

# **TRAFFIC NOISE IMPACT REPORT**

## **Vista Boulevard Widening Project**

**Prepared for:**

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**May 2009**

## Traffic Noise Impact Report

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# Chapter 1 Introduction

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PBS&J prepared this Traffic Noise Impact Report for the Regional Transportation Commission of Washoe County, Nevada (RTC). The purpose of this technical report is to determine if motor vehicle traffic noise impacts would result from the proposed widening to Vista Boulevard between North Los Altos Parkway and Wingfield Parkway in Sparks, Nevada. This report also provides recommendations for the construction of sound walls to reduce any identified traffic noise impacts.

Traffic volumes for the proposed project were based on data from the Vista Boulevard Traffic Study prepared by PBS&J.

## 1.1 Summary of Findings

Residents adjacent to Vista Boulevard were identified as noise-sensitive receptors that could experience noise impacts as a result of the proposed roadway widening. Existing sound levels measured at these locations ranged from 49 dBA  $L_{eq}$  to 67 dBA  $L_{eq}$ , which for some residences exceed the Regional Transportation Commission's (RTC's) Noise Abatement Criteria (NAC). Modeling of future traffic noise levels with the Federal Highway Administration's (FHWA's) Traffic Noise Model (TNM) indicates that the NAC would be exceeded at up to 67 of the 153 single-family homes and at one of the two multi-family developments in the corridor. Eight sound wall configurations in specified locations were evaluated, six of which were found to be both reasonable and feasible at a height of 6 or 8 feet. The sound wall configurations/locations that were found to meet the RTC's feasibility and reasonability criteria were as follows:

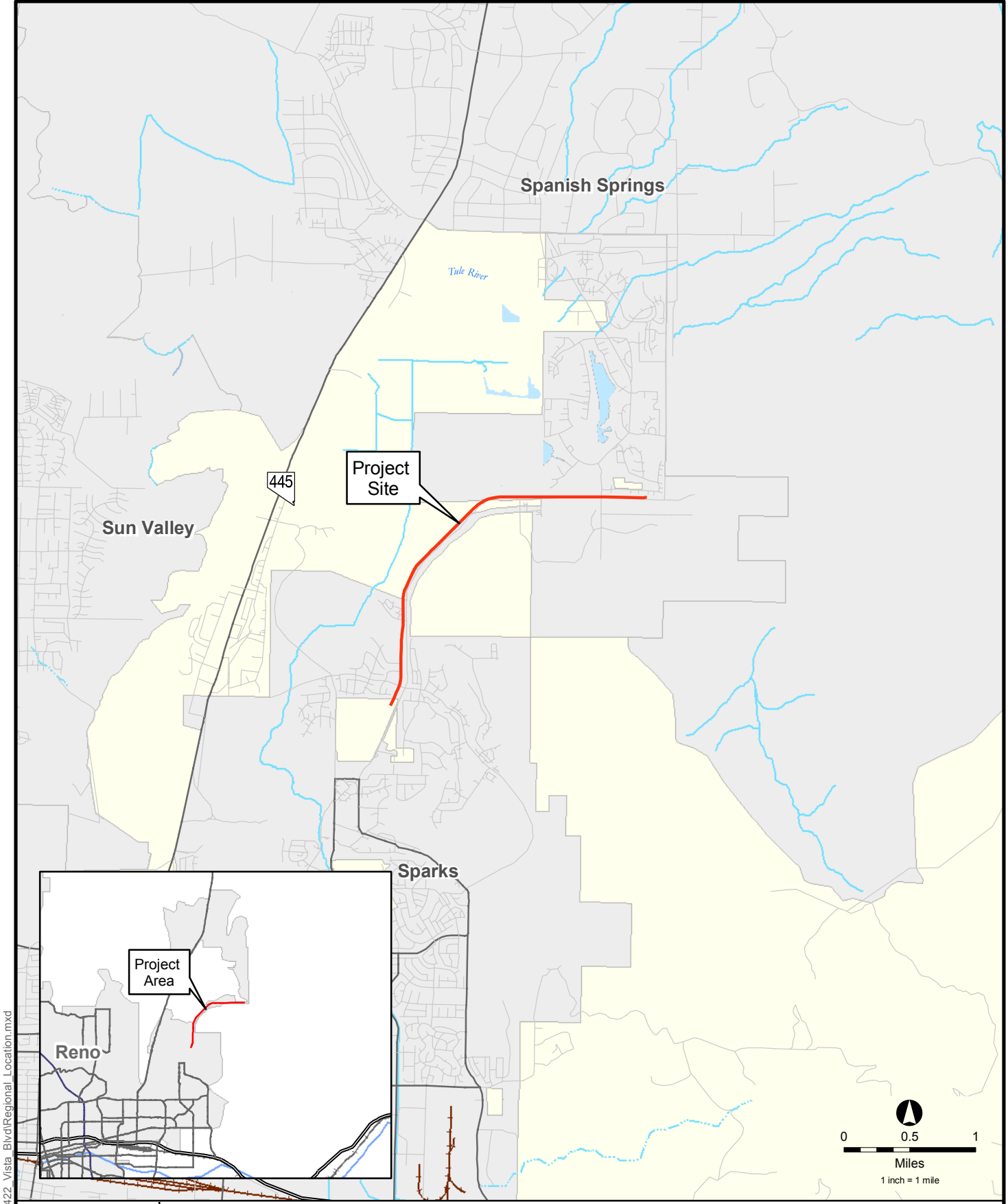
- Barrier 1, eastern side of Vista Boulevard from Commercial Driveway to Vista Del Rancho Parkway.
- Barrier 2, eastern side of Vista Boulevard from Commercial Driveway to Vista Del Rancho Parkway.
- Barrier 5, southern side of Vista Boulevard from west of Peppergrass Way to Wingfield Hills Road.
- Barrier 6, southern side of Vista Boulevard from Wingfield Hills Road to Ingleston Drive.
- Barrier 7, southern side of Vista Boulevard from Wingfield Hills Road to Ingleston Drive.
- Barrier 8, southern side of Vista Boulevard east of Ingleston Drive.

