Environmental Noise Assessment

Montano de El Dorado Shopping Center Expansion EIR Update

El Dorado County, California

BAC Job # 2016-032

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Introduction

The Montano de El Dorado Expansion Project (project) consists of the expansion on an existing commercial development located in the southeast quadrant of the White Rock Road and Latrobe Road intersection in El Dorado Hills, California. The existing shopping center encompasses approximately 6 acres and the project proposes the development of approximately 16 acres to the south. The project proposes additional commercial uses, a 4-story hotel, and an outdoor amphitheater. Surrounding land uses include the following: Existing commercial development (Town Center East) to the north; vacant land to the west; and adjacent residential to the east. Figures 1 and 2 show the project site area and site plan, respectively.

This analysis focuses on off-site traffic noise generation, noise generated by on-site commercial-related activity, the proposed amphitheater, events and sales promotions, the proposed SS lift station, construction, and future interior traffic noise levels within rooms of the proposed hotel. On-site commercial related activities that were considered in this analysis consisted of truck circulation and deliveries, waste removal activities, and mechanical equipment associated with air conditioning and potential food cold storage equipment. Specific noise mitigation recommendations are provided in this analysis to mitigate project noise impacts.

Acoustical Fundamentals and Terminology

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard, and are designated as sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, or hertz. Definitions of acoustical terminology are shown in Appendix A.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure) as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness.

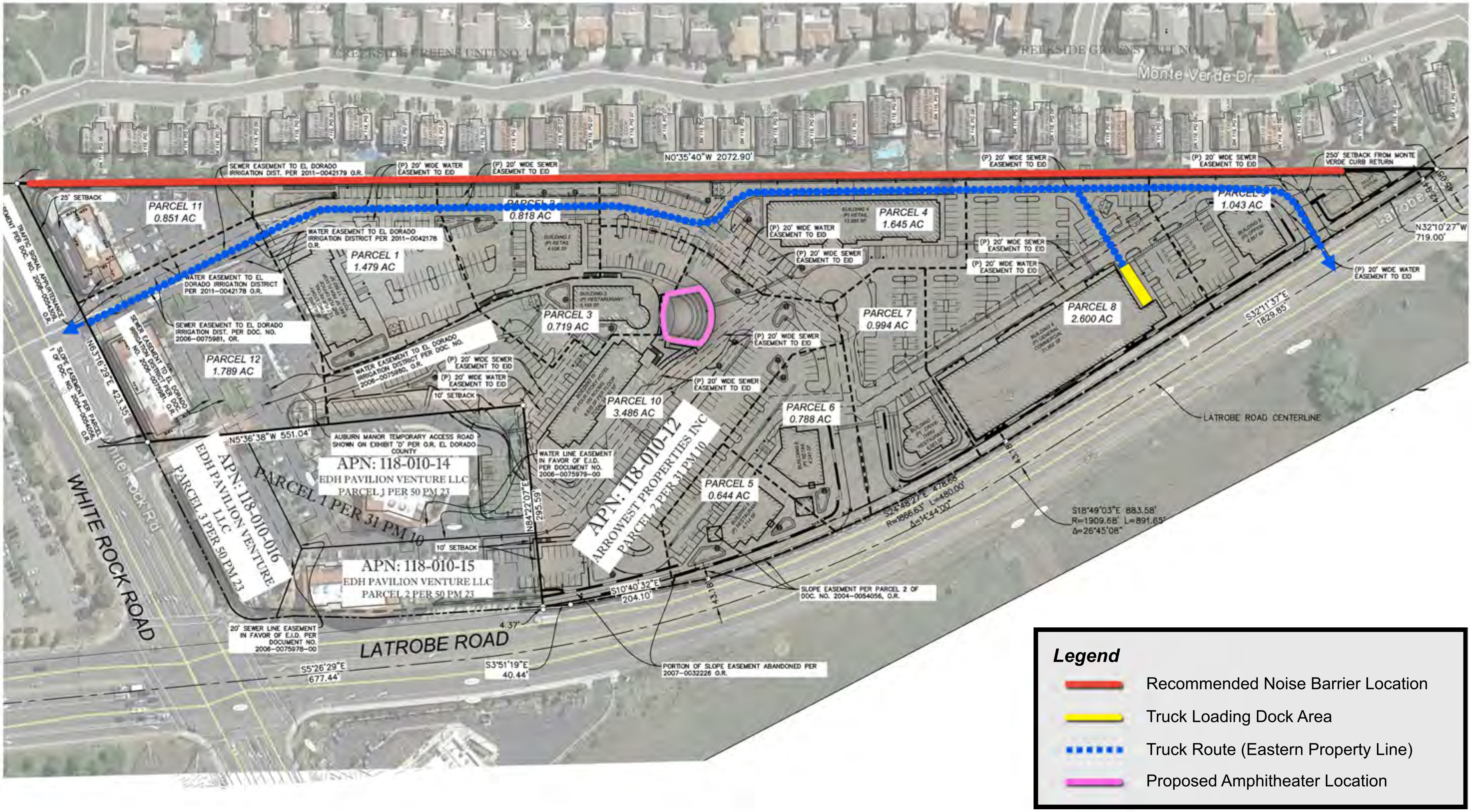
The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by filtering the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels.

Figure 1

Project Area and Noise Measurement Locations

Montano de El Dorado Shopping Center Expansion - El Dorado County, California

Figure 2
Proposed Project Site Plan
Montano de El Dorado Shopping Center Expansion - El Dorado County, California



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Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}). The L_{eq} is the foundation of the day/night average noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The Day-night Average Level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. For this reason, El Dorado County utilizes hourly performance standards for non-transportation noise sources.

Criteria for Acceptable Noise Exposure

El Dorado County General Plan Noise Level Standards

The Noise Element of the El Dorado County General Plan contains policies to ensure that County residents are not subjected to noise beyond acceptable levels. Noise impacts associated with this project would occur if proposed non-transportation noise sources (e.g. rooftop mechanical equipment, parking lot movements, loading dock activities, on-site slow-moving heavy-truck passbys, idling heavy-trucks, heavy-truck refrigeration units, amphitheater activities), exceed County noise standards at the existing residences to the east. Noise impacts associated with this project would also occur if projected future Latrobe Road traffic noise levels exceed County noise standards at the exterior and interior of the proposed hotel within the project site, or if the project would result in a substantial increase in traffic noise levels at existing residences in the immediate project vicinity. The County General Plan Policies which are applicable to these to potential impacts are reproduced below:

Policy 6.5.1.1 Where noise-sensitive land uses are proposed in areas exposed to existing or projected exterior noise levels exceeding the levels specified in Table 1 (GP Table 6-1) or the performance standards of Table 2 (GP Table 6-2), an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.

Policy 6.5.1.2 Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table 2 at existing or planned noise-sensitive uses, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.

Policy 6.5.1.3 Where noise mitigation measures are required to achieve the standards of Tables 1 and 2, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project and the noise barriers are not incompatible with the surroundings.

Policy 6.5.1.5 Setbacks shall be the preferred method of noise abatement for residential projects located along U.S. Highway 50. Noise walls shall be discouraged within the foreground viewshed of U.S. Highway 50 and shall be discouraged in favor of less intrusive noise mitigation (e.g., landscaped berms, setbacks) along other high volume roadways.

Policy 6.5.1.7 Noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards of Table 2 for noise-sensitive uses.

Policy 6.5.1.8 New development of noise sensitive land uses will not be permitted in areas exposed to existing or projected levels of noise from transportation noise sources which exceed the levels specified in Table 1 unless the project design includes effective mitigation measures to reduce exterior noise and noise levels in interior spaces to the levels specified in Table 1.

Policy 6.5.1.9 Noise created by new transportation noise sources, excluding airport expansion but including roadway improvement projects, shall be mitigated so as not to exceed the levels specified in Table 1 at existing noise sensitive land uses.

Policy 6.5.1.12 When determining the significance of impacts and appropriate mitigation for new development projects, the following criteria shall be taken into consideration:

A. Where existing or projected future traffic noise levels are less than 60 dBA L_{dn} at the outdoor activity areas of residential uses, an increase of more than 5 dBA L_{dn} caused by a new transportation noise source will be considered significant;

B. Where existing or projected future traffic noise levels range between 60 and 65 dBA L_{dn} at the outdoor activity areas of residential uses, an increase of more than 3 dBA L_{dn} caused by a new transportation noise source will be considered significant; and

C. Where existing or projected future traffic noise levels are greater than 65 dBA L_{dn} at the outdoor activity areas of residential uses, an increase of more than 1.5 dBA L_{dn} caused by a new transportation noise will be considered significant.

Policy 6.5.1.13 When determining the significance of impacts and appropriate mitigation to reduce those impacts for new development projects, including ministerial development, the following criteria shall be taken into consideration:

A. In areas in which ambient noise levels are in accordance with the standards in Table 2, increases in ambient noise levels caused by new non-transportation noise sources that exceed 5 dBA shall be considered significant; and

B. In areas in which ambient noise levels are not in accordance with the standards in Table 2, increases in ambient noise levels caused by new non-transportation noise sources that exceed 3 dBA shall be considered significant.

Table 1
Maximum Allowable Noise Exposure for Transportation Noise Sources
(Table 6-1 of El Dorado County General Plan Noise Element)

Land Use	Outdoor Activity Areas[1] Ldn/CNEL, dB	Interior Spaces	
		Ldn/CNEL, dB	Leq, dB[2]
Residential	60[3]	45	--
Transient Lodging	60[3]	45	--
Hospitals, Nursing Homes	60[3]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls, Schools	60[3]	--	40
Office Buildings	--	--	45
Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

Notes:

[1] In Communities and Rural Centers, where the location of outdoor activity areas is not clearly defined, the exterior noise level standard shall be applied to the property line of the receiving land use. For residential uses with front yards facing the identified noise source, an exterior noise level criterion of 65 dB L_{dn} shall be applied at the building facade, in addition to a 60 dB L_{dn} criterion at the outdoor activity area. In Rural Regions, an exterior noise level criterion of 60 dB L_{dn} shall be applied at a 100 foot radius from the residence unless it is within Platted Lands where the underlying land use designation is consistent with Community Region densities in which case the 65 dB L_{dn} may apply. The 100-foot radius applies to properties which are five acres and larger; the balance will fall under the property line requirement.

[2] As determined for a typical worst-case hour during periods of use.

[3] Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Table 2
Noise Level Performance Standards for Noise Sensitive Land Uses Affected by Non-Transportation Sources
(Table 6-2 of El Dorado County General Plan Noise Element)

	Daytime 7 a.m. – 7 p.m.		**Evening 7 p.m. – 10 p.m.**		**Night 10 p.m. – 7 a.m.**	
Noise Level Descriptor	Community	Rural	Community	Rural	Community	Rural
Hourly L_{eq}, dB	55	50	50	45	45	40
Maximum Level, dB	70	60	60	55	55	50

Notes:

Each of the noise levels specified above shall be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive tones.

Each of the noise levels specified above shall be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

The County can impose noise level standards which are up to 5 dB less than those specified above based upon determination of existing low ambient noise levels in the vicinity of the project site. In Community areas the exterior noise level standard shall be applied to the property line of the receiving property. In Rural Areas the exterior noise level standard shall be applied at a point 100' away from the residence. The above standards shall be measured only on property containing a noise sensitive land use as defined in Objective 6.5.1. This measurement standard may be amended to provide for measurement at the boundary of a recorded noise easement between all effected property owners and approved by the County.

El Dorado County Zoning Ordinance

Chapter 130.37, Noise Standards, of the El Dorado County Zoning Ordinance contains noise level standards that are consistent with those found in the County's General Plan. Therefore, satisfaction of the general plan noise level standards (Tables 1 and 2) would ensure satisfaction with the zoning ordinance noise level standards.

Noise Standards Applied to the Project

Because the project area is within the El Dorado Hills Community, the Table 2 standards which would be applicable to this project would be those under the "Community" heading. In addition, because it is possible that activities associated with development within the Montano de El Dorado project could occur during daytime, evening, and nighttime periods, this assessment addresses all three time periods.

