NOISE STUDY REPORT

U.S. 50/SOUTH SHORE COMMUNITY REVITALIZATION PROJECT

SOUTH LAKE TAHOE, CALIFORNIA / DOUGLAS COUNTY, NEVADA

LSA

April 2012

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SOUTH LAKE TAHOE, CALIFORNIA / DOUGLAS COUNTY, NEVADA

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SUMMARY

Although the project area is located in both the State of California and Nevada, the Nevada Department of Transportation (NDOT) does not have specific definitions for the determination of highway noise impacts. Therefore, for consistency purposes, this Noise Study Report (NSR) was prepared in accordance with the May 2011 California Department of Transportation (Caltrans) Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol). Compliance with the Protocol would meet the requirements of NDOT.

The Tahoe Transportation District (TTD), in cooperation with the Tahoe Regional Planning Agency (TRPA), Caltrans, NDOT, City of South Lake Tahoe (City), Douglas County, Nevada (County), and Federal Highway Administration (FHWA) proposes to realign U.S 50 to divert through traffic on U.S. 50 around the tourist centers of the City of South Lake Tahoe and Stateline.

The purpose of the U.S. 50/South Shore Community Revitalization Project is to improve the corridor in a manner consistent with the Loop Road System concept; reduce congestion; improve vehicle, pedestrian, and bicycle safety; advance multi-modal transportation opportunities; improve the environmental quality of the area; enhance visitor and community experience; and promote the economic vitality of the area. The proposed project is needed for improved pedestrian safety, mobility, and multimodal transportation options. Also, the proposed project is needed to mitigate severe summer and winter peak-period traffic congestion along U.S. 50 in the project area, meet the intent of the Loop Road System concept, and implement the various regional and local plans for the area.

Two Build Alternatives (Alternatives C and D) and a No Build Alternative are being evaluated. The two Build Alternatives would bypass both directions of U.S. 50 around the casino gaming center between Pioneer Trail in California and Lake Parkway in Nevada. For Alternative C, Lake Parkway East, or the mountainside, would be expanded to accommodate traffic passing through the area. Alternative D is identical to Alternative C, except that modern double-lane roundabouts would be constructed at the U.S. 50/Pioneer Trail intersection and at the U.S. 50/Lake Parkway intersection.

The proposed project is considered a Type 1 project because it would use federal aid to realign U.S. 50 and would substantially alter the horizontal alignment. A noise analysis is required for all Type 1 projects.

Existing land uses in the project area include single-family residences, a picnic area, a golf course, hotels, motels, casinos, restaurants/bars, retail facilities, and vacant land. The primary source of noise in the project area is traffic on U.S. 50.

Eight short-term noise level measurements were conducted at representative locations to document the existing noise environment. All eight short-term noise level measurements were used to calibrate the noise prediction model with concurrent traffic counts. A total of 124 representative existing receptors were modeled and evaluated for potential noise impacts resulting from traffic noise. The

results of the modeled noise levels for existing, future No Build, and Alternatives C and D are shown in Table 7.1.

When traffic noise impacts have been identified, noise abatement measures must be considered. Traffic noise impacts result from one or more of the following occurrences: (1) an increase of 12 A-weighted decibels (dBA) or more over their corresponding existing noise levels, or (2) predicted noise levels approach or exceed the Noise Abatement Criteria (NAC).

Implementation of the proposed project would result in potential short-term noise impacts during construction and long-term noise impacts from use of the completed project. Of the 124 modeled receptors evaluated, four receptors (Receptors 90, 114, 115 and 116) would experience a substantial noise increase of 12 dBA or more over their corresponding modeled existing noise level and/or approach or exceed the 67 dBA equivalent continuous sound level (L_{eq}) NAC under Alternatives C and D. Noise abatement measures were not evaluated for areas represented by these four receptors because their property would be completely acquired as part of Alternatives C and D. Therefore, the preparation of a Noise Abatement Decision Report (NADR) is not required.

The closest sensitive receptors that would not be acquired as part of the project are located within 50 feet (ft) from project construction areas. Therefore, these receptor locations may be subject to short-term noise higher than 90 dBA maximum instantaneous noise level (L_{max}) generated by construction activities along the project alignment. Compliance with the construction hours specified by TRPA, City, County, and Caltrans' Standard Special Provisions (SSP) will be required to minimize construction noise impacts on sensitive land uses adjacent to the project site. Construction noise is regulated by Caltrans Standard Specifications in Section 14-8.02, "Noise Control," and also by SSP S5-310, "Noise Control." Noise control shall conform to the provisions in Section 14-8.02 and the SSP in S5-310. The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 6:00 a.m., shall not exceed 86 dBA L_{max} at a distance of 50 ft. The Contractor should use an alternative warning method instead of a sound signal unless required by safety laws. In addition, the Contractor shall equip all internal combustion engines with the manufacturer-recommended muffler and shall not operate any internal combustion engine on the job site without the appropriate muffler.

The following measures would further minimize short-term construction-related noise impacts resulting from the proposed project:

- During all project excavation and on-site grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.
- During all project construction, the project contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.
- During all project construction, the construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site.

CEQA NOISE ANALYSIS

The California Environmental Quality Act (CEQA) provides a broad basis for analyzing and abating highway traffic noise effects. CEQA requires a strict baseline versus build analysis to assess whether a proposed project will have a noise impact. If a proposed project is determined to have a significant noise impact under CEQA, then CEQA dictates that mitigation measures must be incorporated into the project unless such measures are not feasible. As the project would not result in any substantial noise level increases over their corresponding modeled existing noise levels in the project area for both Alternatives C and D, no significant noise effect would occur under CEQA. Therefore, long-term effects are considered less than significant.