## 1.2 Background

Vista Boulevard currently serves the city of Sparks, Nevada. The proposed project is anticipated to include approximately 13,600 linear feet of street reconstruction and widening along Vista Boulevard

from North Altos Parkway to Wingfield Parkway. The project is located in Township 20, Range 20 in between Sections 11, 12, 13, 14, 15, and 22, in the City of Sparks, Washoe County, Nevada. A location map is provided in Figure 1. In general, roadway design and construction consist of capacity improvements including additional travel lanes, bike lanes, turn lanes, drainage and intersection improvements, street lighting, and pedestrian facilities. The proposed project intends to improve existing roadway conditions and accommodate the future growth anticipated to occur in this area. Construction of the project would begin in 2009 and be completed in 2010.

The Vista Boulevard alignment runs generally in a north-south direction between North Los Altos Parkway and Peppergrass Way where it bends and then runs generally in an east-west direction through Wingfield Parkway. The posted speed limit along Vista Boulevard is 45 miles per hour for the majority of the project corridor.



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FIGURE 1  
**Regional Location**



100003422

## Chapter 2 Environmental Setting

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### 2.1 Characteristics of Sound and Noise

Sound is created when vibrating objects produce pressure variations that move rapidly outward into the surrounding air. The main characteristics of these air pressure waves are amplitude, which we experience as a sound's "loudness," and frequency, which we experience as a sound's "pitch." The standard unit of sound amplitude is the decibel (dB); it is a measure of the physical magnitude of the pressure variations relative to the human threshold of perception. The human ear's sensitivity to sound amplitude is frequency-dependent; it is more sensitive to sound with a frequency at or near 1000 cycles per second than to sound with much lower or higher frequencies.

Most "real world" sounds (e.g., a dog barking, a car passing, etc.) are complex mixtures of many different frequency components. When the average amplitude of such sounds is measured with a sound level meter, it is common for the instrument to apply different adjustment factors to each of the measured sound's frequency components. These factors account for the differences in perceived loudness of each of the sound's frequency components relative to those that the human ear is most sensitive to (i.e., those at or near 1000 cycles per second). This practice is called "A-weighting." The unit of A-weighted sound amplitude is also the decibel. But in reporting measurements to which A-weighting has been applied, an "A" is appended to dB (i.e., dBA) to make this clear (see Table 1).

Noise is the term generally given to the "unwanted" aspects of intrusive sound. Many factors influence how a sound is perceived and whether or not it is considered annoying to a listener. These include not only the physical characteristics of a sound, but also non-acoustic factors that influence the judgment of listeners regarding the "unwantedness" of a sound, the most important of which are presented in Table 2. Excessive noise can negatively affect the physiological or psychological well-being of individuals or communities.

All quantitative descriptors used to measure environmental noise exposure recognize the strong correlation between the high acoustical energy content of a sound (i.e., its loudness and duration) and the disruptive effect it is likely to have as noise. Because environmental noise fluctuates over time, most such descriptors average the sound level over the time of exposure, and some add "penalties" during the times of day when intrusive sounds would be more disruptive to listeners. This analysis uses the descriptor  $L_{eq}$ , the equivalent energy noise level, which is the constant noise level that would deliver the same acoustic energy to the ear as the actual time-varying noise over the same exposure time.  $L_{eq}$  does not apply a penalty to evening or nighttime noise.

Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and parks and outdoor recreation areas are more sensitive to noise than are commercial and industrial land uses.

**Table 1**  
**Representative Environmental Sound Levels**

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	—110—	Rock Band
Jet Fly-over at 100 feet		
	—100—	
Gas Lawnmower at 3 feet		
	—90—	Food Blender at 3 feet
Diesel Truck going 50 mph at 50 feet	—80—	Garbage Disposal at 3 feet
Noisy Urban Area during Daytime		
Gas Lawnmower at 100 feet	—70—	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
Heavy Traffic at 300 feet	—60—	
		Large Business Office
Quiet Urban Area during Daytime	—50—	Dishwasher in Next Room
		Theater, Large Conference Room (background)
Quiet Urban Area during Nighttime	—40—	
Quiet Suburban Area during Nighttime		
	—30—	Library
Quiet Rural Area during Nighttime		Bedroom at Night, Concert Hall (background)
	—20—	
		Broadcast/Recording Studio
	—10—	
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

*Source:* California Department of Transportation, *Technical Noise Supplement*, October 1998.

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**Table 2**  
**Factors that Affect Individual Judgment of a Sound’s “Noisiness”**

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**Primary Acoustic Factors**

Sound Level  
Sound Frequency  
Sound Duration

**Secondary Acoustic Factors**

Frequency Characteristics of the Sound  
Fluctuations in Sound Level  
Fluctuations in Sound Frequency  
Rise-Time of the Sound (e.g., Is it “fast” like an automobile horn, or “slow” like an approaching train?)  
Localization of Sound Source (Is it obvious where the sound is coming from, or not?)

**Non-Acoustic Factors**

Physiology of the Listener (Is the listener’s hearing ability acute, or not?)  
Listener’s Adaptation from Past Experience (e.g., How long has the listener lived near the airport?)  
Listener’s Activity During Exposure (Was the listener sleeping, working, etc.?)  
Predictability of When the Sound Will Occur (e.g., Is it an expected noon-time whistle or a random car horn)  
Listener’s Judgment of Personal Benefit from Activity Producing the Sound (e.g., Has the repair work being done on a street been long requested by local residents?)  
Individual Differences and Personalities

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*Source:* Adapted from *Handbook of Noise Control*, Cyril M. Harris, 1979.