The maximum noise level standard of 55 dB L_{max} at exterior spaces of noise-sensitive land uses shown in Table 2 would ensure that noise levels within those sensitive receptors would be approximately 45 dB L_{max} with windows open and approximately 30 dB L_{max} within those uses with windows in the closed position. Due to the low interior noise levels which would result from satisfaction with the Table 2 nighttime standard, compliance with those standards would adequately address the issue of sleep disturbance within those uses, as subsequent analysis of potential impacts related to sleep disturbance would not be warranted.

Evaluation of Existing Ambient Noise Environment

The California Environmental Quality Act (CEQA) requires that a project's noise impacts be evaluated not only against a locally adopted noise standards but also against existing ambient conditions which exist without the project. More specifically, a project's noise impacts are considered significant if the project would cause local noise standards to be exceeded or if the project would result in a substantial increase in ambient noise levels. As a result, it is necessary to define existing ambient conditions in order to satisfy CEQA requirements.

The ambient noise environment in the immediate project vicinity is defined primarily by noise from White Rock Road and Latrobe Road. Because the project site is located approximately 12 miles east of Mather Airport, aircraft operations associated with that airport, while intermittently audible, do not appreciably affect the ambient noise environment at the project site.

To quantify existing ambient noise levels at the existing residential community located adjacent to the eastern project site boundary, continuous (48-hour) ambient noise surveys were conducted on March 1-2, 2016 at the locations shown in Figure 1. The noise measurement sites were selected to represent the potentially affected sensitive land uses nearest to the project site.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the ambient surveys. The meters were calibrated before use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 (precision) sound level meters (ANSI S1.4). The results of the continuous measurements are presented in Table 3. Detailed results are shown numerically in Appendix B and graphically in Appendix C.

Table 3
Existing Continuous Hourly Ambient Noise Measurement Results
Montano de El Dorado Expansion – March 1 & 2, 2016

			Average Measured Noise Levels, dBA					
			Daytime (7 am - 10 pm)			Nighttime (10 pm - 7 am)		
Location	Date	L_{dn}/CNEL	L_{eq}	L_{50}	L_{max}	L_{eq}	L_{50}	L_{max}
Site A	March 1, 2016	63	59	57	62-99	51	47	61-79
	March 2, 2016	60	56	55	62-84	50	46	61-71
Site B	March 1, 2016	69	67	65	74-89	58	45	71-88
	March 2, 2016	69	67	65	74-95	58	45	71-83

Source: Bollard Acoustical Consultants, Inc.
Please refer to Appendix A for definitions of acoustical terminology used in this report.

The Table 3 and Appendices B & C data indicate that measured ambient noise levels were generally in the range of the County's noise level guidelines identified in Table 2 for both daytime and nighttime hours. As a result, provided the noise generation of the Montano de El Dorado project land uses satisfies the County's Table 2 noise standards at the nearest residences, the CEQA requirement that the project not result in a substantial increase in ambient noise levels would also be satisfied.

Noise Generation Associated with Project Development

Off-Site Traffic Noise Level Increases

Development of the project site will result in increased traffic on the local roadway network. According to the project traffic analysis prepared by Kimley Horn Transportation Consultants, the project is estimated to generate approximately 4,300 new daily trips while the existing shopping center generates approximately 3,800 daily trips.

To calculate the traffic noise generation of the additional traffic which would be generated by the project, the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model was used. Traffic volumes in the form of AM and PM peak hour turning movements were obtained from the project traffic study. To estimate daily segment volumes, the AM and PM peak hour volumes were added and then multiplied by a factor of 5. Other FHWA Model inputs, including heavy truck percentages, day/night distribution of traffic, and vehicle speeds were estimated from BAC file data and posted speed limits. Appendix D contains the traffic noise modeling assumptions. The modeled existing traffic noise levels, with and without the development of the project site, are provided in Table 4. The modeled cumulative (2035) traffic noise levels, with and without the development of the project site, are provided in Table 5.

Table 4
Existing Traffic Noise Levels with and without the Project Development
Montano de El Dorado Expansion – El Dorado County, California

Roadway	Segment Description	Predicted Traffic Noise Level, Ldn, @ 100 feet from Roadway Centerline (dB)		
		Existing No-Project	Existing + Project	Increase
El Dorado Hills Blvd	North of Saratoga Way	68.3	68.3	0.0
	Saratoga Way to US-50 WB Ramps	68.0	68.1	0.1
Latrobe Rd	US-50 EB Ramps to Town Center Blvd	69.6	69.7	0.1
	Town Center Blvd to White Rock Rd	68.0	68.2	0.2
	White Rock Rd to Project Driveway	69.2	69.4	0.2
	Project Driveway to Golden Foothill Pkwy N	69.2	69.4	0.2
	Golden Foothill Pkwy to Suncast Ln	68.3	68.4	0.1
	Suncast Ln to Golden Foothill Pkwy S	67.8	67.8	0.0
	South of Golden Foothill Pkwy S	64.8	64.8	0.0
White Rock Rd	West of Stonebriar Dr	63.5	63.3	-0.3
	Stonebriar Dr to Town Center Blvd	64.4	64.5	0.1
	Town Center Blvd to Latrobe Rd	64.4	64.5	0.1
	Latrobe Rd to Post St	64.5	64.8	0.3
	Post St to Valley View Pkwy	64.3	64.4	0.1
	East of Valley View Pkwy	63.1	63.2	0.1
Valley View Pkwy	South of White Rock Rd	59.9	60.0	0.1

Source: FHWA-RD-77-108 with inputs shown in Appendix D.

Table 5
Cumulative (2035) Traffic Noise Levels with and without the Project Development
Montano de El Dorado Expansion – El Dorado County, California

Roadway	Segment Description	Predicted Traffic Noise Level, Ldn, @ 100 feet from Roadway Centerline (dB)		
		2035 No-Project	2035 + Project	Increase
El Dorado Hills Blvd	North of Saratoga Way	68.8	68.8	0.0
	Saratoga Way to US-50 WB Ramps	68.3	68.4	0.1
Latrobe Rd	US-50 EB Ramps to Town Center Blvd	70.4	70.5	0.1
	Town Center Blvd to White Rock Rd	68.8	69.0	0.1
	White Rock Rd to Project Driveway	69.7	69.8	0.2
	Project Driveway to Golden Foothill Pkwy N	69.7	69.8	0.1
	Golden Foothill Pkwy to Suncast Ln	68.5	68.6	0.1
	Suncast Ln to Golden Foothill Pkwy S	67.6	67.7	0.1
	South of Golden Foothill Pkwy S	65.4	65.4	0.0
White Rock Rd	West of Stonebriar Dr	66.4	66.5	0.0
	Stonebriar Dr to Town Center Blvd	66.7	66.7	0.0
	Town Center Blvd to Latrobe Rd	66.7	66.7	0.0
	Latrobe Rd to Post St	66.7	66.9	0.2
	Post St to Valley View Pkwy	66.3	66.4	0.1
	East of Valley View Pkwy	66.9	67.0	0.1
Valley View Pkwy	South of White Rock Rd	61.8	61.8	0.0

Source: FHWA-RD-77-108 with inputs shown in Appendix D.

Inspection of the Table 4 and 5 data indicate that the project-related traffic noise level increases would be less than 0.5 dB on all of the local roadways. According to Policy 6.5.1.12 of the County General Plan, this range of traffic noise level increases would not be considered significant. As a result, noise impacts associated with project-related traffic noise level increases resulting from the project are predicted to be less than significant.

On-Site Truck Circulation Noise Generation

The project proposes the creation of one anchor commercial building, and eight (8) additional smaller commercial buildings. The anchor commercial store includes a dedicated loading dock on the southeast side of the building. That future loading dock area is indicated in Figure 2. At the smaller commercial buildings, the deliveries would likely occur at the front of the buildings, most likely with medium duty trucks and vans. However, a truck route runs along the eastern boundary of the site, which would carry slow-moving truck traffic in close proximity to the existing residences to the east.

Based on BAC file data for similar sized commercial centers, the single event maximum sound level for slow-moving heavy-duty trucks and medium-duty trucks was assumed to be 75 dB and 70 dB L_{max}, respectively, at a reference distance of 50 feet from the passby area. The outdoor activity areas (backyards) of the single-family residences located to the east are approximately 50 feet from the proposed on-site circulation route. At that distance, heavy and medium-duty truck passby levels would be approximately 75 and 70 dB L_{max} respectively.

Because the heavy-duty and medium-duty truck passbys would be of short duration, the Table 2 noise standard which would be most applicable to these sources would be the L_{max} standard. The predicted heavy-duty and medium-duty truck passby levels of 75 dB and 70 dB, respectively, at the nearby single-family residences to the east would exceed the daytime, evening and nighttime noise level standards of 70 dB, 60 dB and 55 dB L_{max}. Therefore, consideration of additional noise mitigation measures would be warranted for this aspect of the project.

Mitigation Requirements Relative to Daytime Noise Level Standard of 70 dB L_{max}

Predicted heavy-duty truck passby noise levels at the backyards of the residences to the east, 50 feet away, would be approximately 75 dB L_{max}. This level exceeds the County's daytime maximum noise level limit of 70 dB L_{max} by 5 dB. With the location of the passby area fixed, the only available noise mitigation measure would be the construction of a solid noise barrier between the truck passby route and the existing residences.

Because only a 5 dB reduction in maximum noise levels would be required during daytime deliveries, this level of attenuation could be achieved through construction of a solid property line noise barrier of 8 feet in height, provided the barrier blocks line of sight to the residential backyards. The barrier would need to be long enough to ensure that sound would not flank around the ends of the barrier into the neighboring backyards and would need to be constructed at the same base elevation as the final grading of the truck route. In areas along the southern end of the site where a retaining wall is proposed adjacent to the truck route at the location of the barrier, the specified 8-foot height refers to the combined height of the retaining wall and barrier, rather than an 8-foot barrier on top of the retaining wall.

Inspection of the project grading plans indicate that the backyards nearest to the truck passby route vary in elevation relative to the project site. On the northern end of the site, residential pads are depressed 5-10 feet relative to the site, while on the southern end residential pads are elevated as much as 25 feet relative to the site. At the elevated southern residences, the combination of shielding provided by the site grading/retaining wall and intervening topography itself would act as a barrier.

BAC calculated that at residential locations along the southern end of the project site, the combination of retaining wall and intervening topography would provide the 5 dB of noise reduction necessary to reduce maximum noise levels to compliance with the County daytime standard of 70 dB L_{max}. The combined noise reduction of the recommended noise barrier and site topography would mitigate daytime truck passby noise levels to a state of compliance with County's daytime noise level standards. No other mitigation measures would be required for the mitigation of truck passby noise levels, provided such activities were limited to daytime hours.

Mitigation Requirements Relative to Evening Noise Level Standard of 60 dB L_{max}

Predicted heavy-duty truck passby noise levels at the backyards of the residences to the east, 50 feet away, would be approximately 75 dB L_{max}. This level exceeds the County's evening maximum noise level limit of 60 dB L_{max} by 15 dB. As mentioned previously, the only available noise mitigation measure would be the construction of a solid noise barrier between the truck passby route and the existing residences. 15 dB of attenuation from a noise barrier (CMU wall) would likely be infeasible.

Because it is unlikely that a solid wall could be constructed tall enough to provide the 15 dB of noise attenuation required to satisfy the evening maximum noise standard, elimination of evening truck traffic along the route on the eastern side of the site would be required.

Mitigation Requirements Relative to Nighttime Noise Level Standard of 55 dB L_{max}

Predicted heavy-duty truck passby noise levels at the backyards of the residences to the east, 50 feet away, would be approximately 75 dB L_{max}. This level exceeds the County's nighttime maximum noise level limit of 55 dB L_{max} by 20 dB. With the location of the passby area fixed at 50 feet, the only available noise mitigation measure would be the construction of a solid noise barrier between the truck passby route and the existing residences. 20 dB of attenuation from a noise barrier (CMU wall) would likely be infeasible.

Because a solid wall could not be constructed tall enough to provide the 20 dB of noise attenuation required to satisfy the nighttime maximum noise standard, elimination of nighttime truck traffic along the route on the eastern side of the site would be required.