In addition, short-term, construction-related noise effects would occur as a result of the proposed project. However, construction for the proposed project would be in compliance with local jurisdiction noise restrictions as well as Caltrans Standard Specifications Section 14-8.02 and Caltrans SSP S5-310. Therefore, temporary effects are considered less than significant.

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List of Acronyms

ac	acre(s)
ADT	average daily traffic
µg/m3	micrograms per cubic meter
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
City	City of South Lake Tahoe
CNEL	community noise equivalent level
Compact	Tahoe Regional Planning Compact
County	Douglas County, Nevada
dB	decibels
dBA	A-weighted decibels
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
Ft	feet
Hz	Hertz
kHz	kilohertz
LOS	level of service
mi	miles
mph	miles per hour
NAC	Noise Abatement Criteria
NADR	Noise Abatement Decision Report
NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NEPA	National Environmental Policy Act
NSR	Noise Study Report
Protocol	Retrofit Barrier Projects
RWQCB	Lahontan Regional Water Quality Control Board
SPL	sound pressure level
SSP	Standard Special Provisions
State	State of California
TeNS	Caltrans Technical Noise Supplement
TNM	Traffic Noise Model
TRPA	Tahoe Regional Planning Agency
TTD	Tahoe Transportation District
µPa	micro-Pascals
U.S. 50	United States Highway 50

1.0 INTRODUCTION

The TTD, in cooperation with the TRPA, Caltrans, NDOT, the City, the County, and FHWA, proposes to realign U.S 50 to divert through traffic on U.S. 50 around the tourist centers of the City of South Lake Tahoe and Stateline.

In late 2002, the TRPA initiated a transportation planning effort to address significant traffic congestion and other issues in the U.S. 50 corridor. The corridor extends from the Pioneer Trail intersection in the City of South Lake Tahoe, California, to Nevada State Route 207, or Kingsbury Grade, in Douglas County, Nevada. The 1.1-mile (mi) long corridor encompasses a planning area that is approximately 300 acres (ac) in size.

The U.S. 50 corridor experiences significant traffic congestion during peak periods, especially during the summer months. The corridor also has inadequate facilities for pedestrians and bicyclists. There are also possibilities for enhancing transit in the corridor to reduce the current dependence on the private automobile and for enhancing scenic quality.

The Tahoe Regional Planning Compact (Compact) of 1980 calls for the consideration of a Loop Road System around the area. The TRPA Community Plans for the area call for a number of improvements to meet TRPA's environmental thresholds and other requirements. Project goals include the following:

- Identify options to reduce traffic congestion and improve traffic flow patterns while maintaining the current overall capacity of the roadway network in the project area
- Identify options to improve pedestrian and bicycle access, public safety, and transit services in the project area
- Develop design solutions that reflect the community and the adjoining land uses
- Help achieve scenic resources, recreation, air quality, water quality, and other TRPA thresholds
- Balance transportation needs with other community goals such as economic vitality and visitors' interests
- Reflect the need to address snow removal and emergency access requirements

The regional project location and project vicinity, as shown on Figure 1-1, is the U.S. 50 corridor from where the roadway intersects with Pioneer Trail in the City of South Lake Tahoe, continuing east through the California/Nevada State line to Nevada State Route 207, also known as Kingsbury Grade, in Douglas County.