## **2.2 Noise Standards and Criteria**

For regional street or highway transportation projects under its jurisdiction, the RTC has adopted guidance for traffic and construction noise abatement procedures, as included in Appendix C of the RTC Street and Highway Program. The procedures for traffic noise mitigation included in the RTC guidance conform to the federal noise standards as outlined in the United States Code of Federal Regulations 23 CFR 772 “Procedures for Abatement of Highway Traffic Noise and Construction Noise,” and the Nevada Department of Transportation’s (NDOT’s) “Traffic and Construction Noise Abatement Policy.”

The RTC regulations require that potential noise impacts in areas of frequent human use be identified during the planning and design of a street or highway project. The regulations contain traffic noise abatement criteria (NAC) that are used to determine when a noise impact would occur. The NAC differ depending on the type of land use under analysis, as shown in Table 3 below. For example, the NAC for residences (i.e., 67 dBA peak hour Leq) is lower than the NAC for commercial areas (i.e., 72 dBA peak hour Leq). The NAC are objective absolute noise levels for varying land use categories where an impact is triggered.

In accordance with RTC guidance, a noise impact occurs when the predicted peak-hour traffic noise levels approach the NAC. While “approach” is not defined by the RTC, approaching the NAC is defined by NDOT as coming within 1 dBA of the NAC. With this interpretation, the noise abatement threshold would be 66 dBA for activity Category B (residential). In addition to the NAC, RTC consider a traffic noise impact to occur if predicted levels substantially exceed existing levels (i.e., an increase over existing ambient of 15 dBA or more).

In determining and abating traffic noise impacts, primary consideration should be given to ground level exterior areas. In those situations where there are no exterior activities to be affected by the traffic noise, or where the exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities, the application of the appropriate criterion for the interiors of the affected noise-sensitive uses, as shown in Table 3, shall be used as the basis of determining noise impacts.

**Table 3**  
**Noise Abatement Criteria (NAC) Hourly A-Weighted Sound Level - decibels (dBA)**

Activity Category	Leq(h)	L10(h)	Description of Activity Category
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D			Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

*Source:* RTC, Appendix C Traffic and Construction Noise Abatement Procedure;. Federal Highway Administration, 23 CFR, Part 772.

*Note:* Either L<sub>10</sub>(h) or L<sub>eq</sub>(h) (but not both) may be used on a project.

When noise impacts occurs by either criteria, RTC requires study of noise abatement measures, including traffic management, alteration of horizontal and vertical alignments, noise barriers within or outside the right-of-way, acquisition of buffer zones, noise insulation of public-use or nonprofit institutional structures. Measures that are both feasible and reasonable must be incorporated into the project.

To be feasible, an abatement measure must first meet all safety, maintenance and other accepted design requirements. After safety/maintenance issues are resolved, RTC considers a noise-abatement measure to be feasible if that measure can technically achieve a noise reduction of 5 decibels or more, given its physical aspects and those of its surroundings.

Reasonableness implies that common sense and good judgment were applied in arriving at a decision concerning the abatement measure. RTC requires that the views of the impacted residents be a major consideration, and that the overall noise abatement benefits outweigh the overall adverse social, economic, and environmental effects.

The judgment as to whether noise abatement measures are reasonable can include such factors as community wishes, aesthetics, restrictions of view, projected noise-level increase above existing levels, projected noise-level increase above future no-build levels, amount of development that occurred before and after the initial construction of the highway, the timing of newer developments in relation to public knowledge of the project, type of protected development, effectiveness of land-use controls by the local jurisdiction, construction effects of the abatement measure on the natural environment, and the potential ability of the abatement measure to reduce noise during project construction. Cost effectiveness can also be considered as a factor. The RTC also has policies relating to when it is the RTC's duty to abate traffic noise. One of these policies (Policy 3.1) refers to using funds for noise impacts at existing land uses when the existing developments were constructed prior to the first public knowledge of the new road project.

## Chapter 3      **Noise Analysis**

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### **3.1      Methodology**

Project-related traffic noise impacts were evaluated by measuring existing traffic and background noise levels at noise-sensitive uses in the project area and using these measurements to calibrate the FHWA Traffic Noise Model (TNM) Version 2.5 to predict future traffic noise levels. TNM input parameters include traffic volumes and operating speeds, vehicle types geometric information (in three dimensions) representing the existing and proposed roadway alignments, the locations of receptors, and the heights and lengths of soundwalls. The traffic data was obtained from the *Vista Boulevard Traffic Study* prepared by PBS&J (November 2008). Project-related traffic noise impacts were evaluated against the traffic noise impact criteria for year 2020 and year 2040 under build conditions.

## **3.2 Existing Conditions**

### **3.2.1 Existing Land Uses**

Land uses along Vista Boulevard in the project area consist primarily of residential and commercial uses.<sup>1</sup> The residential uses along Vista Boulevard are shielded to some degree from traffic noise by local topography, and by sound walls, privacy fences, and landscaping included as part of the existing development. Residential uses occur on the eastern side of Vista Boulevard from south of North Los Altos Parkway to Vista Del Rancho Parkway, with some residential and commercial development on the western side. Along this segment of Vista Boulevard, the residences on the western side of Vista Boulevard include 6-foot-tall masonry walls that would act as an effective barrier to traffic noise. In contrast, residents on the eastern side have only a wood fence that would provide residential privacy but little noise reduction since field observations identified substantial gaps between the wood planks. Although such wood fences would provide some shielding from traffic noise, they were assumed to provide no noise reduction for the purposes of this analysis.

Near the Vista Del Rancho Parkway, there are multi-family residential units and single-family attached townhomes adjacent to and west of Vista Boulevard. The multi-family and townhome units do not include sound walls. However, the units that are closest to the roadway are partially shielded from traffic noise by the elevation changes between the roadway and the closest residents and an associated retaining wall. The shielding effects of these elevation changes were factored into the noise modeling.