Waste Collection Noise Generation

As shown in Figure 2, a waste storage facility is proposed along the truck route located along the eastern side of the site. Waste collection activities would generate noise levels comparable to slow-moving heavy truck traffic. During the actual dumping of the garbage bin, a brief period of increased maximum noise levels would result. However, the construction of the 8-foot tall retaining wall/noise barrier adjacent to the eastern property line near the waste collection area is expected to substantially attenuate the noise generated during garbage collection activities. Nonetheless, to the extent possible, garbage collection activities should be limited to daytime hours.

Loading Dock Noise Generation

The primary noise source associated with the proposed loading dock area, which is identified in Figure 2, is the heavy trucks stopping (air brakes), backing into the loading docks (back-up alarms), and pulling out of the loading docks (revving engines). Once the trucks have backed into the loading dock, they are unloaded from the inside of the store using a fork lift or hand cart, and most of that unloading noise is contained within the building and truck trailer.

BAC file data collected at a commercial loading dock facility indicate that maximum and average loading dock noise generation at a reference distance of 50 feet was 63 dB L_{eq} and 75 dB L_{max}. The distance between the nearest residences and the effective noise center of the proposed loading dock area is approximately 150 feet. At that distance, and after consideration of the recommended 8-foot tall property line noise barrier, loading dock noise levels are predicted to be approximately 40 dB L_{eq} and 52 dB L_{max} at the nearest residences to the east. The predicted loading dock average noise levels would satisfy the daytime, evening, and nighttime noise level standards of 55 dB L_{eq}, 50 dB L_{eq}, and 45 dB L_{eq}, respectively. Similarly, predicted loading dock maximum noise levels would satisfy the daytime, evening, and nighttime noise level standards of 70 dB L_{max}, 60 dB L_{max}, and 55 dB L_{max}, respectively.

As a result, this analysis concludes that daytime, evening, and nighttime truck deliveries at the loading dock shown in Figure 2 would comply with the applicable El Dorado County daytime, evening, and nighttime noise standards, provided truck circulation does not occur on the truck route on the eastern side of the site during evening and nighttime hours. No other mitigation measures would be required for the mitigation of loading dock noise levels.

Mechanical Equipment Noise Generation

The HVAC systems for maintaining comfortable temperatures within future uses constructed within the project area will likely consist of packaged rooftop air conditioning systems. Such HVAC units, which typically stand about 4-5 feet tall, would be shielded from view of nearby sensitive uses by the building parapets. Such rooftop HVAC units frequently generate a noise level of approximately 45 dB L_{eq} at a reference distance of 100 feet from the building façade, including shielding by the building parapet. The predicted HVAC noise levels would satisfy the El Dorado County daytime, evening and nighttime noise level standards.

If uses involving food cold storage are proposed within the project area, additional mechanical equipment would be required of those uses. That equipment is typically located on the roof of the building, within a mechanical equipment room inside the building, or at ground-level outside the building. If such equipment is proposed on the roof of a future building located adjacent to the residential property line to the east, rather than enclosed within an equipment room, a project-specific analysis will be required to ensure that adequate shielding of food cold storage mechanical equipment is included in the project design.

Construction Noise Levels

During the construction of the project, noise from construction-related activities would add to the noise environment in the immediate project vicinity. Activities involved in construction would generate maximum noise levels, as indicated in Table 6, ranging from 85 to 90 dB at a distance of 50 feet.

Table 6
Typical Construction Equipment Noise

Equipment Description	Maximum Noise Level at 50 feet, dBA
Auger drill rig	85
Backhoe	80
Bar bender	80
Blasting	94
Boring jack power unit	80
Chain saw	85
Clam shovel	93
Compactor (ground)	80
Compressor (air)	80
Concrete batch plant	83
Concrete mixer truck	85
Concrete pump truck	82
Concrete saw	90
Crane (mobile or stationary)	85
Dozer	85
Dump truck	84
Excavator	85
Flatbed truck	84
Front end loader	80
Generator (25 kilovolt-amperes [kVA] or less)	70
Generator (more than 25 kVA)	82
Grader	85
Hydra break ram	90
Impact pile driver (diesel or drop)	95
Jackhammer	85
Mounted impact hammer (hoe ram)	90
Paver	85
Pickup truck	55
Pneumatic tools	85
Pumps	77
Rock drill	85
Scraper	85
Soil mix drill rig	80
Tractor	84
Vacuum street sweeper	80
Vibratory concrete mixer	80
Vibratory pile driver	95
Welder/Torch	73

Source: Federal Highway Administration 2006.

Given the proximity of existing and proposed noise-sensitive land uses to the project site, all construction activities must adhere to the County's requirements with respect to hours of construction. In addition, equipment must have appropriate sound muffling devices, which shall be properly maintained and used at all times such equipment is in operation. Furthermore, the construction contractor shall locate on-site equipment staging areas so as to maximize the distance between construction-related noise sources and noise-sensitive receptors nearest the project construction areas.

Amphitheater Noise Generation

Amphitheater Location and Configuration

The project proposes the construction of an outdoor amphitheater at the location shown in Figure 2. Figure 3 shows a more detailed aerial view of the proposed amphitheater location the relationship of the amphitheater to the nearest residences to the east. Figure 3 also indicates the locations of the 20 nearest existing residences with the greatest potential for exposure to amphitheater-generated sound.

Amphitheater Sound Generation

As with any venue which incorporates sound amplification systems, the sound output of the venue will depend largely on the capacity and amplifier settings of the system. Large concert venues, such as Cal Expo Amphitheater, Vina Robles Amphitheater, and Mid-State Fairgrounds in Paso Robles generate average sound levels on the order of 100 dBA at the sound mixing board which is typically located approximately 100 feet from the stage. However, the proposed Montano de El Dorado amphitheater would only be 70 feet from the rear of the stage to the last seating area, so it is a dramatically smaller venue than those previously mentioned.

Given the size of the proposed venue, the distance from the speakers to the farthest patrons would be approximately 50 feet. At this relatively short distance, considerably lower speaker volume levels would be required to maintain comfortable listening conditions within the seating area. The venue size would be more typical of a wedding reception than a major concert.

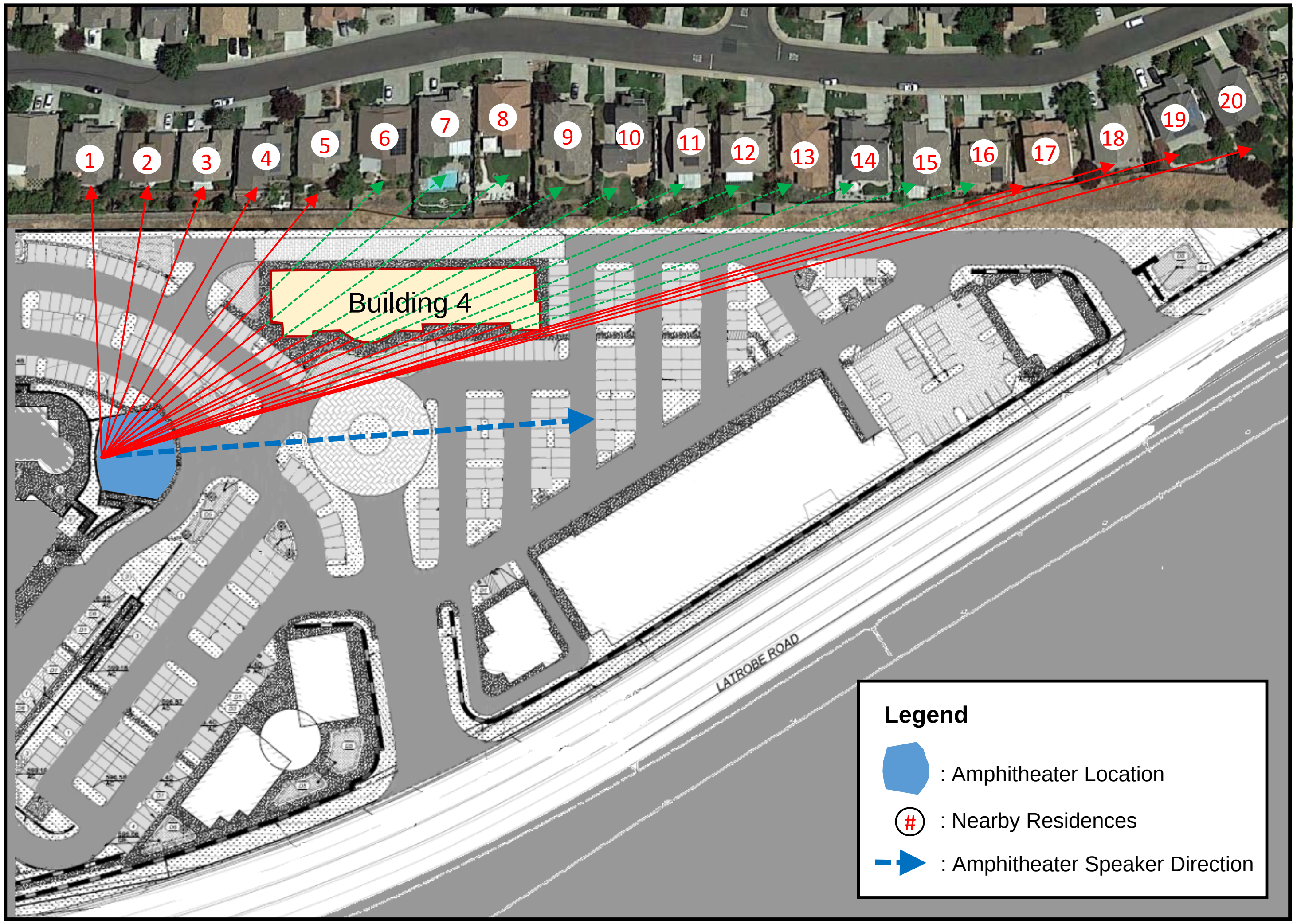
BAC has conducted sound level measurements at various small entertainment venues in recent years. Table 7 shows the sound levels measured at each venue.

Table 7
Measured Amplified Music Sound Levels at Various Comparably Sized Venues

Location	Measurement Distance	Measured Levels, dBA	
		Lmax	Leq
Gold Hill Gardens - Placer County, CA	75	76	72
PJ's at Gray's Crossing – Truckee, CA	50	80	75
Sheldon Inn – Elk Grove, CA	85	79	69
Tahoe Donner Resort – Truckee, CA	40	77	75
Fruit Yard – Modesto, CA	100	78	70
Average of all venues at 50 ft. distance.	**50**	**80**	**75**

Notes: All data was collected by BAC staff using calibrated Type 1 sound level meters while amplified music was being played at the various venues. Crowd sizes present at the various venues ranged from approximately 50 to 200 persons. It should be noted that subwoofers were used at each of these locations. Subwoofers generate considerable low-frequency energy (≈100hz +/-) that is subject to lower levels of atmospheric absorption than mid and higher frequencies.

Figure 3
Proposed Amphitheater Location and Orientation Relative to Existing Residences to the East
Montano De El Dorado Project – El Dorado County, California



Note: Green dashed lines indicate locations where line-of-sight between the proposed amphitheater and residences would be interrupted by proposed Building 4.

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The Table 7 data indicate that, while the amplified music levels varied at each location, the average levels computed to 80 dBA Lmax and 75 dBA L_{eq} at a reference distance of 50 feet from the amplified sound system speakers. Nonetheless, for a more conservative estimate of project sound generation, a reference level of 80 dB Leq was assumed at a 50 foot distance.

Attenuation due to Loud Speaker Directionality

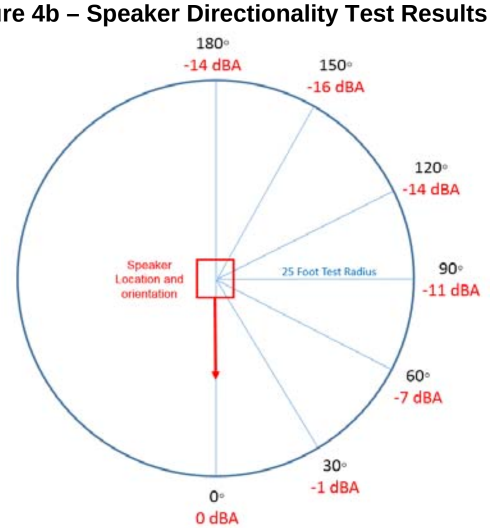
As indicated on Figure 3, the amphitheater orientation is such that loudspeakers which would periodically be used for amplified speech or music would generally face south, parallel to the property line of the residences to the east. As a result of the amphitheater orientation, the nearest residences to the north would have sideline (90 degrees off axis) exposure to the amphitheater, whereas the further residences to the southeast would have more direct exposure (12 degrees off axis).