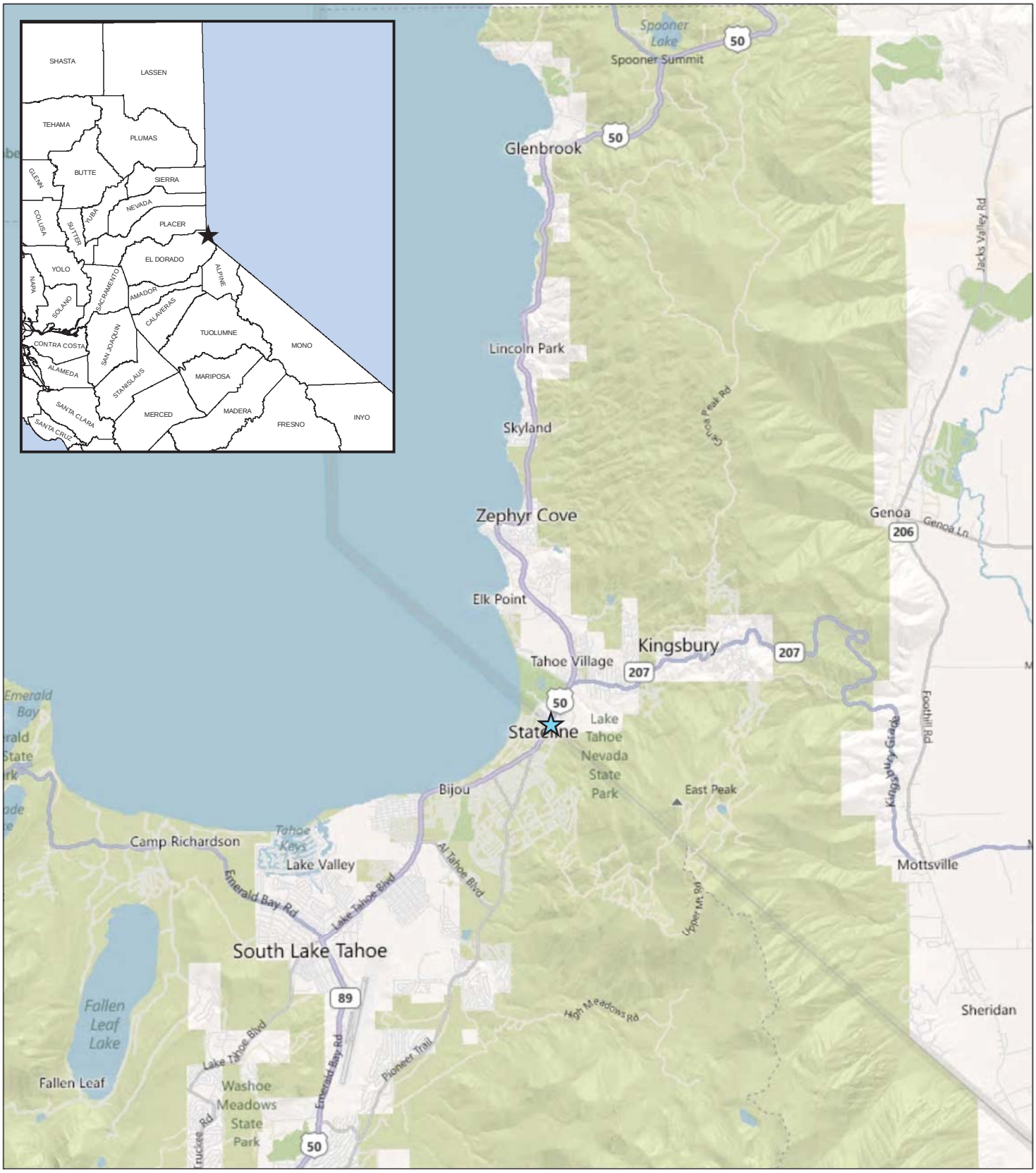

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FIGURE 1-1

LEGEND

Project Location

N

0 1 2
MILES

SOURCE: ESRI Imagery (4/2008)

P:\WRS0902\Graphics\Noise\Figure 1-1.pdf (11/30/11)

U.S. 50 / Stateline Corridor Project

Regional Location and Project Vicinity

1.1 PURPOSE OF THE NOISE STUDY REPORT

The purpose of 23 Code of Federal Regulations (CFR) 772, "Procedures for Abatement of Highway Traffic Noise," is to provide procedures to help protect public health and welfare, supply Noise NAC, and establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to 23 CFR 772.1. As such, 23 CFR 772 provides procedures for preparing operational and construction noise impact studies and evaluating noise abatement considered for federal and federal-aid highway projects. According to 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with FHWA noise standards.

The Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Protocol (Caltrans 2011) provides Caltrans policy for implementing 23 CFR 772 in California. The Protocol outlines the requirements for preparing NSRs. Noise impacts associated with this project under the National Environmental Policy Act (NEPA) and the CEQA are evaluated in the project's environmental document CEQA Draft Environmental Impact Report and TRPA Draft Environmental Impact Statement for the U.S. 50/South Shore Community Revitalization Project.

1.2 PROJECT PURPOSE AND NEED

The purpose of the U.S. 50/South Shore Community Revitalization Project is to improve the corridor in a manner consistent with the Loop Road System concept; reduce congestion; improve vehicle, pedestrian, and bicycle safety; advance multimodal transportation opportunities; improve the environmental quality of the area; enhance visitor and community experience; and promote the economic vitality of the area. The project will fulfill the following specific needs:

- Article V(2) of the Compact (Public Law 96-551), 1980, requires a transportation plan for the integrated development of a regional system of transportation within the Tahoe region. The Compact requires the transportation plan to include consideration of the completion of the Loop Road System in the States of California and Nevada. Improvements to the corridor are required to meet the intent of the Loop Road System concept.
- Ongoing and proposed resort redevelopment in the project area has increased pedestrian traffic, creating a need for improved pedestrian safety, mobility, and multimodal transportation options. Improvements to pedestrian facilities, bicycle lanes, and transit are needed to connect the outlying residential and retail-commercial uses with employment and entertainment facilities, including hotels and gaming interests. Currently, there are no bicycle lanes on U.S. 50 through the project area, and sidewalks are either not large enough to meet the increased demand or do not exist. These issues adversely affect safety and the visitor and community experience of the area.
- Environmental improvements are needed in the area to help achieve TRPA's adopted environmental threshold carrying capacities (ETCCs or thresholds), including water quality and air quality. Improvements to storm water runoff collection and treatment facilities are needed to meet TRPA, Nevada Department of Environmental Protection (NDEP), and Lahontan Regional Water Quality Control Board (RWQCB) regulations and requirements. Reduction of vehicle congestion and numbers of vehicles on the roadway through enhanced pedestrian and multimodal opportunities is needed to provide for improved air quality. Landscape improvements are needed

to enhance the scenic quality of the project area, to facilitate compliance with TRPA's scenic thresholds, and to enhance the community and tourism experience.

- The project is needed to implement the various regional and local plans for the area, including the Lake Tahoe Regional Transportation Plan, the Lake Tahoe Environmental Improvement Program, and the Stateline/Ski Run Community Plan.
- The project is needed to mitigate severe summer and winter peak-period traffic congestion along U.S. 50 in the project area by achieving and maintaining acceptable levels of service (LOS) for existing and future traffic demand. During peak hours, traffic often operates at LOS "F" (breakdown) when tourism is at its peak during the summer and winter months.

1.3 PROJECT DESCRIPTION

The proposed project would realign both directions of U.S. 50 around the casino gaming center between Pioneer Trail in California and Lake Parkway in Nevada. New storm water facilities would be constructed, and sidewalks, landscaping, and street furnishings would be furnished adjacent to U.S. 50. The streetscape would incorporate similar design elements that have been implemented as part of the Village Center and Heavenly Village redevelopment and that are planned as part of Redevelopment Project No. 3. Utilities would be installed or relocated as needed. Bike lanes would be provided on U.S. 50, and the area would be enhanced for nonvehicular traffic to encourage using other modes of transportation.