There are also residential uses on the southern side of Vista Boulevard from west of Peppergrass Way to Ingleston Drive. These uses are primarily single-family units with an approximately 6-foot wooden fence that runs the length of the housing development. Unlike the fence for the residential uses between North Los Altos Parkway and Vista Del Rancho Parkway, this fence is constructed such that the wooden planks overlap with no gaps. This type of wood fencing would be expected to provide a higher noise reduction than a wooden fence with gaps. However, to be conservative, this fence was also assumed to provide no noise shielding for the residential uses behind them.

The primary existing environmental noise source contributing to the ambient noise levels within the project area is traffic on Vista Boulevard. Traffic on other local roadways in the project area make a minor contribution to environmental noise levels, but these sources were not included in the analysis.

### **3.2.2 Measured Noise Levels**

Existing daytime noise levels were monitored at five locations in the project corridor on March 12, 2009. The noise measurements were taken at select representative receptor locations and were primarily used to calibrate the TNM model. The locations of the measurement locations are shown in Figure 2 as measurement locations A through E.

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<sup>1</sup> Note that Vista Boulevard runs in a north-south direction between North Los Altos Parkway and Peppergrass Way where it bends and runs in an east-west direction through Wingfield Parkway.

Noise levels were monitored using a Larson-Davis Laboratories Model 820 sound level meter, which satisfies the American National Standards Institute (ANSI) for general environmental noise measurement instrumentation. The noise sources and measurement data at each location are presented in Table 4. Existing traffic noise levels at measurement locations are below the NAC for most areas, except for residents between North Los Altos Parkway and Vista Del Rancho Parkway where noise levels were above 67 dBA during the PM peak period.

**Table 4**  
**Daytime Noise Levels Measurements at Selected Locations On/Around the Project Site**

	Noise Measurement Location	Primary Noise Sources	Noise Statistics		
			L <sub>eq</sub>	L <sub>min</sub>	L <sub>max</sub>
A	Single-family residential neighborhood on the east side of Vista Boulevard, south of North Los Altos Parkway. No barrier effects.	Traffic along Vista Boulevard	58.0	43.6	69.6
B	Single-family residential neighborhood on the east side of Vista Boulevard, between North Los Altos Parkway and Vista Del Rancho Parkway. In gap between residential units in front of wooden fences.	Traffic along Vista Boulevard	67.2	42.5	77.2
C	Single-family attached townhomes on west side of Vista Boulevard, north of Vista Del Rancho Parkway. No barrier effects.	Traffic along Vista Boulevard	56.3	39.2	69.5
D	Single-family residential neighborhood on south side of Vista Boulevard, east of Wingfield Hills Road, behind 4-foot-tall wooden fence.	Traffic along Vista Boulevard	49.8	36.1	63.2
E	Single-family residential neighborhood on north side of Vista Boulevard, east of Wingfield Parkway	Traffic along Vista Boulevard	49.0	30.2	64.3

Source: PBS&J, 2009.

Notes:

See Figure 2 for measurement locations.

Noise measurements taken during the PM peak period between 3:00 p.m. and 6:00 p.m. on March 12, 2009. Each measurement was 10 minutes in duration L<sub>eq</sub> is the average noise level over the measurement period, L<sub>min</sub> is the minimum instantaneous noise level during the measurement period, while L<sub>max</sub> is the maximum instantaneous noise level during the measurement period.

### **3.2.3 Calibration of Traffic Noise Model**

Existing peak hour traffic  $L_{eq5}$  at the measurement locations were estimated using TNM and the traffic volumes counted during the measurement periods to test agreement between the modeled and measured noise levels. The calculated and measured noise levels at each location differed by less than 2 dBA, a precision which is considered to be acceptable for environmental noise modeling.

### **3.2.4 Calculated Existing Peak-Hour Noise Levels**

Modeling receptor locations were selected to represent the range of noise-sensitive land uses in the project corridor to gain a more complete understanding of the spatial variation of noise levels. The locations of the modeling locations are shown in Figure 2. The existing peak-hour traffic  $L_{eq5}$  at these noise-sensitive land uses in the project area were estimated using TNM, as shown in Table 5. The calculated existing traffic noise levels at most noise-sensitive land uses in the project area are below the NAC, except for the residences between North Los Altos Parkway and Vista Del Rancho Parkway. Under existing conditions, the NAC for residential land uses would be approached or exceeded at 5 of the 37 modeled representative noise-sensitive receptors. Those 5 affected receptors represent a total of 16 noise-impacted dwelling units and one multi-family development.

## **3.3 Build Conditions (2020)**

The proposed project (i.e., the “Build” scenario) includes the traffic increases from development through the year 2020 and the widening of Vista Boulevard to accommodate that traffic. In many areas along Vista Boulevard, the Build scenario would move the centerline and the closest travel lane closer to existing residential uses. Figure 2 shows the centerline and proposed edge of roadway for Vista Boulevard in relation to existing residential uses.

The peak-hour traffic  $L_{eq5}$  under 2020 conditions were calculated using traffic volumes provided by the project traffic study. The estimated peak-hour  $L_{eq5}$  at the selected local noise-sensitive land uses are presented in Table 6. Under 2020 conditions, the noise levels for the first row of houses along Vista Boulevard between North Los Altos Parkway and Vista Del Rancho Parkway, from west of Peppergrass Way to Wingfield Hills, and from Wingfield Hills to east of Ingleston Drive would be above NAC. The noise abatement criteria for first-row residential land uses would be approached or exceeded at 12 of the 37 modeled representative noise-sensitive receptors; those 12 affected receptors represent a total of 56 noise-impacted dwelling units and one multi-family development. However, the calculated traffic noise levels would be below the NAC under 2020 build conditions for most residents along Vista Boulevard beyond the first row of houses.