At low frequencies (i.e. 63 – 125 hertz), loudspeakers are not particularly directional. However, at mid and high frequencies, loudspeaker intensity drops off considerably at off-axis positions, including substantial decreases in sound intensity at positions behind the loudspeaker.

BAC conducted acoustical testing to quantify the decrease in sideline sound levels which can generally be expected for commercial loudspeakers of the type which would be used for a venue of this size. Specifically, BAC placed a Yamaha MSR 400 watt amplified speaker in the center of an open area and conducted sound level testing at equally spaced distances (25 feet from the speaker) and angles (30 degree increments from 0 to 180 degrees), on October 17, 2019. Figure 4a shows a photograph of the test configuration and Figure 4b provides a schematic of the test locations and indicates the decrease in A-weighted sound pressure levels by position.

Figure 4a – Speaker Directionality Test Photo

Figure 4b – Speaker Directionality Test Results



As indicated by Figure 4b, the decrease in sound levels at positions within 30 degrees off-axis of the speaker orientation was negligible (-1 dBA). However, at positions 60 and 90 degrees off axis, the decrease in A-weighted sound pressure levels was measured to be -7 and -11 dBA, respectively.

Figure 3 shows that receivers 1-5 are all located off-axis to the speaker direction. Receiver 1 is approximately 90 degrees off axis whereas receiver 5 is approximately 45 degrees off axis. BAC interpolated the speaker directionality test results indicated above in Figure 4b to develop offsets to amphitheater sound levels at the nearest residences resulting from speaker directionality. Those offsets are presented later in this discussion of potential amphitheater noise impacts at the nearest residences.

Attenuation due to Atmospheric Absorption of Sound in Air

Air absorbs sound energy. The amount of absorption is dependent on the temperature and humidity of the air, as well as the frequency of the sound. Families of curves have been developed which relate these variables to molecular absorption coefficients, frequently expressed in terms of dB per thousand feet. For standard day atmospheric conditions, defined as 59 degrees Fahrenheit and 70% relative humidity, the molecular absorption coefficient at 1000 hertz is 1.5 dB per thousand feet. Molecular absorption is greater at higher frequencies, and reduced at lower frequencies. In addition, for drier conditions, which are common in the El Dorado Hills area, the molecular absorption coefficients generally increase. Similarly, as temperatures increase, molecular absorption coefficients typically increase as well. For a conservative assessment of sound propagation for this evaluation, a single attenuation factor of 1.5 dB per thousand feet of distance from the amphitheater was applied.

Effects of Barriers and Ground Cover

A noise barrier is any impediment which intercepts the path of sound as it travels from source to receiver. Such impediments can be natural, such as a hill or other naturally occurring topographic feature which blocks the receiver's view of the source, vegetative, such as heavy tree cover which similarly blocks the source from view of the receiver, or man-made, such as a solid wall, earthen berm, or building constructed between the noise source and receiver. Regardless of the type of impediment, the physical properties of sound are such that, at the point where the line-of-sight between the source and receiver is interrupted by a barrier, a 5 dB reduction in sound occurs.

The effectiveness of a barrier is a function of the difference in distance sound travels on a straight-line path from source to receiver versus the distance it must travel from source to barrier, then barrier to receiver. This difference is referred to as the "path length difference", and is used to calculate the Fresnel Number. A barrier's effectiveness is a function of the Fresnel number and frequency content of the source. In general, the more acute the angle of the sound path created by the introduction of a barrier, the greater the noise reduction provided by the barrier.

For this project the nearest residences to the proposed amphitheater site will be shielded by intervening topography resulting from the residences being substantially depressed relative to the eastern project property line. Further south on the project site, the adjacent receptors are elevated relative to portions of the project site, thereby reducing the level of natural topographic shielding between the proposed amphitheater and those residences.

As indicated on Figure 3, additional shielding of the amphitheater from view of residences 6 through 16 will result from the construction of Building 4 on the project site. In addition, the presence of vehicles in the parking areas will also provide an additional degree of acoustical shielding in the direction of some of the nearest residences.

Because the project site will be cleared of vegetation and paved, no sound absorption offsets were applied in this analysis for ground cover.

Predicted Amphitheater Sound Levels at Nearest Residences

The assumed reference sound system level of 80 dBA Leq was projected to the nearest residences assuming standard spherical spreading of sound (6 dBA decrease for each doubling of distance from the source). Offsets for speaker directionality were applied as appropriate and shielding offsets resulting from both intervening topography and structures were computed and applied. Table 8 shows the predicted average sound pressure levels at each of the nearest residences to the north of the proposed amphitheater site.

Table 8
Computed Amphitheater Sound Levels at Nearest Residences

Receiver	Distance	Speaker Direction Angle	Speaker Direction Offset	Shielding Offset	Atmospheric Absorption	Predicted Sound Level, Leq dBA
1	225	90	-11	-12	0	**44**
2	230	75	-9	-12	0	**45**
3	240	65	-8	-12	0	**46**
4	260	55	-6	-12	0	**47**
5	300	45	-4	-12	0	**48**
6	325	40	-3	-18	0	**42**
7	370	35	-2	-16	1	**44**
8	420	30	-1	-15	1	**45**
9	460	25	0	-13	1	**47**
10	515	22	0	-13	1	**46**
11	565	20	0	-13	1	**45**
12	615	18	0	-12	1	**45**
13	670	15	0	-11	1	**45**
14	720	13	0	-12	1	**44**
15	785	12	0	-11	1	**44**
16	825	12	0	-10	1	**44**
17	880	11	0	-5	1	**49**
18	945	11	0	-5	1	**48**
19	1015	10	0	-5	2	**47**
20	1080	10	0	-5	2	**47**

Source: Bollard Acoustical Consultants, Inc. (BAC)

The Table 8 data indicate that predicted amphitheater sound levels would be in the range of 42 to 49 dBA at the nearest residences to the amphitheater site during an amplified music event which generates a reference level of 80 dBA at a distance of 50 feet from the sound system speakers.

Amphitheater Event Simulation

To generally evaluate the propagation of sound from the proposed amphitheater site location in the direction of the nearest residences, BAC conducted an outdoor concert simulation at the location of the proposed amphitheater on August 25, 2017.

Amplified music was generated through Yamaha MSR 400 portable concert speakers and a Yamaha MSR 800 subwoofer at a volume level of 75 dBA measured from a position 50 feet in front of the speakers. While music was being played at this average level, noise measurements were taken at various positions along the eastern property line (shown in Figure 1). Noise measurement equipment met the same specifications as described previously. Appendix E contains photographs of the concert simulation setup.

The simulation utilized a reference music level of 75 dB at a distance of 50 feet from the speakers. The resulting measured noise levels at measurement locations 1 – 4 (shown in Figure 1) are provided below in Table 9, along with the predicted noise levels at these locations and the resulting calculated offsets for topographic shielding and existing ground cover.

Table 9
Measured Amphitheater Simulation Noise Levels
Montano de El Dorado – El Dorado County, California

Location[1]	Distance to Speakers	Predicted Level, dBA[2]	Measured Level, dBA[3]	Offset[4]
Reference	50	75	75	0
1	420	57	50	-7
2	280	60	45	-15
3	210	63	43	-20
4	200	63	47	-16

Notes:
1. Measurement locations shown in Figure 1. All locations were along the eastern property line, representing the nearest residences.
2. Predicted noise level at specified distance, given a reference level of 75 dB at 50 feet, assuming spherical spreading and no topographical shielding.
3. Measured noise level at same specified distance, collected during concert simulation.
4. Noise reduction provided by topographic shielding and existing ground cover. Calculated by subtracting measured level from predicted level.

Source: Bollard Acoustical Consultants, Inc.

The Table 9 data indicate that up to a 20 dB reduction in sound levels resulted from a combination of existing topographic shielding and ground cover at locations along the eastern property line nearest to the proposed amphitheater. Because the project site will be graded and paved, some of this topographic shielding and the majority of the existing ground cover absorption will be removed. However, additional shielding by intervening Building 4 and vehicles in the parking areas would be introduced. The net effect of the shielding which will be removed versus that which will be added is expected to be relatively minor.

Amphitheater Noise Impacts and Mitigation Measures

As noted previously, the Table 8 data indicate that predicted amphitheater sound levels would be in the range of 42 to 49 dBA at the nearest residences to the amphitheater site during an amplified music event which generates a reference level of 80 dBA at a distance of 50 feet from the sound system speakers. The actual sound levels received at the nearest residences to the east will depend largely on the actual sound system output, which is variable. Although the use of 80 dBA Leq at 50 feet is a reasonable assumption for this analysis given the size of this proposed venue, it is possible that actual levels could exceed that reference level at times. Nonetheless, based on the assumed reference level of 80 dBA L_{eq} at 50 feet and the offsets for speaker directionality, shielding, and atmospheric absorption of sound reported in Table 8, the predicted sound levels during an amplified music event would be satisfactory relative to the El Dorado County daytime noise level standard of 50 dBA. However, the County's 45 dBA evening noise level standard could be exceeded at some of the nearest residences and the County's 40 dBA nighttime standard would be exceeded at all of the nearby residences. Because ambient noise conditions currently exceed the County's noise level standards at the property lines of the nearby residences due to traffic on Latrobe Road, sound generated by the amphitheater event will be partially to substantially masked by existing ambient noise, particularly at the southernmost residences which are closest to Latrobe Road and elevated. Nonetheless, because amphitheater sound levels could exceed the County's noise standards, the following specific noise mitigation measures are recommended for the proposed amphitheater portion of this project:

1. Limit all amplified music events to daytime hours until it can be concluded through sound level measurements conducted during the initial events that amplified events could occur during evening hours (7 pm – 10 pm), without causing exceedance of the County's evening noise standards within the neighboring residential properties.

2. Prohibit amplified music events during nighttime hours (10 pm – 7 am).

3. Prohibit the use of subwoofers at this venue during amplified music events. This measure is recommended because low frequency sound dissipates less rapidly with distance and is frequently reported as common source of annoyance at residential uses located in relatively close proximity to venues where amplified music occurs.

Noise Generation of Events and Sales Promotions

Montano de El Dorado proposes different types of events and different marketing justifications for doing those events within the Montano Plaza and at times within the amphitheater. According to project representatives, the most common are (I) special events to attract customers who have a special interest or to generate income from promoters, (i.e. craft shows or farmers markets); (2) community events to generate goodwill and publicity, (i.e. charity bazaar, stage-oriented presentations, etc.) (3) sales promotions to generate retail sales and clearaway merchandise, (i.e. a fall sidewalk sale throughout the plaza with product presentations located at the amphitheater); (4) positioning events to create image, (i.e. grand re-openings, tenant business openings, Chamber of Commerce activities); and (5) seasonal entertainment that may offer ongoing local music talent in the early evening occasionally in the summer or plays (i.e. El Dorado Music Theater (EDMT), Monday Night at the Movies, etc.).

Noise generated by music events at the proposed amphitheater was evaluated in the previous section and additional analysis of amphitheater-generated noise related to stage presentations, presentations, Summer plays, and Monday night at the movies would all fall under the noise generation levels previously identified for the amphitheater. However, noise would also be generated by crowds at the various locations where these events and promotions would occur.

BAC was provided with a comprehensive list of activities which would occur at the project site throughout the year, the locations where those activities would occur, and the estimated attendance at each of those activities. That list is provided in Table 10. Figure 5 shows the various locations where the events identified in Table 10 would occur.