1.4 ALTERNATIVES

Two Build Alternatives and one No Build Alternative have been selected for evaluation of impacts for the project.

1.4.1 No Build Alternative

The No Build Alternative considers that no improvements will be made to U.S. 50. The current road alignment and lane configuration will remain the same.

The transportation conditions in the U.S. 50/Stateline Planning Area suffer because there are inadequate facilities to meet the current and forecast future demands of the people residing or staying in the area, visiting it, or traveling through it. These inadequate conditions result in periods of traffic congestion during the peak summer and winter seasons, degrade and discourage the bicycle and pedestrian travel experience, and negatively impact the ability to operate effective transit services. These inadequate conditions result in secondary impacts to the area's businesses, workers, residents, and visitors and detract from the overall "Tahoe Experience." In particular, the existing roadway configuration significantly detracts from the visual quality of this important activity center, and also presently limits the options available to improve the area's scenic quality.

The resulting traffic volumes are expected to increase by 33 percent in the eastbound direction and 22 percent in the westbound direction along U.S. 50 west of Park Avenue between 2003 and 2030. Traffic volumes along U.S. 50 west of Lake Parkway are expected to increase by much less: 14 percent in the eastbound direction, and 13 percent in the westbound direction.

If the No Build Alternative was selected, a number of environmental conditions would decline when compared with the Build Alternatives. LOS would degrade to unacceptable levels, resulting in severe congestion and gridlock.

The No Build Alternative does not meet the project purpose and need identified earlier in this report.

1.4.2 Build Alternative C

With this Build Alternative, Lake Parkway East, or the mountainside, would be expanded to accommodate traffic passing through the area. The U.S. 50 designation in both directions would be moved to this expanded mountainside alignment. The roadway would be extended west of Park Avenue, passing to the south and west of the Village Center shopping complex to a new traffic signal at an intersection formed by the existing U.S. 50 to the east and to the northwest and Pioneer Trail to the west. A signal would also be provided at the new U.S. 50/Harrah's driveway intersection. The new U.S. 50 would provide two travel lanes in each direction, with turn pockets at major intersections and driveways. In addition, this alternative would provide a traffic signal at Friday Avenue on the three-lane alignment to facilitate pedestrian crossings at this location. Streetscape and low impact development type improvements would be made to the existing U.S. 50; which would become a City Road on the California side and a Douglas County Road on the Nevada side of the project.

1.4.3 Build Alternative D

This Build Alternative is identical to Alternative C, except that a modern double-lane roundabout would be constructed at the U.S. 50/Lake Parkway intersection.

2.0 FUNDAMENTALS OF TRAFFIC NOISE

The following is a brief discussion of fundamental traffic noise concepts. For a detailed discussion, please refer to Caltrans Technical Noise Supplement (TeNS) (November 2009), a technical supplement to the Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol), that is available on the Caltrans website: http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf.

2.1 SOUND, NOISE, AND ACOUSTICS

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receptor determines the sound level and characteristics of the noise perceived by the receptor. The field of acoustics deals primarily with the propagation and control of sound.

2.1.1 Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

2.1.2 Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (μPa). One μPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 μPa. Because of this huge range of values, sound is rarely expressed in terms of μPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 μPa.

2.1.3 Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

2.1.4 A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz, and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an “A-weighted” sound level (expressed in units of dBA) can be computed based on this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with highway traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted decibels or dBA. Table 2.1 describes typical A-weighted noise levels for various noise sources.

2.2 HUMAN RESPONSE TO CHANGES IN NOISE LEVELS

As discussed above, doubling sound energy results in a 3 dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different from what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1-dB changes in sound levels, when exposed to steady, single-frequency (“pure-tone”) signals in the midfrequency (1,000 Hz–8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5 dB increase is generally perceived as a distinctly noticeable increase, and a 10 dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on

a highway) that would result in a 3 dB increase in sound would generally be perceived as barely detectable.

Table 2.1: Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 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 daytime	**— 50 —**	Dishwasher next room
Quiet urban nighttime	**— 40 —**	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	**— 0 —**	Lowest threshold of human hearing

Source: California Department of Transportation, Technical Noise Supplement (2009).
dBA = A-weighted decibels

2.3 NOISE DESCRIPTORS

Noise in our daily environment fluctuates over time. Some fluctuations are minor, but some are substantial. Some noise levels occur in regular patterns, but others are random. Some noise levels fluctuate rapidly, but others slowly. Some noise levels vary widely, but others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors most commonly used in traffic noise analysis.

- **Equivalent Sound Level (L_{eq}):** L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level (L_{eq}[h]) is the energy average of A-weighted sound levels occurring during a 1-hour period and is the basis for NAC used by Caltrans and the Federal Highway Administration FHWA.

- **Percentile-Exceeded Sound Level (L_{xx}):** L_{xx} represents the sound level exceeded for a given percentage of a specified period (e.g., L_{10} is the sound level exceeded 10 percent of the time, and L_{90} is the sound level exceeded 90 percent of the time).
- **Maximum Sound Level (L_{max}):** L_{max} is the highest instantaneous sound level measured during a specified period.
- **Day-Night Level (L_{dn}):** L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10:00 p.m. and 7:00 a.m.
- **Community Noise Equivalent Level (CNEL):** Similar to L_{dn}, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10:00 p.m. and 7:00 a.m., and a 5 dB penalty applied to the A-weighted sound levels occurring during evening hours between 7:00 p.m. and 10:00 p.m.

2.4 SOUND PROPAGATION

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends on the following factors.

