist to Sev. Impact Contour (Source 1):	33 ft

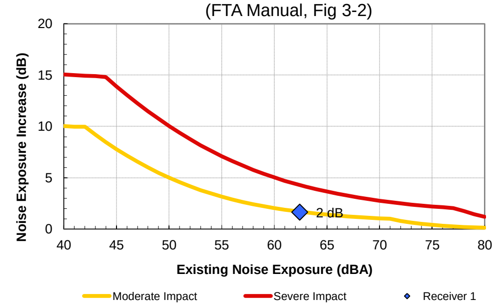
Source 1 Results

Leq(day):	55.7 dBA
Leq(night):	51.8 dBA
Ldn:	59.1 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Detailed Noise Analysis - Severe Impact Distance at Site A

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		**Source 1**
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	70
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	Yes
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

Existing Ldn:	62 dBA
Total Project Ldn:	65 dBA
Total Noise Exposure:	67 dBA
Increase:	4 dB
Impact?:	**Severe**

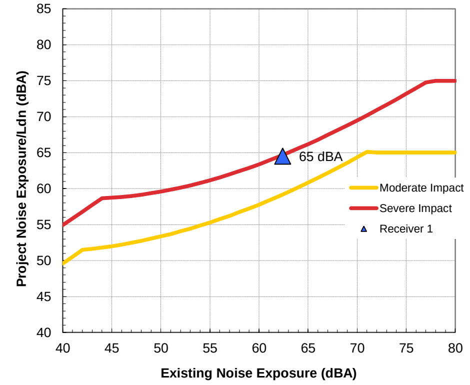
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	164 ft
Dist to Sev. Impact Contour (Source 1):	71 ft

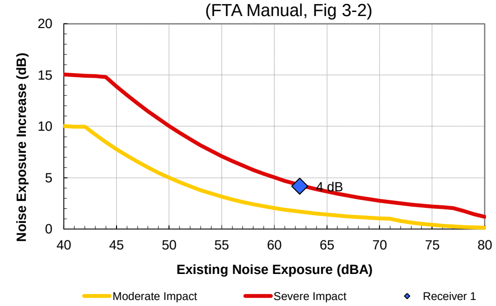
Source 1 Results

Leq(day):	61.2 dBA
Leq(night):	57.3 dBA
Ldn:	64.5 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Detailed Noise Analysis - Moderate Impact Distance at Site A

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**FTA Example 5-1, Part 1**

Receiver Parameters	
Receiver:	**Receiver 1**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**62 dBA**

Noise Source Parameters	
Number of Noise Sources:	**1**

Noise Source Parameters		Source 1
	Source Type:	Fixed Guideway
	Specific Source:	Rail Transit Vehicle
Daytime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	6.4
Nighttime hrs	**Avg. Number of Transit Vehicles/train**	2
	Speed (mph)	35
	Avg. Number of Events/hr	2.6
Distance	**Distance from Source to Receiver (ft)**	160
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No
	Jointed Track?	Yes
	Embedded Track?	No
	Aerial Structure?	Yes

Project Results Summary

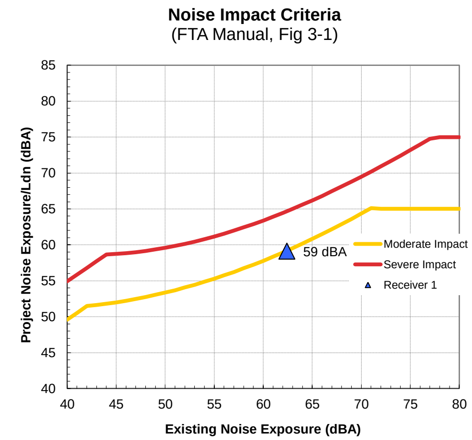
Existing Ldn:	62 dBA
Total Project Ldn:	59 dBA
Total Noise Exposure:	64 dBA
Increase:	2 dB
Impact?:	**Moderate**

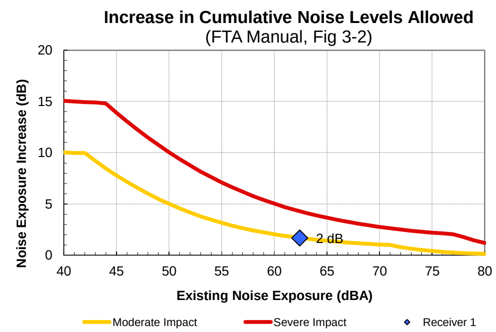
Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	164 ft
Dist to Sev. Impact Contour (Source 1):	71 ft