**Table 6**  
**Calculated Roadway Noise Levels Under 2020 and 2040 Build Conditions**  
**at Selected Noise-Sensitive Locations**

Receptor	Location	Dwelling Units	Distance from Roadway <sup>2</sup>	Existing Barrier	Modeled Peak Hour L <sub>eq</sub> (dBA) <sup>1</sup>			Noise Increase Peak Hour Leq (dBA)		Noise Impacts	
					Existing	Year 2020	Year 2040	Year 2020 minus Existing	Year 2040 Minus Existing	Type of Impact	Noise Abatement Considered
A	South of North Los Altos Pkwy	0	NA	None	55.3	57.6	65.8	2.3	10.5	None	NA
1	South of North Los Altos Pkwy	3	1st Row	None	55.1	57.5	63.0	2.4	7.9	None	NA
2	South of North Los Altos Pkwy	3	1st Row	Masonry Wall	53.5	55.8	60.5	2.3	7	None	NA
3	North Los Altos to Commercial	4	1st Row	Wood Fence (gaps)	61.8	64.1	64.9	2.3	3.1	None	NA
4	North Los Altos to Commercial	5	1st Row	Wood Fence (gaps)	63.2	65.5	<b>66.1</b>	2.3	2.9	NAC	Barrier 1/ Barrier 1A
5	North Los Altos to Commercial	3	2nd Row	Wood Fence (gaps)	59.8	62.1	62.8	2.3	3	None	NA
6	North Los Altos to Commercial	4	2nd Row	Wood Fence (gaps)	59.4	61.8	62.4	2.4	3	None	NA
7	Commercial to Vista Del Rancho	2	1st Row	Wood Fence (gaps)	<b>66.2</b>	<b>68.6</b>	<b>69.1</b>	2.4	2.9	NAC	Barrier 1/ Barrier 1A
8	Commercial to Vista Del Rancho	4	1st Row	Wood Fence (gaps)	<b>66.4</b>	<b>68.8</b>	<b>69.4</b>	2.4	3	NAC	Barrier 1/ Barrier 1A
9	Commercial to Vista Del Rancho	4	2nd Row	Wood Fence (gaps)	61.6	63.9	64.5	2.3	2.9	None	NA
10	Commercial to Vista Del Rancho	6	1st Row	Masonry Wall	59.3	61.7	62.2	2.4	2.9	None	NA
11	Commercial to Vista Del Rancho	2	2nd Row	Masonry Wall	57.5	59.8	60.4	2.3	2.9	None	NA
12	Commercial to Vista Del Rancho	2	1st Row	Masonry Wall	60.8	63.0	63.5	2.2	2.7	None	NA
13	Commercial to Vista	2	1st Row	Wood Fence (gaps)	<b>66.2</b>	<b>68.8</b>	<b>69.3</b>	2.6	3.1	NAC	Barrier 2/

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											Barrier 1A
14	Del Rancho										
	Commercial to Vista Del Rancho	2	2nd Row	Wood Fence (gaps)	61.7	64.0	64.6	2.3	2.9	None	NA
B	Commercial to Vista Del Rancho	0	NA	None	67.6	70.3	70.8	2.7	3.2	None <sup>3</sup>	NA
15	Commercial to Vista Del Rancho	10	1st Row	Wood Fence (gaps)	64.9	<b>67.3</b>	<b>67.8</b>	2.4	2.9	NAC	Barrier 2/ Barrier 1A
16	Commercial to Vista Del Rancho	4	2nd Row	Wood Fence (gaps)	61.0	63.4	63.9	2.4	2.9	None	NA
17	Commercial to Vista Del Rancho	4	1st Row	Wood Fence (gaps)/None	65.9	<b>68.2</b>	<b>68.7</b>	2.3	2.8	NAC	Barrier 3/ Barrier 1A
18	Commercial to Vista Del Rancho	5	2nd Row	Wood Fence (gaps)/None	61.6	63.8	64.3	2.2	2.7	None	NA
19	Commercial to Vista Del Rancho	2	1st Row	Wood Fence (gaps)/None	65.1	<b>67.4</b>	<b>67.9</b>	2.3	2.8	NAC	Barrier 3/ Barrier 1A
20	Commercial to Vista Del Rancho	2	2nd Row	Wood Fence (gaps)/None	61.1	63.4	63.9	2.3	2.8	None	NA
21	Commercial to Vista Del Rancho	MF	1st Row	None	61.4	63.7	64.2	2.3	2.8	None	NA
22	Commercial to Vista Del Rancho	MF	1st Row	None	59.9	62.4	62.9	2.5	3	None	NA
23	North of Vista Del Rancho Pkwy	6	1st Row	None	62.7	64.9	65.4	2.2	2.7	None	NA
24	North of Vista Del Rancho Pkwy	10	2nd Row	None	60.1	62.3	62.8	2.2	2.7	None	NA
25	North of Vista Del Rancho Pkwy	6	1st Row	None	63.5	65.7	<b>66.2</b>	2.2	2.7	NAC	Barrier 4
26	North of Vista Del Rancho Pkwy	4	1st Row	None	61.6	63.8	64.3	2.2	2.7	None	NA
C	North of Vista Del Rancho Pkwy	0	NA	None	59.8	62.0	62.5	2.2	2.7	None	NA
27	West of Peppergrass Way to Wingfield Hills Rd	5	1st Row	Wood Fence (no gaps)	65.2	<b>67.7</b>	<b>68.2</b>	2.5	3	NAC	Barrier 5
28	West of Peppergrass Way to Wingfield Hills Rd	2	2nd Row	Wood Fence (no gaps)	60.3	62.5	63.1	2.2	2.8	None	NA
29	West of Peppergrass Way to Wingfield	16	1st Row	Wood Fence (no gaps)	65.3	<b>67.9</b>	<b>68.4</b>	2.6	3.1	NAC	Barrier 5