2.4.1 Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source.

2.4.2 Ground Absorption

The propagation path of noise from a highway to a receptor is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet (ft). For acoustically hard sites (i.e., sites with a reflective surface between the source and the receptor, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receptor, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance.

2.4.3 Atmospheric Effects

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 ft) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

2.4.4 Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor specifically to reduce noise. A barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. Taller barriers provide increased noise reduction. Vegetation between the highway and receptor is rarely effective in reducing noise because it does not create a solid barrier.

3.0 REGULATORY FRAMEWORK

3.1 FEDERAL REGULATIONS

The FHWA 23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under 23 CFR 772.7, projects are categorized as Type 1, Type 2, or Type 3 projects. The FHWA defines a Type 1 project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, or the physical alteration of an existing highway where there is either substantial horizontal or substantial vertical alteration, or increases the number of through-traffic lanes. A Type 2 project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. A Type 3 project is a project that does not meet the classifications of a Type 1 or Type 2 project. Type 3 projects do not require a noise analysis.

Type 1 projects include the addition of through traffic lanes that function as high-occupancy vehicle lanes, high-occupancy toll lanes, bus lanes, or truck climbing lanes. Type 1 projects include the addition of an auxiliary lane (except when an auxiliary lane is a turn lane); addition or relocation of interchange lanes or ramps; restriping existing pavement for the purpose of adding a through-traffic lane or auxiliary lane; and the addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza. Projects unrelated to increased noise levels, such as striping, lighting, signing, and landscaping projects, are not considered Type 1 projects.

Under 23 CFR 772.11, noise abatement must be considered for Type 1 projects if the project is predicted to result in a traffic noise impact. In such cases, 23 CFR 772 requires that the project sponsor “consider” noise abatement before adoption of the final NEPA document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to be incorporated into the project, and of noise impacts for which no apparent solution is available.

Traffic noise impacts, as defined in 23 CFR 772.5, occur when the predicted noise level in the design year approaches or exceeds the NAC specified in 23 CFR 772, or a predicted noise level substantially exceeds the existing noise level (i.e., a “substantial” noise increase). The FHWA 23 CFR 772 does not specifically define the terms “substantial increase” or “approach”; these criteria are defined in the Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol), as described below.

Table 3.1 summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

In identifying noise impacts, primary consideration is given to exterior areas of frequent human use. In situations where there are no exterior activities, or where the exterior activities are far from the roadway or physically shielded in a manner that prevents an impact on exterior activities, the interior criterion (Activity Category D) is used as the basis for determining a noise impact.

Table 3.1: Activity Categories and Noise Abatement Criteria

Activity Category	Activity $L_{eq}(h)$[1]	Evaluation Location	Description of Activities
A	57	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[2]	67	Exterior	Residential.
C[2]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A–D or F.
F			Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G			Undeveloped lands that are not permitted.

Source: Federal Highway Administration 23 CFR 772.
[1] The $L_{eq}(h)$ activity criteria values are for impact determination only and are not design standards for noise abatement measures.
[2] Includes undeveloped lands permitted for this activity category.
CFR = Code of Federal Regulations
dBA = A-weighted decibels
$L_{eq}(h)$ = 1-hour A-weighted equivalent continuous sound level

3.2 STATE REGULATIONS AND POLICIES

3.2.1 California

Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects. The Protocol specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of federal or federal-aid highway projects. The NAC specified in the Protocol are the same as those specified in 23 CFR 772. The Protocol defines a noise increase as substantial when the predicted noise levels with project implementation exceed existing noise levels by 12 A-weighted decibels (dBA). The Protocol also states that a sound level is considered to approach an NAC level when the sound level is within 1 decibel (dB) of the NAC identified in 23 CFR 772 (e.g., 66 dBA is considered to approach the NAC of 67 dBA, but 65 dBA is not).

The TeNS to the Protocol provides detailed technical guidance for the evaluation of highway traffic noise. This includes field measurement methods, noise modeling methods, and report preparation guidance.

Section 216 of the California Streets and Highways Code. Section 216 of the California Streets and Highways Code relates to the noise effects of a proposed freeway project on public and private elementary and secondary schools. Under this code, a noise impact occurs if, as a result of a proposed freeway project, noise levels exceed 52 dBA 1-hour A-weighted equivalent continuous sound level (L_{eq}[h]) in the interior of public or private elementary or secondary classrooms, libraries, multipurpose rooms, or spaces. This requirement does not replace the "approach or exceed" NAC criterion for FHWA Activity Category D for classroom interiors, but it is a requirement that must be addressed in addition to the requirements of 23 CFR 772.

If a project results in a noise impact under this code, noise abatement must be provided to reduce classroom noise to a level that is at or below 52 dBA L_{eq}(h). If the noise levels generated from freeway and non-freeway sources exceed 52 dBA L_{eq}(h) prior to the construction of the proposed freeway project, then noise abatement must be provided to reduce the noise to the level that existed prior to construction of the project.

3.2.2 Nevada

The State of Nevada and the NDOT use federal laws that govern noise and its effect on transportation projects. NEPA and federal regulation 23 CFR 772 provide procedures for NDOT to prepare operational and construction noise studies and evaluate noise abatements considered for federal and federal-aid highway projects.

3.3 LOCAL REGULATIONS AND POLICIES

3.3.1 Tahoe Regional Planning Area

TRPA's Code of Ordinances (Chapter 23, Section 23.8) states that TRPA-approved construction or maintenance project, or the demolition of structures, provided such activities are limited to the hours between 8:00 a.m. and 6:30 p.m.