Source 1 Results

Leq(day):	55.8 dBA
Leq(night):	51.9 dBA
Ldn:	59.1 dBA





General Vibration Assessment

			Transit	ASSUMED	ASSUMED	GIS/TRAIN	TRAIN	DIAGONAL DISTANCE	TRAIN	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE
		Event	Structure	FOUNDATION TYPE	FUNDATION DEPTH	T DISTANCE FROM F	RAIL DEPTH		TRAIN SPEED	JUSTED VIBRATION	SPEED ADJUSTMENT	L Trackwork (CROSS	VEHICLE
Distance Set Back if Impacts	Existing or Build Condition	"Frequen events" is defined as more than 70 vibration events per day.			height-indicated foundation depth in feet; used with bedrock depth to determine Assumed Foundation Depth (notes: 0.5			Distance from track to building foundation level	30mph, constant conservative estimate	VdB; based on Distance to Foundation taken from curve on page 10-3	VdB; 20*(LOG10((P/30)))	10 VdB adjustment for special trackwork (crossover)	8 VdB adjustment for old vehicles with still primary suspension
Receptor Site													
1	Build	Frequent	Elevated	Wood Frame	6.0	100.0	15.0	102.2	30.0	67.0	0.0	0.0	0.0
2	Build	Frequent	Elevated	Wood Frame	6.0	115.0	15.0	116.9	30.0	66.0	0.0	0.0	0.0
1 (NoiseImpact)	Build	Frequent	Elevated	Wood Frame	6.0	80.0	15.0	82.7	30.0	69.0	0.0	0.0	0.0
1 (VibrationImpact)	Build	Frequent	Elevated	Wood Frame	6.0	60.0	15.0	63.6	30.0	71.0	0.0	0.0	0.0
A (NoiseImpact)	Build	Frequent	Elevated	Wood Frame	6.0	200.0	15.0	201.1	30.0	60.0	0.0	10.0	0.0
A (NoiseImpact)	Build	Frequent	Elevated	Wood Frame	6.0	190.0	15.0	191.2	30.0	61.0	0.0	10.0	0.0

General Vibration Assessment

		VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE	VIBNOISE
		OF TRANSIT ADJUST	OF TRANSIT ADJUST	DATION TYPE ADJUS	AND BASEMENT AD	TED SOUND ADJUST	JUSTED VIBRATION	VIBRATION ADJUST	USTED VIBRATION LE	AL NOISE ADJUSTME	ROUND NOISE LEVE	VIB THRESHOLD	NOISE THRESHOLD	VIB VIO	NOISE VIO
Distance Set Back if Impacts	Existing or Build Condition	10 VdB adjustment for elevated transit structure	10 VdB adjustment for propagation in soil	5 VdB adjustment for wood frame and 10 VdB adjustment for masonry	VdB;+6 Vdb for amplification due to resonances	VdB; a VdB deduction that applies only to the Ground Noise Level, 35 for Soil and 20 for Rock	VdB; based on Distance to Foundation; 90-(20*(LOG10((T/25)))); same as previous	VdB; total of all Vibration Adjustments	VdB; Unadjusted Vibration Level + Total Vibration Adjustments	VdB; based on Noise Path Adjustment	VdB; Adjusted Vibration Level + Total Noise Adjustment				
Receptor Site															
1	Build	-10.0	10.0	-5.0	6.0	-35.0	67.0	1.0	68.0	-35.0	33.0	72.0	35.0	No Impact	No Impact
2	Build	-10.0	10.0	-5.0	6.0	-35.0	66.0	1.0	67.0	-35.0	32.0	72.0	35.0	No Impact	No Impact
1 (NoiseImpact)	Build	-10.0	10.0	-5.0	6.0	-35.0	69.0	1.0	70.0	-35.0	35.0	72.0	35.0	No Impact	Impact
1 (VibrationImpact)	Build	-10.0	10.0	-5.0	6.0	-35.0	71.0	1.0	72.0	-35.0	37.0	72.0	35.0	Impact	Impact
A (NoiseImpact)	Build	-10.0	10.0	-5.0	6.0	-35.0	60.0	11.0	71.0	-35.0	36.0	72.0	35.0	No Impact	Impact
A (NoiseImpact)	Build	-10.0	10.0	-5.0	6.0	-35.0	61.0	11.0	72.0	-35.0	37.0	72.0	35.0	Impact	Impact