Figure 5: Locations of Events and Promotions

Table 10
Potential Event Calendar
(Subject to Change)

Month	Event	Where on Site	Attendance Estimate
January	Community Blood Drive at the Amphitheater	Red	100
February	Bridal Fashion Show at the Amphitheater	Red	100
March	Fashion Show at the Amphitheater	Red	100
	Montano Chile Cookoff/plaza wide craft Fair Charity event	Green	200
April	Easter Event/Egg Hunt	Orange	100
	Monday Movie at Montano - Amphitheater	Red	75
	St. Patrick's Day Event	Purple	350
May	Memorial Day Music - Amphitheater	Red	150
	El Dorado Music Theater (EDMT) Play (4 days)	Red	150
	Local Wine Crush & Arts Festival	Green	350
	Monday Movie at Montano - Amphitheater	Red	75
	Amphitheater Music – limited amplification 5:30pm-8:30pm	Red	150
June	Farmers Market 2nd Saturday	Orange	175
	Taste of El Dorado County – Food, Wine, and Crafts	Green	150
	Monday Movie at Montano - Amphitheater	Red	75
	Amphitheater Music – limited amplification 5pm-8pm	Red	150
July	July 4th celebration in coordination with Town Center	Orange	300
	Farmers Market 2nd Saturday	Orange	175
	Amphitheater Music – limited amplification 5:30pm-8:30pm (Saturdays)	Red	150
	Monday Movie at Montano - Amphitheater	Red	75
August	Farmers Market 2nd Saturday	Orange	175
	El Dorado Music Theater (EDMT) Play - Amphitheater	Red	150
	Amphitheater Music – limited amplification 5:30pm-8:30pm (Saturdays)	Red	150
	Perks & Paws Festival to benefit Humane Society	Orange	300
	Monday Movie at Montano - Amphitheater	Red	75
September	9/11 Patriots/Veterans Event	White	150
	Farmers Market 2nd Saturday	Orange	175
	Monday Movie at Montano - Amphitheater	Red	75
	Amphitheater Music – limited amplification 5:30pm-8:30pm (Saturdays)	Red	150
October	Oktoberfest (2-4 days) primarily at 36 Handles Pub.	Purple	350
	Craft Brew Tasting & Blue Grass	Green	250
	Monday Movie at Montano – Amphitheater	Red	75
	Classic Car Show	Orange	150
November	Cornish Craft Festival & Merchant Each Saturday (Tgiving to Xmas)	Plaza Wide	250
	Talent Show to benefit Charity Groups	Plaza Wide	150
December	Cornish Craft and Merchant Festival Each Saturday (Tgiving to Xmas)	Plaza Wide	250
	Christmas Special/charity event – Coordinate Santa Sleigh visit	Plaza Wide	150

In order to quantify event-generated crowd noise from the outdoor events and promotions described in Table 10, BAC utilized reference file data for persons speaking in normal and raised voices (normal voice = 57 dB per person at 3 feet, raised voice = 64 dB, and loud voice = 73 dB). Based on the provided information of typical guest's speech sound generation in the outdoor event areas, the analysis concluded that worst-case crowd noise exposure is predicted to range from approximately 33 to 47 dB L_{eq} and 38 to 52 dB L_{max} at the nearby residences, including the noise attenuation provided by the proposed property line noise barrier. Based on the proposed hours of the events and activities, the predicted crowd noise levels are within compliance of the County's daytime and evening noise level standards at the noise-sensitive residences to the east, and no additional noise mitigation measures would be warranted for this aspect of the project.

Future Interior Traffic Noise Levels within Proposed Hotel Rooms

The summarized results in Table 4 included an analysis of future Latrobe Road traffic noise levels. Just south of White Rock Road, future Latrobe Road traffic noise levels were calculated to be 70 dB L_{dn}, 100 feet from the roadway centerline. However, the proposed hotel building façade is located approximately 130 feet from the centerline of Latrobe Road. At that distance, future exterior traffic noise levels at the first-floor (ground level) hotel building façade were calculated to be 68 dB L_{dn}. Due to the reduced ground absorption of sound at elevated location, traffic noise levels at upper-floor facades would be expected to be approximately 3 dB higher, resulting in a predicted traffic noise level at upper-floor facades of 71 dB L_{dn}.

Standard hotel construction (wood siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof), results in an exterior to interior noise reduction of at least 25 dB with windows closed and approximately 15 dB with windows open. To achieve compliance with the El Dorado County transient lodging interior noise level standard of 45 dB L_{dn}, exterior-to-interior noise reductions of at least 23 dB and 26 dB would be required of the first-floor and upper-floor facades, respectively. Standard construction practices would, therefore, be adequate for the proposed first-floor rooms in achieving compliance with the County standard of 45 dB L_{dn}. However, at upper-floor rooms, BAC recommends that all windows, from which Latrobe Road can be seen, be upgraded to have a Sound Transmission Class (STC) rating of at least 30. In addition, mechanical ventilation (air conditioning) should be provided within all hotel rooms to allow the occupants to close doors and windows as desired for additional acoustical isolation.

Conclusions and Recommendations

The preceding analysis focused on off-site traffic noise generation, noise generated by on-site commercial-related activity, construction activity noise generation, and future interior traffic noise levels within rooms of the proposed hotel. In order to ensure compliance with the El Dorado County General Plan noise level standards, the following activity-specific mitigation measures are recommended:

On-Site Truck Circulation and Unloading (Loading Dock):

1. A solid noise barrier (e.g. CMU wall) measuring at least 8 feet in height relative to the truck passby route elevation should be constructed at the location shown on Figure 2. The 8 feet in height can be achieved by either a sound wall, a retaining wall, or a combination of the sound wall and retaining wall.

2. Truck circulation on the route along the eastern side of the project site (adjacent to the existing residences; see Figure 2) must be limited to daytime hours (7 am to 7 pm). Even after consideration of the recommended noise barrier, predicted truck passby levels would exceed evening (7 pm to 10 pm) and nighttime (10 pm to 7 am) noise level standards, thereby necessitating the requirement for daytime-only circulation along this route. Evening and nighttime deliveries at the proposed anchor commercial building loading dock (shown in Figure 2) would be permissible, provided delivery trucks use alternate routes during these hours.

Mechanical Equipment:

3. All rooftop HVAC equipment associated with air heating and cooling shall be completely shielded from view of nearby sensitive land uses by the rooftop parapets.

4. An acoustical analysis shall be required for any use where mechanical equipment associated with food cold storage is proposed which would not be completely enclosed within the building.

Project Construction:

5. All construction activities must adhere to the County's requirements with respect to hours of construction.

6. Construction equipment must have appropriate sound muffling devices, which shall be properly maintained and used at all times such equipment is in operation.

7. The construction contractor shall locate on-site equipment staging areas so as to maximize the distance between construction-related noise sources and noise-sensitive receptors nearest the project construction areas.

Amphitheater:

8. Limit all amplified music events to daytime hours until it can be concluded through sound level measurements conducted during the initial events that amplified events could occur during evening hours (7 pm – 10 pm), without causing exceedance of the County's evening noise standards within the neighboring residential properties.

9. Prohibit amplified music events during nighttime hours (10 pm – 7 am).

10. Prohibit the use of subwoofers at this venue during amplified music events.

Hotel – Future Interior Traffic Noise:

11. Standard construction practices (wood siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof) would be adequate for the proposed first-floor hotel rooms.

12. All upper-floor hotel rooms with a view of Latrobe Road should be upgraded to an STC rating of 30.

13. Mechanical ventilation (air conditioning) should be provided for all hotel rooms to allow the occupants to close windows as desired to achieve compliance with the applicable interior noise level criteria.

Waste Collection Activities:

14. To the extent practical, waste collection activities should be scheduled during daytime hours.

This concludes BAC's assessment of the Montano de El Dorado Expansion Project. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com if you have any comments or questions regarding this report.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Appendix B-1
Ambient Noise Monitoring Results - Site A
Montano de El Dorado
Tuesday, March 01, 2016

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	47	63	36	56	51	44	41	39
1:00 AM	48	61	38	57	52	46	44	40
2:00 AM	47	61	42	56	50	45	44	43
3:00 AM	48	62	41	57	53	46	44	43
4:00 AM	50	65	40	58	55	50	46	42
5:00 AM	57	66	41	64	62	58	54	46
6:00 AM	61	79	47	67	65	63	60	53
7:00 AM	62	71	51	68	66	64	61	56
8:00 AM	59	77	45	64	62	60	58	53
9:00 AM	58	65	44	63	61	59	56	50
10:00 AM	58	76	43	63	61	58	56	50
11:00 AM	58	68	45	64	62	60	57	52
12:00 PM	59	68	46	64	63	60	58	53
1:00 PM	59	75	42	67	64	59	56	51
2:00 PM	62	73	45	69	67	62	58	52
3:00 PM	69	99	47	74	71	65	61	55
4:00 PM	59	67	46	63	62	60	58	53
5:00 PM	60	66	47	64	63	62	60	56
6:00 PM	59	65	47	64	62	60	58	53
7:00 PM	55	63	39	61	59	57	54	47
8:00 PM	53	62	36	59	57	54	51	44
9:00 PM	53	63	35	60	57	54	51	44
10:00 PM	52	66	36	60	57	53	48	40
11:00 PM	48	65	35	57	54	47	42	38

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	59	71	44	64	63	60	57	51
High	69	99	51	74	71	65	61	56
Low	53	62	35	59	57	54	51	44

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	51	66	40	59	55	50	47	43
High	61	79	47	67	65	63	60	53
Low	47	61	35	56	50	44	41	38

Ldn:	63

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Appendix B-2
Ambient Noise Monitoring Results - Site A
Montano de El Dorado
Wednesday, March 02, 2016

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	48	66	37	57	53	46	42	40
1:00 AM	47	61	39	56	50	45	43	41
2:00 AM	46	61	42	55	48	45	43	42
3:00 AM	47	62	41	57	51	45	44	42
4:00 AM	50	63	40	58	55	50	45	41
5:00 AM	56	71	39	62	60	58	54	45
6:00 AM	59	70	47	65	63	61	58	52
7:00 AM	57	64	50	62	61	58	56	53
8:00 AM	56	64	44	61	59	57	55	51
9:00 AM	53	75	40	59	56	53	51	47
10:00 AM	53	65	42	58	56	54	51	47
11:00 AM	53	62	43	59	56	54	52	47
12:00 PM	55	64	44	61	59	56	54	48
1:00 PM	56	66	43	61	60	57	55	49
2:00 PM	56	76	42	62	60	57	55	49
3:00 PM	60	79	46	65	63	61	59	54
4:00 PM	62	84	49	66	63	62	60	56
5:00 PM	60	67	48	64	63	62	60	56
6:00 PM	58	65	46	63	62	60	57	53
7:00 PM	57	69	41	62	61	58	56	49
8:00 PM	55	65	39	61	59	56	54	46
9:00 PM	53	65	36	60	58	54	51	41
10:00 PM	50	61	35	57	55	51	45	37
11:00 PM	48	67	34	56	53	47	39	36

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	56	69	44	62	60	57	55	50
High	62	84	50	66	63	62	60	56
Low	53	62	34	58	56	53	51	41

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	50	65	39	58	54	50	46	42
High	59	71	47	65	63	61	58	52
Low	46	61	34	55	48	45	39	36

Ldn:	60

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Appendix B-3
Ambient Noise Monitoring Results - Site B
Montano de El Dorado
Tuesday, March 01, 2016

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	55	73	31	66	60	46	37	33
1:00 AM	54	71	31	65	58	43	37	33
2:00 AM	54	72	32	65	56	40	35	33
3:00 AM	54	72	31	65	59	45	36	33
4:00 AM	58	73	33	68	64	56	42	36
5:00 AM	65	76	35	72	70	66	60	42
6:00 AM	69	88	43	74	72	70	67	57
7:00 AM	69	87	50	74	72	70	67	60
8:00 AM	68	84	46	74	72	70	67	59
9:00 AM	67	77	45	73	72	69	65	55
10:00 AM	68	82	45	74	72	69	66	57
11:00 AM	68	80	46	75	73	70	66	58
12:00 PM	68	78	48	73	72	69	66	58
1:00 PM	67	81	42	73	71	69	65	56
2:00 PM	68	85	45	73	71	69	66	58
3:00 PM	68	80	46	73	72	70	67	61
4:00 PM	69	89	47	74	72	70	67	61
5:00 PM	68	80	48	73	72	70	67	61
6:00 PM	66	80	46	73	70	68	65	57
7:00 PM	64	74	39	71	69	66	62	50
8:00 PM	62	76	33	69	66	63	59	46
9:00 PM	61	74	31	68	66	63	58	41
10:00 PM	59	74	32	68	65	60	51	37
11:00 PM	57	76	32	67	62	54	39	34