TRPA has adopted standards for noise, including single event standards for aircraft and other motorized vehicles and standards for cumulative noise events measured in terms of the 24-hour average noise metric CNEL. CNEL is the time varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). The standards, established in the Goals and Policies, apply to the entire Lake Tahoe Region. Table 3.2 shows TRPA Noise Threshold Standards. The stated noise standard for development within the U.S. 50 corridor is 65 dBA CNEL.

Table 3.2: TRPA Noise Threshold Standards

Single Noise Events	Noise Measurement
Boats (not to exceed any of 3 tests)	82 dBA measured at 50 feet with engine at 3,000 rpm
	SAE test J1970 or SAEJ1970, Shoreline Test, 75 dBA (standard adopted 7/03)
	SAE Test J2005, Stationary Test, 88 dBA if watercraft manufactured on or after 1/1/93 and 90 dBA if watercraft manufactured before 1/1/93 (standard adopted 7/03)
Motor Vehicles (less than 6,00 lbs GVW)	76 dBA running at <35/mph (82 dBA running at >35/mph) measured at 50 feet
Motor Vehicles (greater than 6,00 lbs GVW)	82 dBA running at <35/mph (86 dBA running at >35/mph) measured at 50 feet
Motorcycles	77 dBA running at <35/mph (86 dBA running at >35/mph) measured at 50 feet
Off-road Vehicles	72 dBA running at <35/mph (86 dBA running at >35/mph) measured at 50 feet
Snowmobiles	82 dBA running at <35/mph measured at 50 feet
Community Noise Equivalent Levels: Background levels shall not exceed the following:	
Industrial	65 dB CNEL
High Density Residential	55 dB CNEL
Low density residential	50 dB CNEL
Hotel/motel facilities	55 dB CNEL
Commercial area	65 dB CNEL
Urban outdoor recreation	55 dB CNEL
Rural outdoor recreation	50 dB CNEL
Wilderness and roadless	45 db CNEL
Transportation[1]	
U.S. 50	65[(2)] dB CNEL
State Route 89, 207, 28, 267 and 431	55[(2)] dB CNEL
South Lake Tahoe Airport	60[(3)] dB CNEL

Source: TRPA, 2011.
[1] CNEL values for transportation corridor.
[2] This threshold overrides the land use CNEL thresholds and is limited to an area within 300 feet from the edge of the road.
[3] This threshold applies to those areas impacted by the approved flight paths.
CNEL = Community Noise Equivalent Level measurements are weighted average of sound level gathered throughout a 24–hour period.
dBA = A-weighted decibels
dB = Decibel

3.3.2 City of South Lake Tahoe, CA

The City Code does not contain acceptable hours of construction. Noise generated from construction activities should be limited to between the hours of 7:00 a.m. and 7:00 p.m. on Monday through Saturday as standard practice. Also, construction activity would be prohibited on Sundays and federal holidays.

3.3.3 Douglas County, Nevada

Policy 5.21.05 of the Conservation Element in the Master Plan states that all construction activities should be limited to daytime hours. Although the daytime hours were not specified, they are typically limited to between 7:00 a.m. and 7:00 p.m.

4.0 METHODOLOGY AND PROCEDURES

Although the project area is located in both the State of California and Nevada, the NDOT does not have specific definitions for the determination of highway noise impacts. Therefore, for consistency purposes, this NSR was prepared in accordance with the May 2011 Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Protocol. Compliance with the Protocol would meet the requirements of NDOT.

4.1 METHODS FOR IDENTIFYING LAND USES AND SELECTING NOISE MEASUREMENTS AND MODELING RECEIVER LOCATIONS

A field investigation was conducted to identify land uses that could be subject to traffic and construction noise impacts from the proposed project. Land uses in the project area were categorized by land use type, activity category as defined in Table 4.1, and the extent of frequent human use. As stated in the Protocol, noise abatement is only considered for areas of frequent human use that would benefit from a lowered noise level. Although all developed land uses are evaluated in this analysis, the focus is on locations of frequent human use that would benefit from a lowered noise level. Accordingly, this impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards and common use areas at hotels/motels in the project vicinity.

The geographical features of the project area relative to nearby existing land uses were also identified.

A short-term noise measurement location was selected to represent the major developed area within the project area along the existing portion of the project roadway segments. A single long-term measurement site was selected to capture the diurnal traffic noise level pattern in the project area. The short-term measurement location was selected to serve as representative modeling location. Several other non-measurement locations were selected as modeling locations. A total of 124 receptor locations were modeled to represent the land uses in the project vicinity. The monitoring and modeled receptor locations are shown on Figures 5-1 through 5-3.

4.2 FIELD MEASUREMENT PROCEDURES

A field noise study was conducted in accordance with recommended procedures in the Caltrans TeNS document (Caltrans 2009). The following is a summary of the procedures used to collect short-term and long-term sound level data.