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	Hills Rd										
	West of Peppergrass Way to Wingfield Hills Rd	11	2nd Row	Wood Fence (no gaps)	61.2	63.6	64.1	2.4	2.9	None	NA
30	West of Peppergrass Way to Wingfield Hills Rd	11	2nd Row	Wood Fence (no gaps)	61.2	63.6	64.1	2.4	2.9	None	NA
31	West of Peppergrass Way to Wingfield Hills Rd	3	1st Row	Wood Fence (no gaps)	63.7	<b>66.3</b>	<b>66.9</b>	2.6	3.2	NAC	Barrier 5
32	West of Peppergrass Way to Wingfield Hills Rd	3	2nd Row	Wood Fence (no gaps)	60.3	62.6	63.2	2.3	2.9	None	NA
33	Wingfield Hills to Ingleston Dr	8	1st Row	Wood Fence (no gaps)	<b>66.7</b>	<b>68.0</b>	<b>68.8</b>	1.3	2.1	NAC	Barrier 6
34	Wingfield Hills to Ingleston Dr	6	2nd Row	Wood Fence (no gaps)	63.2	64.3	65.0	1.1	1.8	None	NA
D	Wingfield Hills to Ingleston Dr	0	NA	Wood Fence (no gaps)	66.6	67.9	68.8	1.3	2.2	None <sup>3</sup>	NA
35	Wingfield Hills to Ingleston Dr	MF	1st Row	None	65.0	66.4	<b>67.3</b>	1.4	2.3	NAC	Barrier 7
36	East of Ingleston Dr	MF	1st Row	None	<b>67.6</b>	<b>69.1</b>	<b>70.0</b>	1.5	2.4	NAC	Barrier 8
37	East of Ingleston Dr	MF	2nd Row	None	65.0	<b>66.4</b>	<b>67.3</b>	1.4	2.3	NAC	Barrier 8
E	East of S. Wingfield Pkwy	0	NA	None	59.8	61.6	62.6	1.8	2.8	None	NA

Source: PBS&J, 2009.

Notes:

**Bold** = Exceeds or Approaches the NAC; the effective NAC for residential uses under activity category B lands is a peak-hour  $L_{eq}$  of 66 dBA.

MF = Multi-family residential use

- Noise levels calculated using FHWA's TNM. Noise levels calculated during the PM peak hour at the identified receptors. Based on traffic data from the traffic study.
- Distance from roadway refers to which row of houses the modeling location represents. First row of houses are the closest to the roadway, where second row houses are behind the first row and would be partially shielded from traffic noise by the first row of houses.
- Noise levels at these locations exceed 66 dBA; however, there are no residential units thus no impacts would occur.

### **3.4 Cumulative Conditions (2040)**

The project traffic study identifies the ultimate right-of-way that would be required to accommodate the Year 2040 traffic volumes (i.e., the “Cumulative” scenario). Although the proposed project does not include the widening of Vista Boulevard to accommodate the year 2040 traffic, there could be additional noise impacts from this traffic volume growth through year 2040.

The estimated peak-hour  $L_{eq5}$  under Cumulative conditions at the selected noise-sensitive land uses are presented in Table 6. The Cumulative noise levels for the first row of houses along Vista Boulevard between North Los Altos Parkway and Vista Del Rancho Parkway, from west of Peppergrass Way to Wingfield Hills, and from Wingfield Hills to east of Ingleston Drive would be above the NAC. The NAC for residential land uses would be approached or exceeded at 15 of the 37 modeled representative noise-sensitive receptors. Those 15 affected receptors represent a total of 67 noise-impacted dwelling units and one multi-family development. The Cumulative traffic noise levels would be below the NAC for most residents along Vista Boulevard beyond the first row of houses.

### **3.5 Preliminary Noise Abatement Evaluation**

In accordance with RTC policies, noise abatement is considered where noise impacts are predicted in areas of frequent human use that would benefit from a lowered noise level. Potential noise abatement measures include the following:

- avoiding the impact by using design alternatives, such as altering the horizontal and vertical alignment of the roadway;
- constructing noise barriers;
- acquiring property to serve as a buffer zone;
- using traffic management measures to regulate types of vehicles and speeds; and
- acoustically insulating public-use or nonprofit institutional structures.

Of all potential traffic noise mitigation measures that can be used to mitigate noise impacts, the construction of noise barriers (i.e., walls, earthen berms, or a combination of berms and walls) is the most practical, reasonable, and effective choice for most projects. For this project, the identified noise impacts would primarily be at existing single-family residential uses where there are currently wooden fences constructed at the property line. Replacement of these wooden fences with more substantial noise barriers would be the most efficient method of reducing noise impacts.

The RTC considers a noise-abatement measure to be feasible if that measure can technically achieve a noise reduction of 5 decibels or more, given the physical specifications of the abatement measure and the shielding effects of the surrounding terrain/structures. The TNM model was used to determine the noise reduction provided by soundwalls at the locations shown in Figure 2. Table 7 identifies the

predicted traffic noise impacts with and without abatement and the noise reductions from a 6- or 8-foot wall at each location. A cost estimate for each of the feasible barriers is provided in Table 8.