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	67	80	44	73	71	68	65	56
High	69	89	50	75	73	70	67	61
Low	61	74	31	68	66	63	58	41

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	58	75	33	68	63	53	45	38
High	69	88	43	74	72	70	67	57
Low	54	71	31	65	56	40	35	33

Ldn:	69

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Appendix B-4
Ambient Noise Monitoring Results - Site B
Montano de El Dorado
Wednesday, March 02, 2016

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	56	74	32	67	61	47	38	34
1:00 AM	55	74	31	65	59	44	37	34
2:00 AM	54	72	31	65	57	41	37	34
3:00 AM	54	73	32	66	59	41	37	34
4:00 AM	59	71	33	68	65	58	44	36
5:00 AM	65	77	35	72	69	66	61	43
6:00 AM	68	83	44	73	72	70	67	57
7:00 AM	68	79	50	73	72	70	68	60
8:00 AM	69	91	46	74	72	70	67	60
9:00 AM	67	78	43	73	71	69	65	58
10:00 AM	67	83	43	73	71	68	65	58
11:00 AM	68	77	45	73	71	69	66	59
12:00 PM	68	80	47	73	71	69	66	58
1:00 PM	67	84	45	73	71	69	65	57
2:00 PM	68	86	47	73	71	69	66	58
3:00 PM	70	93	47	75	72	70	68	61
4:00 PM	71	95	51	74	72	70	68	61
5:00 PM	68	80	48	73	71	70	67	61
6:00 PM	66	81	44	72	70	68	65	57
7:00 PM	65	80	40	72	69	67	63	51
8:00 PM	63	76	38	70	67	64	60	45
9:00 PM	62	74	35	70	67	64	58	40
10:00 PM	59	79	33	68	65	59	47	35
11:00 PM	56	73	32	67	62	51	38	34

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	67	82	45	73	71	68	65	56
High	71	95	51	75	72	70	68	61
Low	62	74	31	70	67	64	58	40

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	58	75	34	68	63	53	45	38
High	68	83	44	73	72	70	67	57
Low	54	71	31	65	57	41	37	34

Ldn:	69

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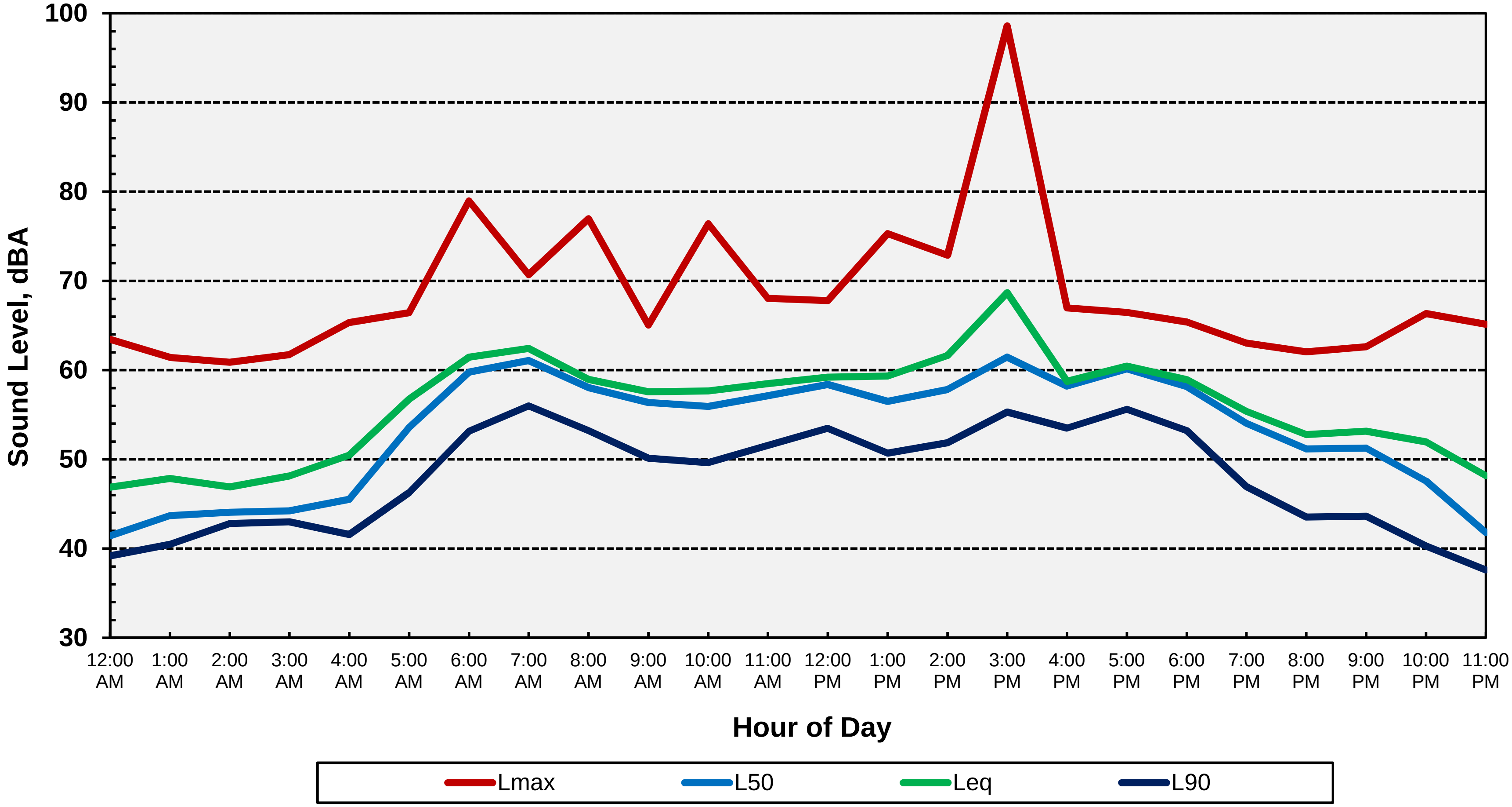
Appendix C-1
Ambient Noise Monitoring Results - Site A
Montano de El Dorado
Tuesday, March 01, 2016



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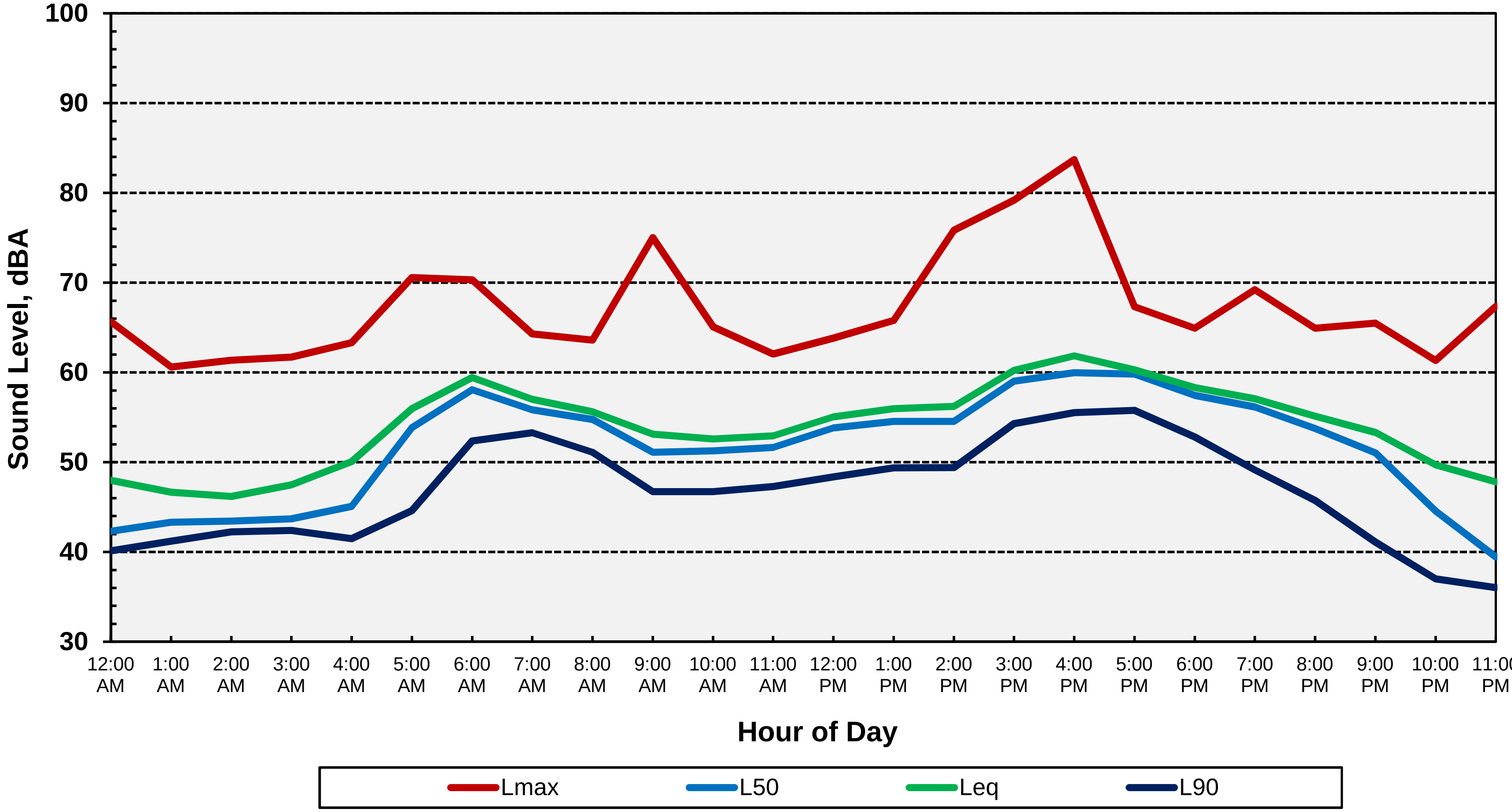
Appendix C-2
Ambient Noise Monitoring Results - Site A
Montano de El Dorado
Wednesday, March 02, 2016



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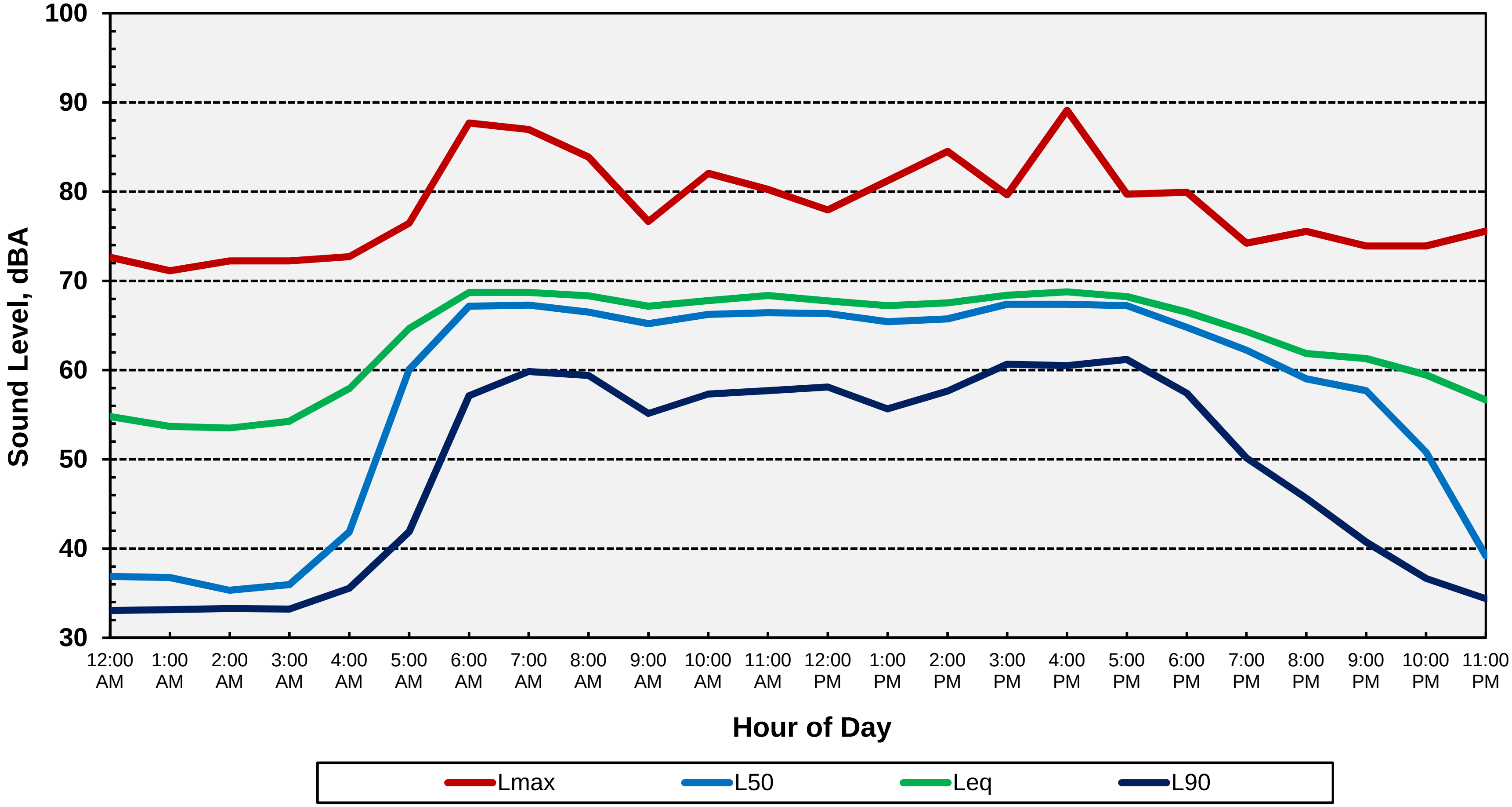
Appendix C-3
Ambient Noise Monitoring Results - Site B
Montano de El Dorado
Tuesday, March 01, 2016