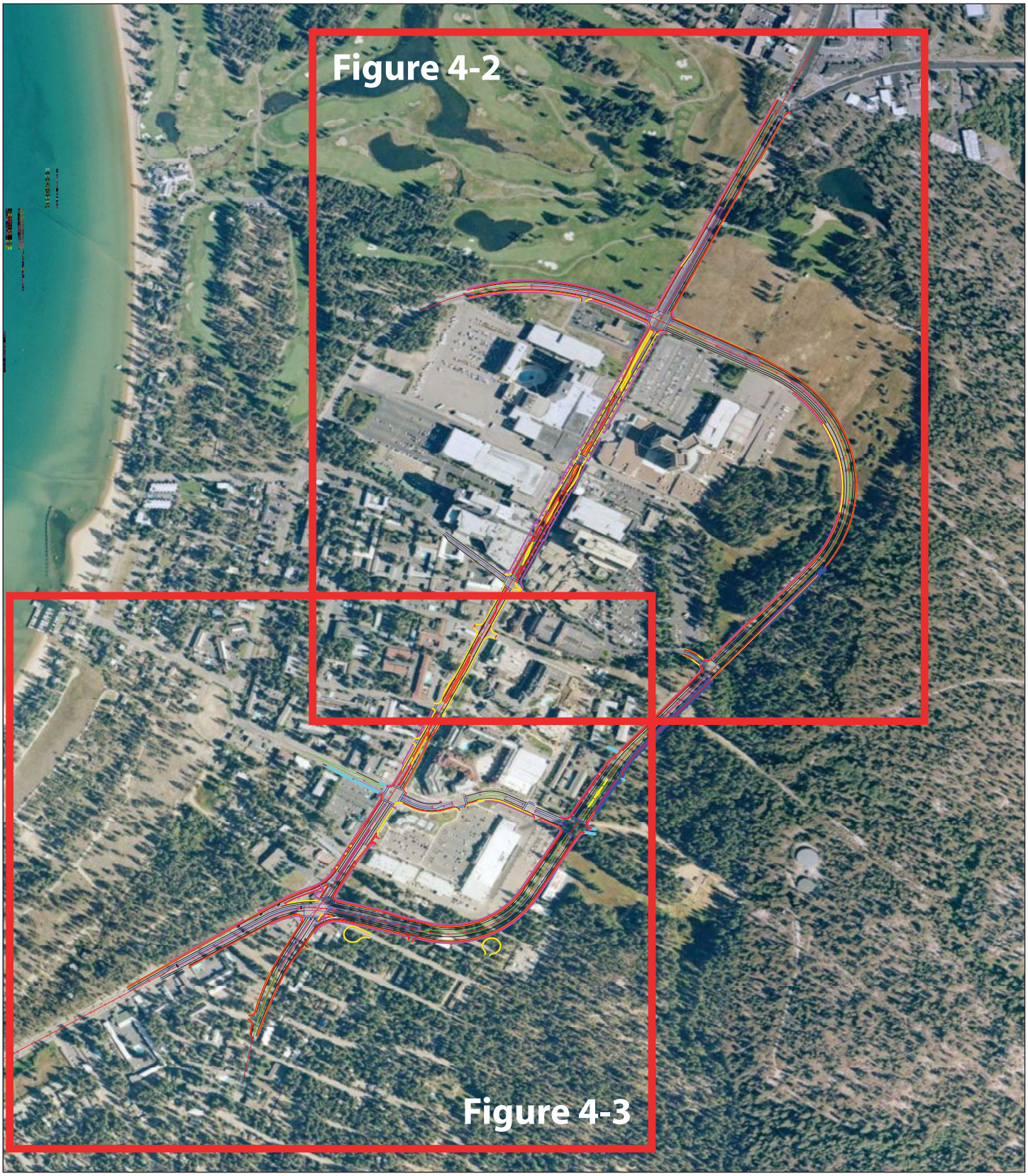

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FIGURE 4-1

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Figure Page Areas

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U.S. 50 / Stateline Cooridor Project
Monitoring and Modeled Receptor Locations

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FIGURE 4-2

Noise Monitoring Locations (Short-term)

Noise Monitoring Location (Long-term)

Receptor Locations

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U.S. 50 / Stateline Cooridor Project

Monitoring and Modeled Receptor Locations

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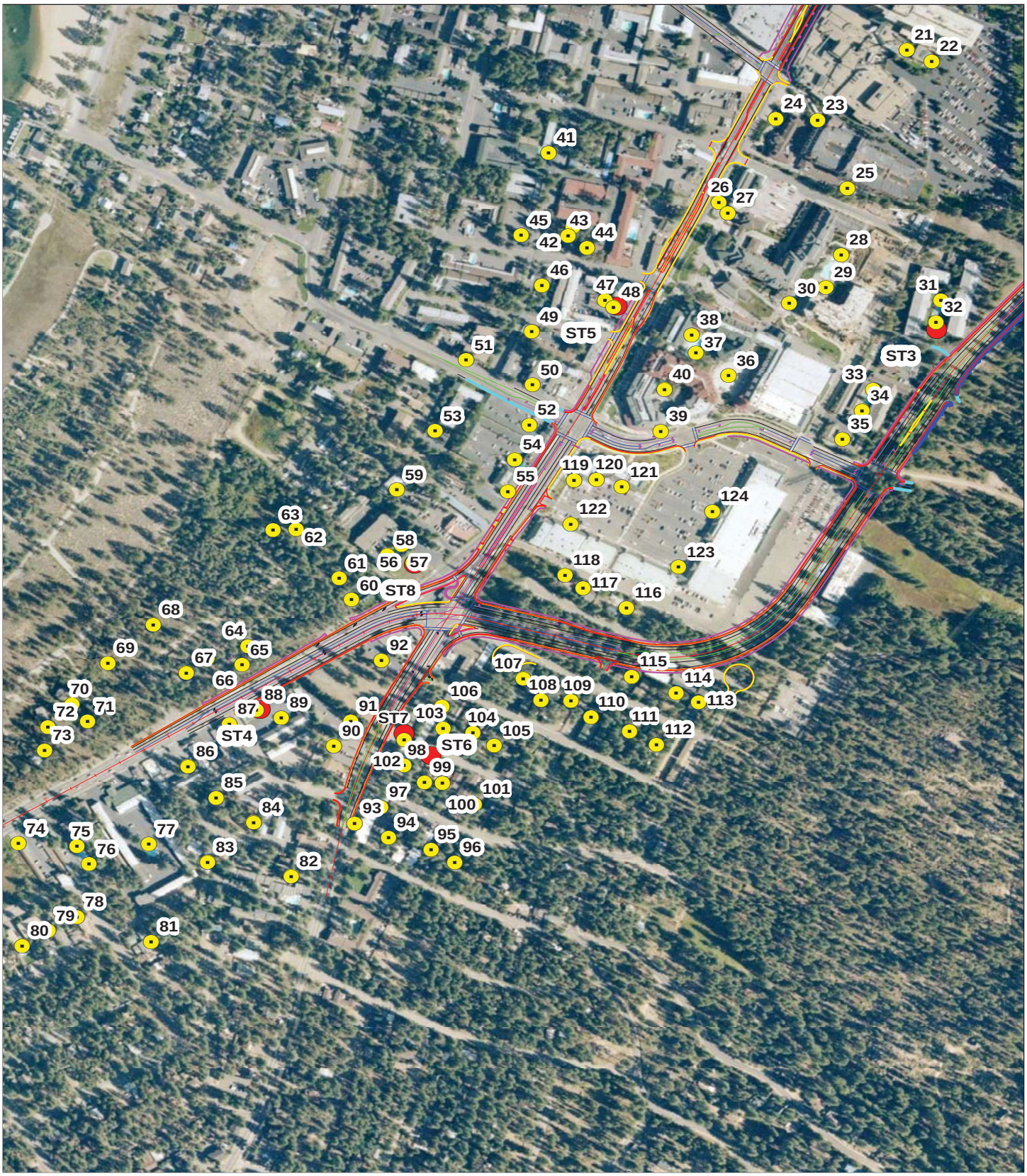