Noise barriers were considered at the following locations:

- **Barrier 1** – A 6- or 8-foot-high sound wall would be feasible for this location, as it would result in at least 5 decibels of reduction for the impacted residents. Cost estimates for a 6-foot and an 8-foot wall would be \$144,990 and \$193,320, respectively, and would benefit approximately 11 residences. This barrier would replace an existing wooden fence and would require a temporary or permanent easement for construction of the wall at the property line of these residents.
- **Barrier 1A** – A 6- to 8-foot-high sound wall<sup>2</sup> was considered as an alternative location to Barriers 1, 2, and 3. This sound wall would be feasible for this location as it would result in at least 5 decibels of reduction for the impacted residents. Cost estimates for a 6-foot and an 8-foot wall would be \$539,730 and \$719,640, respectively, and would benefit approximately 29 residences. This barrier would be in the roadway right-of-way and would not require any temporary or permanent easements.
- **Barrier 2** – A 6- or 8-foot-high sound wall would be feasible for this location, as it would result in at least 5 decibels of reduction for the impacted residents. Cost estimates for a 6-foot and an 8-foot wall would be \$168,750 and \$225,000, respectively, and would benefit approximately 12 residences. This barrier would replace an existing wooden fence and would require a temporary or permanent easement for construction of the wall at the property line of these residents.
- **Barrier 3** – A sound wall would not be feasible for this location, as it would require construction within the parcel boundaries. The residences north of Vista Boulevard have the same horizontal distance to the roadway and the same vertical topography changes as the residences to the south of Vista Boulevard. However, the property parcels for the northern residences extend down the hill toward Vista Boulevard. Thus, to be in line with the adjacent barriers to the south, the noise barrier shown in Figure 2 would need to be constructed within the parcel boundaries. Some northern residences currently have wooden fences constructed in this location and it could be possible to obtain an easement to replace these wooden fences with sound barriers that would provide a greater noise reduction. However, unless all residents agreed to replacement of all the wooden fences, the effectiveness of the new sound wall would be greatly diminished. Construction of a wall at the property boundary nearest Vista Boulevard would not be feasible as the wall would not be close enough to either the roadway or the residences to block the line of site for noise propagation because of local topography conditions.

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<sup>2</sup> A 6-foot-high sound wall would be feasible for all modeled receivers behind the sound wall except Receiver 19, which would require an 8-foot sound wall to result in traffic noise below the NAC.

- **Barrier 4** – A sound wall would not be feasible for this location, as it would not provide a 5 dB reduction for the residences.
- **Barrier 5** – A 6- or 8-foot sound wall would be feasible for this location, as it would result in at least 5 decibels of reduction for the impacted residences. Cost estimates for a 6-foot and an 8-foot wall would be \$411,210 and \$548,280, respectively, and would benefit approximately 24 residences. This barrier would replace an existing wooden fence and would require a temporary or permanent easement for construction of the wall at the property line of these residents if constructed. However, while this barrier was found to be feasible, because these residential units were constructed after first public knowledge of the proposed roadway widening, RTC has determined that abatement for these units would not be within RTC’s duty for abatement.
- **Barrier 6** - A 6- or 8-foot sound wall would be feasible for this location, as it would result in at least 5 decibels of reduction for the impacted residences. Cost estimates for a 6-foot and an 8-foot wall would be \$92,610 and \$123,480, respectively, and would benefit approximately 8 residences. This barrier would replace an existing wooden fence, and would require a temporary or permanent easement for construction of the wall at the property line of these residents. However, while this barrier was found to be feasible, because these residential units were constructed after first public knowledge of the proposed roadway widening, RTC has determined that abatement for these units would not be within RTC’s duty for abatement.
- **Barrier 7** – A 6- or 8-foot sound wall would be feasible for this location, as it would result in at least 5 decibels of reduction for the impacted residences. Cost estimates for a 6-foot and an 8-foot wall would be \$31,590 and \$42,120, respectively, and would benefit one multi-family residential building. However, because of an existing multi-use trail in the vicinity, there may be difficulties constructing the sound wall. Visual changes to the area may result, which may not be desirable to the residents. It should be noted that this multi-family residential development does not have clearly defined outdoor activity areas, such as backyards. Therefore, no noise impacts to outdoor noise-sensitive areas would occur. Also, because these residential units were constructed after first public knowledge of the proposed roadway widening, RTC has determined that abatement for these units would not be within RTC’s duty for abatement.
- **Barrier 8** – A 6- or 8-foot sound wall would be feasible for this location, as it would result in at least 5 decibels of reduction for the impacted residences. Cost estimates for a 6-foot and an 8-foot wall would be \$35,100 and \$46,800, respectively, and would benefit one multi-family residential building. However, because of an existing multi-use trail in the vicinity, there may be difficulties constructing the sound wall. Visual changes to the area may result, which may not be desirable to the residents. It should be noted that this multi-family residential development does not have clearly defined outdoor activity areas, such as backyards. Therefore, no noise impacts to outdoor noise-sensitive areas would occur. Also, because these

residential units were constructed after first public knowledge of the proposed roadway widening, RTC has determined that abatement for these units would not be within RTC's duty for abatement.

**Table 7**  
**Noise Barrier Feasibility**

<b>Location</b>	<b>Impacted Residences</b>	<b>Barrier Considered<sup>1</sup></b>	<b>Unabated Noise Level</b>	<b>Abated Noise Level with a 6-foot Sound Wall</b>	<b>Noise Reduction with a 6-foot Sound Wall</b>	<b>Abated Noise Level with an 8-foot Sound Wall</b>	<b>Noise Reduction with an 8-foot Sound Wall</b>
Commercial to Vista Del Rancho	11	Barrier 1	69.4	62.3	<b>7.1</b>	59.9	<b>9.5</b>
Commercial to Vista Del Rancho	29	Barrier 1A	67.4	59.9	<b>7.5</b>	58.1	<b>9.3</b>
Commercial to Vista Del Rancho	12	Barrier 2	67.8	61.1	<b>6.7</b>	58.3	<b>9.5</b>
Commercial to Vista Del Rancho	6	Barrier 3	67.9	62.8	<b>5.1</b>	61.6	<b>6.3</b>
North of Vista Del Rancho Pkwy	6	Barrier 4	66.2	65.7	0.5	65.5	0.8
West of Peppergrass Way to Wingfield Hills Rd	19	Barrier 5	68.4	61.4	<b>7.0</b>	58.7	<b>9.7</b>
Wingfield Hills to Ingleston Dr	8	Barrier 6	68.8	59.2	<b>9.6</b>	57.2	<b>11.6</b>
Wingfield Hills to Ingleston Dr	MF	Barrier 7	67.4	62.1	<b>5.3</b>	61.2	<b>6.2</b>
East of Ingleston Dr	MF	Barrier 8	69.8	63.5	<b>6.3</b>	61.7	<b>8.1</b>

Source: PBS&J, 2009.