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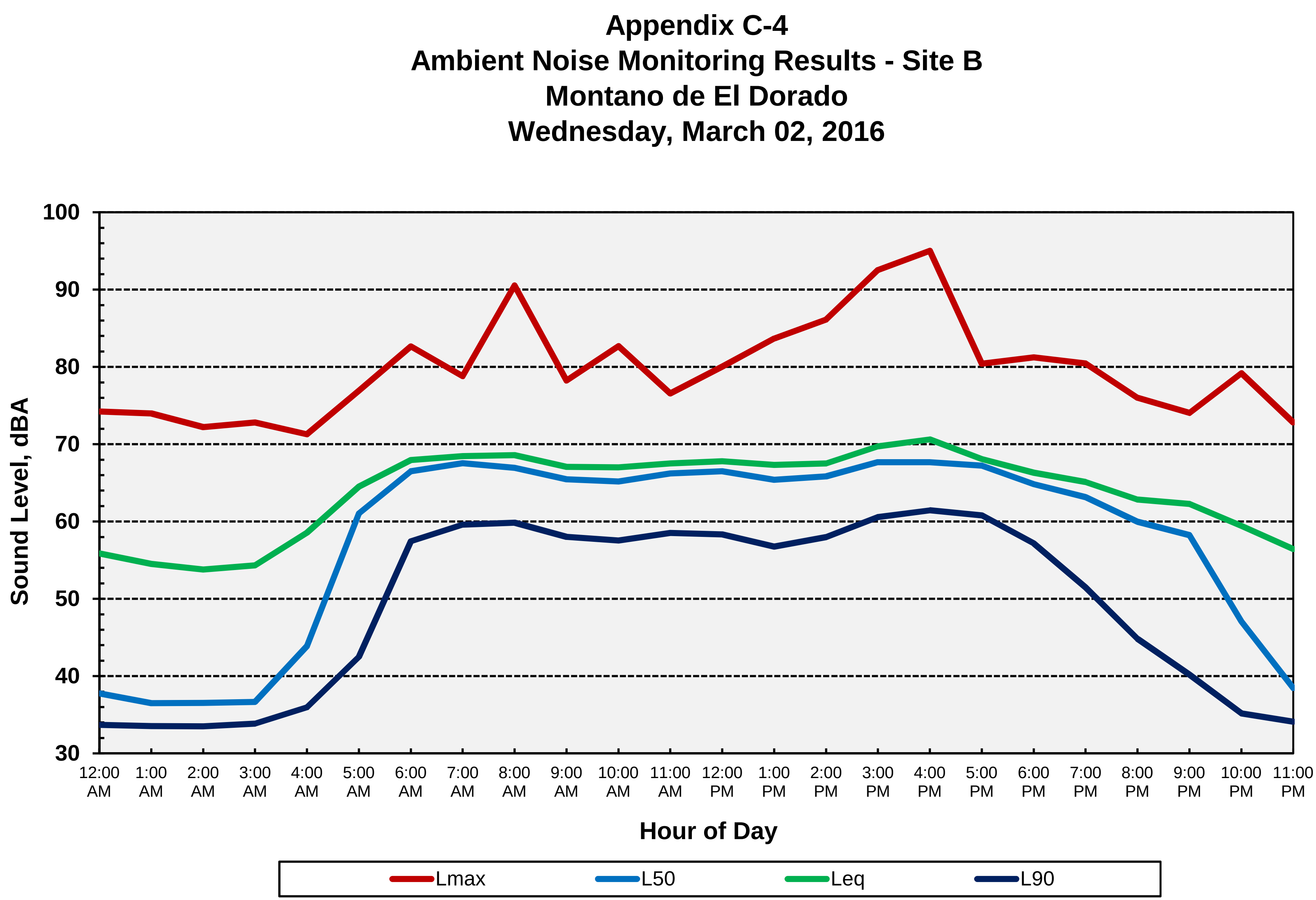

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Appendix D-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2016-032 Montano de El Dorado
Description: Existing
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	El Dorado Hills Blvd	North of Saratoga Way	29,215	83		17	2	2	45	100	
2		Saratogoa Way to US-50 WB Ramps	27,770	83		17	2	2	45	100	
3	Latrobe Rd	US-50 EB Ramps to Town Center Blvd	39,325	83		17	2	2	45	100	
4		Town Center Blvd to White Rock Rd	27,550	83		17	2	2	45	100	
5		White Rock Rd to Project Driveway	22,820	83		17	2	2	55	100	
6		Project Driveway to Golden Foothill Pkwy (N)	22,820	83		17	2	2	55	100	
7		Golden Foothill Pkwy to Suncast Ln	18,475	83		17	2	2	55	100	
8		Suncast Ln to Golden Foothill Pkwy (S)	16,425	83		17	2	2	55	100	
9		South of Golden Foothill Pkwy (S)	8,245	83		17	2	2	55	100	
10	White Rock Rd	West of Stonebriar Dr	9,845	83		17	2	2	45	100	
11		Stonebriar Dr to Town Center Blvd	12,085	83		17	2	2	45	100	
12		Town Center Blvd to Latrobe Rd	12,050	83		17	2	2	45	100	
13		Latrobe Rd to Post St	12,230	83		17	2	2	45	100	
14		Post St to Valley View Pkwy	11,710	83		17	2	2	45	100	
15		East of Valley View Pkwy	8,890	83		17	2	2	45	100	
16	Valley View Pkwy	South of White Rock Rd	4,275	83		17	2	2	45	100	

Appendix D-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2016-032 Montano de El Dorado
Description: Existing Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	El Dorado Hills Blvd	North of Saratoga Way	29,480	83		17	2	2	45	100	
2		Saratogoa Way to US-50 WB Ramps	28,095	83		17	2	2	45	100	
3	Latrobe Rd	US-50 EB Ramps to Town Center Blvd	40,445	83		17	2	2	45	100	
4		Town Center Blvd to White Rock Rd	28,715	83		17	2	2	45	100	
5		White Rock Rd to Project Driveway	23,890	83		17	2	2	55	100	
6		Project Driveway to Golden Foothill Pkwy (N)	23,630	83		17	2	2	55	100	
7		Golden Foothill Pkwy to Suncast Ln	18,770	83		17	2	2	55	100	
8		Suncast Ln to Golden Foothill Pkwy (S)	16,590	83		17	2	2	55	100	
9		South of Golden Foothill Pkwy (S)	8,285	83		17	2	2	55	100	
10	White Rock Rd	West of Stonebriar Dr	9,290	83		17	2	2	45	100	
11		Stonebriar Dr to Town Center Blvd	12,235	83		17	2	2	45	100	
12		Town Center Blvd to Latrobe Rd	12,200	83		17	2	2	45	100	
13		Latrobe Rd to Post St	13,240	83		17	2	2	45	100	
14		Post St to Valley View Pkwy	12,015	83		17	2	2	45	100	
15		East of Valley View Pkwy	9,080	83		17	2	2	45	100	
16	Valley View Pkwy	South of White Rock Rd	4,375	83		17	2	2	45	100	

Appendix D-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2016-032 Montano de El Dorado
Description: Near Term (2025)
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	El Dorado Hills Blvd	North of Saratoga Way	31,050	83		17	2	2	45	100	
2		Saratogoa Way to US-50 WB Ramps	28,800	83		17	2	2	45	100	
3	Latrobe Rd	US-50 EB Ramps to Town Center Blvd	43,500	83		17	2	2	45	100	
4		Town Center Blvd to White Rock Rd	30,500	83		17	2	2	45	100	
5		White Rock Rd to Project Driveway	24,100	83		17	2	2	55	100	
6		Project Driveway to Golden Foothill Pkwy (N)	24,100	83		17	2	2	55	100	
7		Golden Foothill Pkwy to Suncast Ln	19,000	83		17	2	2	55	100	
8		Suncast Ln to Golden Foothill Pkwy (S)	16,150	83		17	2	2	55	100	
9		South of Golden Foothill Pkwy (S)	8,850	83		17	2	2	55	100	
10	White Rock Rd	West of Stonebriar Dr	14,900	83		17	2	2	45	100	
11		Stonebriar Dr to Town Center Blvd	16,150	83		17	2	2	45	100	
12		Town Center Blvd to Latrobe Rd	15,850	83		17	2	2	45	100	
13		Latrobe Rd to Post St	16,400	83		17	2	2	45	100	
14		Post St to Valley View Pkwy	15,250	83		17	2	2	45	100	
15		East of Valley View Pkwy	16,050	83		17	2	2	45	100	
16	Valley View Pkwy	South of White Rock Rd	5,350	83		17	2	2	45	100	

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Appendix D-4

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2016-032 Montano de El Dorado
Description: Near Term (2025) Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	El Dorado Hills Blvd	North of Saratoga Way	31,315	83		17	2	2	45	100	
2		Saratogoa Way to US-50 WB Ramps	29,125	83		17	2	2	45	100	
3	Latrobe Rd	US-50 EB Ramps to Town Center Blvd	44,515	83		17	2	2	45	100	
4		Town Center Blvd to White Rock Rd	31,550	83		17	2	2	45	100	
5		White Rock Rd to Project Driveway	25,075	83		17	2	2	55	100	
6		Project Driveway to Golden Foothill Pkwy (N)	24,885	83		17	2	2	55	100	
7		Golden Foothill Pkwy to Suncast Ln	19,335	83		17	2	2	55	100	
8		Suncast Ln to Golden Foothill Pkwy (S)	16,345	83		17	2	2	55	100	
9		South of Golden Foothill Pkwy (S)	8,890	83		17	2	2	55	100	
10	White Rock Rd	West of Stonebriar Dr	14,980	83		17	2	2	45	100	
11		Stonebriar Dr to Town Center Blvd	16,305	83		17	2	2	45	100	
12		Town Center Blvd to Latrobe Rd	16,005	83		17	2	2	45	100	
13		Latrobe Rd to Post St	17,360	83		17	2	2	45	100	
14		Post St to Valley View Pkwy	15,645	83		17	2	2	45	100	
15		East of Valley View Pkwy	16,380	83		17	2	2	45	100	
16	Valley View Pkwy	South of White Rock Rd	5,405	83		17	2	2	45	100	