Notes:

See Figure 2 for measurement locations.

**Bold** = Meets 5 dB noise reduction feasibility criteria.

MF = Multi-family residential use

1. For each barrier considered, a critical receiver was selected to represent maximum achievable noise reductions. Actual noise reductions for each individual receiver behind the barrier would vary depending on location.
2. Note that Barrier 1A is being considered as an alternative barrier location for Barriers 1, 2, and 3.

**Table 8**  
**Estimated Barrier Construction Costs**

<b>Proposed Barrier</b>	<b>Location</b>	<b>Estimated Length (feet)</b>	<b>Height (feet)</b>	<b>Estimated Construction Cost</b>
1	Commercial to Vista Del Rancho	537	6	\$144,990
			8	\$193,320
1A <sup>1</sup>	Commercial to Vista Del Rancho	1,999	6	\$539,730
			8	\$719,640
2	Commercial to Vista Del Rancho	625	6	\$168,750
			8	\$225,000
5	West of Peppergrass Way to Wingfield Hills Rd	1,523	6	\$411,210
			8	\$548,280
6	Wingfield Hills to Ingleston Dr	343	6	\$92,610
			8	\$123,480
7	Wingfield Hills to Ingleston Dr	117	6	\$31,590
			8	\$42,120
8	East of Ingleston Dr	130	6	\$35,100
			8	\$46,800

*Source:* PBS&J, 2009.

*Note:* Construction costs based on an average construction cost of \$45/square-foot of wall constructed.

1. Note that Barrier 1A is being considered as an alternative barrier location for Barriers 1, 2, and 3.

### 3.6 Construction-Related Noise Impacts

Implementation of the project would result in temporarily elevated noise levels due to the use of construction machinery. Noise impacts may be significant if construction occurs next to dwellings or other sensitive uses that are currently occupied. The sensitive receptors located in the project area would potentially be exposed to on-site construction noise activities as discussed below.

Construction activities are carried out in discrete steps, each of which has its specific mix of equipment, each of which has its own noise characteristics. Noise levels surrounding a construction site would, therefore, vary as work progresses. A variety of construction equipment would be used for the project including dozers, backhoes, compaction equipment, pile drivers, concrete and asphalt paving equipment, and large trucks. Construction activities would be temporary in nature and are anticipated to occur during normal daytime working hours. Construction noise impacts could result in annoyance or sleep disruption if nighttime operations occur or if unusually noisy equipment is used. Because of this, construction activities in developed areas rarely occur during nighttime periods. Table 9 illustrates typical construction equipment noise levels.

**Table 9**  
**Typical Construction Equipment Noise Levels**

Equipment	Distance (Feet)	Sound Level (dB)
Front Loaders	50	79
Dozers	50	80
Concrete Mixer	50	85
Jack Hammers	50	88

*Source:* U.S. Environmental Protection Agency. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, December 1971.

Construction noise sources range from about 79 to 88 dBA at 50 feet for most types of construction equipment. The rate of noise attenuation is about 6 dBA for every doubling of distance from a point source. When individual types of construction equipment are considered, average noise levels generated by the operation of certain types of construction equipment could exceed 80 dBA at 100 feet without noise controls (noise levels at 50 feet from earth-moving equipment range from 73 to 96 dBA). Occupants of buildings located within 100 feet or less of the proposed roadway route could be affected by construction-related noise.

### **3.6.1 Construction Noise Impact Assessment**

Short-term construction levels during construction of the project would result in an increase in ambient noise levels within the project vicinity. Thus, short-term noise impacts at the sensitive receptors in the project area would occur.

### **3.6.2 Construction Noise Mitigation**

For this project, construction equipment operating during construction of the project will conform to contractual specifications that require the contractor to comply with all local noise control noise rules, regulations, and ordinances. If a special plan for controlling construction noise in a sensitive location is needed, a plan will be developed to be included in the contract documents. Furthermore, there are no RTC criteria for construction noise impacts. Although construction noise impacts would be temporary, the following standard measures would be implemented to minimize such impacts:

- a) Maximize the physical separation between noise generators and noise receptors to the extent feasible. Such separation includes, but is not limited to, the following measures:
  - Provide enclosures such as heavy-duty mufflers for stationary equipment; and
  - Locate stationary equipment to minimize noise impacts on the community; and
- b) All stationary noise generating equipment, such as compressors, will be located as far as possible from existing residences.
- c) Machinery and mobile equipment, including motors, will be turned off when not in use.
- d) Schedule construction activity that produces higher noise levels during less noise-sensitive hours to the extent feasible (normally 7 a.m. to 7 p.m. daily). Notification will be given to

residences within 100 feet of planned construction activities and will include the overall duration of construction and the schedule of activities. The notification will also describe noise abatement measures that have been taken. A noise disturbance coordinator or public outreach coordinator will be designated who will be responsible for responding to complaints about noise during construction. The telephone number of this person will be conspicuously posted at the construction site.

### **3.7 References**

California Department of Transportation, Technical Noise Supplement, October 1998.

Federal Highway Administration. 23 CFR Part 772--Procedures for Abatement of Highway Traffic Noise and Construction Noise.

Federal Transit Administration. Transit Noise and Vibration Impact Assessment Manual, May 2006.

PBS&J. Vista Boulevard Traffic Study. November, 2008.

U.S. Environmental Protection Agency. Noise from Construction Equipment and Operations, Building Equipment and Home Appliances, 1971

### **3.8 Appendix: Noise Calculation Worksheets**