Appendix D-5

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2016-032 Montano de El Dorado
Description: Cumulative (2035)
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	El Dorado Hills Blvd	North of Saratoga Way	32,700	83		17	2	2	45	100	
2		Saratogoa Way to US-50 WB Ramps	29,650	83		17	2	2	45	100	
3	Latrobe Rd	US-50 EB Ramps to Town Center Blvd	47,650	83		17	2	2	45	100	
4		Town Center Blvd to White Rock Rd	33,400	83		17	2	2	45	100	
5		White Rock Rd to Project Driveway	25,250	83		17	2	2	55	100	
6		Project Driveway to Golden Foothill Pkwy (N)	25,250	83		17	2	2	55	100	
7		Golden Foothill Pkwy to Suncast Ln	19,400	83		17	2	2	55	100	
8		Suncast Ln to Golden Foothill Pkwy (S)	15,750	83		17	2	2	55	100	
9		South of Golden Foothill Pkwy (S)	9,450	83		17	2	2	55	100	
10	White Rock Rd	West of Stonebriar Dr	19,200	83		17	2	2	45	100	
11		Stonebriar Dr to Town Center Blvd	20,450	83		17	2	2	45	100	
12		Town Center Blvd to Latrobe Rd	20,450	83		17	2	2	45	100	
13		Latrobe Rd to Post St	20,300	83		17	2	2	45	100	
14		Post St to Valley View Pkwy	18,650	83		17	2	2	45	100	
15		East of Valley View Pkwy	21,450	83		17	2	2	45	100	
16	Valley View Pkwy	South of White Rock Rd	6,600	83		17	2	2	45	100	

Appendix D-6

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2016-032 Montano de El Dorado
Description: Cumulative (2035) Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	El Dorado Hills Blvd	North of Saratoga Way	32,970	83		17	2	2	45	100	
2		Saratogoa Way to US-50 WB Ramps	30,050	83		17	2	2	45	100	
3	Latrobe Rd	US-50 EB Ramps to Town Center Blvd	48,665	83		17	2	2	45	100	
4		Town Center Blvd to White Rock Rd	34,450	83		17	2	2	45	100	
5		White Rock Rd to Project Driveway	26,225	83		17	2	2	55	100	
6		Project Driveway to Golden Foothill Pkwy (N)	26,035	83		17	2	2	55	100	
7		Golden Foothill Pkwy to Suncast Ln	19,735	83		17	2	2	55	100	
8		Suncast Ln to Golden Foothill Pkwy (S)	15,945	83		17	2	2	55	100	
9		South of Golden Foothill Pkwy (S)	9,485	83		17	2	2	55	100	
10	White Rock Rd	West of Stonebriar Dr	19,280	83		17	2	2	45	100	
11		Stonebriar Dr to Town Center Blvd	20,605	83		17	2	2	45	100	
12		Town Center Blvd to Latrobe Rd	20,605	83		17	2	2	45	100	
13		Latrobe Rd to Post St	21,260	83		17	2	2	45	100	
14		Post St to Valley View Pkwy	19,045	83		17	2	2	45	100	
15		East of Valley View Pkwy	21,780	83		17	2	2	45	100	
16	Valley View Pkwy	South of White Rock Rd	6,655	83		17	2	2	45	100	

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Appendix E - Concert Simulation Photos
Montano de El Dorado
El Dorado County, California

Construction Source Noise Prediction Model

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	2,272	55.0
Location 1	50	88.1
Location 2	200	76.1

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Concrete Saw	90	0.4
Dozer	85	0.4
Excavator	85	0.4

Ground Type	HARD
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Concrete Saw	86.0
Dozer	81.0
Excavator	81.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
88.1

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

Construction Source Noise Prediction Model

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{max} dBA)
Threshold	359	75.0
Location 1	50	92.1
Location 2	200	80.1

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Concrete Saw	90	1
Dozer	85	1
Excavator	85	1

Ground Type	HARD
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Concrete Saw	90.0
Dozer	85.0
Excavator	85.0

Combined Predicted Noise Level (L_{max} dBA at 50 feet)
92.1

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log (U.F.) - 20*\log (D/50) - 10*G*\log (D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

Construction Source Noise Prediction Model

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{max} dBA)	Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Threshold	446	75.0	**Blasting**	94	1
Location 1	200	82.0			1
Location 2	400	75.9			1

Ground Type	HARD
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Blasting	94.0

Combined Predicted Noise Level (L_{max} dBA at 50 feet)
94.0

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Auger Drill Rig	20	85	84	36	79.0	72.0	100	78.0	71.0
Backhoe	40	80	78	372	74.0	70.0	100	72.0	68.0
Bar Bender	20	80	na	0	74.0	67.0	100		
Blasting	na	94	na	0	88.0		100		
Boring Jack Power Unit	50	80	83	1	74.0	71.0	100	77.0	74.0
Chain Saw	20	85	84	46	79.0	72.0	100	78.0	71.0
Clam Shovel (dropping)	20	93	87	4	87.0	80.0	100	81.0	74.0
Compactor (ground)	20	80	83	57	74.0	67.0	100	77.0	70.0
Compressor (air)	40	80	78	18	74.0	70.0	100	72.0	68.0
Concrete Batch Plant	15	83	na	0	77.0	68.7	100		
Concrete Mixer Truck	40	85	79	40	79.0	75.0	100	73.0	69.0
Concrete Pump Truck	20	82	81	30	76.0	69.0	100	75.0	68.0
Concrete Saw	20	90	90	55	84.0	77.0	100	84.0	77.0
Crane	16	85	81	405	79.0	71.0	100	75.0	67.0
Dozer	40	85	82	55	79.0	75.0	100	76.0	72.0
Drill Rig Truck	20	84	79	22	78.0	71.0	100	73.0	66.0
Drum Mixer	50	80	80	1	74.0	71.0	100	74.0	71.0
Dump Truck	40	84	76	31	78.0	74.0	100	70.0	66.0
Excavator	40	85	81	170	79.0	75.0	100	75.0	71.0
Flat Bed Truck	40	84	74	4	78.0	74.0	100	68.0	64.0
Front End Loader	40	80	79	96	74.0	70.0	100	73.0	69.0
Generator	50	82	81	19	76.0	73.0	100	75.0	72.0
Generator (<25KVA, VMS si	50	70	73	74	64.0	61.0	100	67.0	64.0
Gradall	40	85	83	70	79.0	75.0	100	77.0	73.0
Grader	40	85	na	0	79.0	75.0	100		
Grapple (on Backhoe)	40	85	87	1	79.0	75.0	100	81.0	77.0
Horizontal Boring Hydr. Jac	25	80	82	6	74.0	68.0	100	76.0	70.0
Hydra Break Ram	10	90	na	0	84.0	74.0	100		
Impact Pile Driver	20	95	101	11	89.0	82.0	100	95.0	88.0
Jackhammer	20	85	89	133	79.0	72.0	100	83.0	76.0
Man Lift	20	85	75	23	79.0	72.0	100	69.0	62.0
Mounted Impact Hammer (	20	90	90	212	84.0	77.0	100	84.0	77.0

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Pavement Scarafier	20	85	90	2	79.0	72.0	100	84.0	77.0
Paver	50	85	77	9	79.0	76.0	100	71.0	68.0
Pickup Truck	40	55	75	1	49.0	45.0	100	69.0	65.0
Pneumatic Tools	50	85	85	90	79.0	76.0	100	79.0	76.0
Pumps	50	77	81	17	71.0	68.0	100	75.0	72.0
Refrigerator Unit	100	82	73	3	76.0	76.0	100	67.0	67.0
Rivit Buster/chipping gun	20	85	79	19	79.0	72.0	100	73.0	66.0
Rock Drill	20	85	81	3	79.0	72.0	100	75.0	68.0
Roller	20	85	80	16	79.0	72.0	100	74.0	67.0
Sand Blasting (Single Nozzl	20	85	96	9	79.0	72.0	100	90.0	83.0
Scraper	40	85	84	12	79.0	75.0	100	78.0	74.0
Shears (on backhoe)	40	85	96	5	79.0	75.0	100	90.0	86.0
Slurry Plant	100	78	78	1	72.0	72.0	100	72.0	72.0
Slurry Trenching Machine	50	82	80	75	76.0	73.0	100	74.0	71.0
Soil Mix Drill Rig	50	80	na	0	74.0	71.0	100		
Tractor	40	84	na	0	78.0	74.0	100		
Vacuum Excavator (Vac-tru	40	85	85	149	79.0	75.0	100	79.0	75.0
Vacuum Street Sweeper	10	80	82	19	74.0	64.0	100	76.0	66.0
Ventilation Fan	100	85	79	13	79.0	79.0	100	73.0	73.0
Vibrating Hopper	50	85	87	1	79.0	76.0	100	81.0	78.0
Vibratory Concrete Mixer	20	80	80	1	74.0	67.0	100	74.0	67.0
Vibratory Pile Driver	20	95	101	44	89.0	82.0	100	95.0	88.0
Warning Horn	5	85	83	12	79.0	66.0	100	77.0	64.0
Welder / Torch	40	73	74	5	67.0	63.0	100	68.0	64.0

Source:
FHWA Roadway Construction Noise Model, January 2006. Table 9.1
U.S. Department of Transportation
CA/T Construction Spec. 721.560

Distance Propagation Calculations for Stationary Sources of Ground Vibration

KEY:

- Orange cells are for input.
- Grey cells are intermediate calculations performed by the model.
- Green cells are data to present in a written analysis (output).

STEP 1: Determine units in which to perform calculation.

— If vibration decibels (VdB), then use Table A and proceed to Steps 2A and 3A.
— If peak particle velocity (PPV), then use Table B and proceed to Steps 2B and 3B.

STEP 2A: Identify the vibration source and enter the reference vibration level (VdB) and distance.

STEP 3A: Select the distance to the receiver.

Table A. Propagation of vibration decibels (VdB) with distance

Noise Source/ID	Reference Noise Level			Attenuated Noise Level at Receptor		
	vibration level (VdB)	@	distance (ft)	vibration level (VdB)	@	distance (ft)
blasting	109	@	25	80.1	@	230

STEP 2B: Identify the vibration source and enter the reference peak particle velocity (PPV) and distance.

STEP 3B: Select the distance to the receiver.

Table B. Propagation of peak particle velocity (PPV) with distance

Noise Source/ID	Reference Noise Level			Attenuated Noise Level at Receptor		
	vibration level (PPV)	@	distance (ft)	vibration level (PPV)	@	distance (ft)
blasting	1.130	@	25	0.197	@	80

Notes:

Computation of propagated vibration levels is based on the equations presented on pg. 12-11 of FTA 2006. Estimates of attenuated vibration levels do not account for reductions from intervening underground barriers or other underground structures of any type, or changes in soil type.

Sources:

Federal Transit Association (FTA). 2006 (May). Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. Washington, D.C. Available: <http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf>. Accessed: September 24, 2010.

Attenuation Calculations for Stationary Noise Sources

KEY:
- Orange cells are for input.
- Grey cells are intermediate calculations performed by the model.
- Green cells are data to present in a written analysis (output).

STEP 1: Identify the noise source and enter the reference noise level (dBA and distance).

STEP 2: Select the ground type (hard or soft), and enter the source and receiver heights.

STEP 3: Select the distance to the receiver.

Noise Source/ID	Reference Noise Level noise level (dBA)	@	distance (ft)	Attenuation Characteristics Ground Type (soft/hard)	Source Height (ft)	Receiver Height (ft)	Ground Factor	Attenuated Noise Level at Receptor noise level (dBA)	@	distance (ft)
Loading Dock Activity Lmax	86.0	@	50	hard	12	5	0.00	70.4	@	300
							0.66			
Generator Leq	78.0	@	50	hard	12	5	0.00	55.0	@	708
Generator Lmax	82.0	@	50	hard	12	5	0.00	70.0	@	199
							0.66			
							0.66			
							0.66			
							0.66			
							0.66			
							0.66			
							0.66			
							0.66			
							0.66			

Notes:

Estimates of attenuated noise levels do not account for reductions from intervening barriers, including walls, trees, vegetation, or structures of any type.

Computation of the attenuated noise level is based on the equation presented on pg. 12-3 and 12-4 of FTA 2006.

Computation of the ground factor is based on the equation presentd in Figure 6-23 on pg. 6-23 of FTA 2006, where the distance of the reference noise leve can be adjusted and the usage factor is not applied (i.e., the usage factor is equal to 1).

Sources:

Federal Transit Association (FTA). 2006 (May). Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. Washington, D.C. Available: <http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf>. Accessed: September 24, 2010.