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FIGURE 4-3

Noise Monitoring Locations (Short-term)

Receptor Locations

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U.S. 50 / Stateline Cooridor Project

Monitoring and Modeled Receptor Locations

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4.2.1 Short-Term Measurements

Eight short-term (15-minute) noise measurements were conducted at representative receptor sites classified as Activity Categories B, C, and E within the project area on Thursday, August 25, 2011, between 7:00 a.m. and 5:00 p.m. when traffic was free flowing. All measurements were made using a Larson Davis Model 720 Type 2 sound level meter (Serial No. 0519). The short-term measurement locations are identified on Figures 4-1through 4-3.

The following measurement procedures were utilized:

- Calibrate sound level meter.
- Set up sound level meter at a height of 5 feet (ft).
- Commence noise monitoring.
- Collect site-specific data such as date, time, direction of traffic, and distance from sound level meter to the right-of-way.
- Count passing vehicles for a period of 15 minutes. Vehicles were split into three categories: heavy trucks, medium trucks, and automobiles.
- Stop measurement after 15 minutes.
- Calibrate sound level meter.

The traffic counts were expanded to hourly volumes (multiplied by four to normalize the results to hourly values) and entered into Traffic Noise Model (TNM) 2.5 for each monitoring site. The monitoring results were used to calibrate the model outputs.

Temperature, wind speed, and humidity were recorded manually during the short-term monitoring session using a Kestrel 3000 portable weather station. During the short-term measurements, winds were calm and temperature measurements ranged between 63.3 degrees Fahrenheit (°F) and 71.1°F, with relative humidity at 50 percent.

Traffic on U.S. 50 and Pioneer Trail was counted during the short-term (15-minute) noise measurement. Traffic counts for each monitoring site are included in Appendix A. Vehicles were classified as automobiles, medium-duty trucks, or heavy-duty trucks. An automobile was defined as a vehicle with two axles and four tires that are designed primarily to carry passengers. Small vans and light trucks were included in this category. Medium-duty trucks included all cargo vehicles with two axles and six tires. Heavy-duty trucks included all vehicles with three or more axles. The posted speed limits on this portion of U.S. 50 and Pioneer Trail are 35 mph and 30 mph, respectively.

5.2.1 Long-Term Measurement

Long-term monitoring was conducted at one location (LT-1) using a Larson-Davis Model 720 Type 2 sound level meter (Serial No. 0519). The purpose of these measurements was to identify variations in sound levels throughout the day. The long-term sound level data were collected over a 12-hour period from 7:00 p.m. on Wednesday, August 24, 2011, to 7:00 p.m. on Thursday, August 25, 2011. The

long-term monitoring location was located at the edge of right-of-way along the east side of Lake Parkway.

4.3 TRAFFIC NOISE LEVELS PREDICTION METHODS

Traffic noise levels were predicted using FHWA TNM 2.5. TNM 2.5 is a computer model based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a, 1998b). Key inputs to the traffic noise model were the locations of roadways, shielding features (e.g., topography and buildings), existing noise barriers, ground type, and receptors. Three-dimensional representations of these inputs were developed using computer-aided design drawings, aerials, and topographic contours provided by Wood Rodgers, Inc.

Traffic noise was evaluated under existing conditions, 2035 no project conditions, and 2035 conditions with the project alternatives. Summer peak traffic volumes under Existing and 2035 conditions were provided by Wood Rodgers, Inc. (2011) for input into the traffic noise model. The highest average traffic volumes on U.S. 50 and Lake Parkway are predicted to occur during the summer; therefore, summer peak-traffic volumes were used in the model.

The TNM 2.5 model is sensitive to the volume of trucks on the roadway because trucks are louder than automobiles and therefore contribute disproportionately to the traffic noise. Truck percentages on U.S. 50 were obtained from the Caltrans *Annual Average Daily Trucks on the California State Highway System* (Caltrans 2009). Truck percentages on Lake Parkway, Park Avenue, Pioneer Trail, and Stateline were assumed to be the same as U.S. 50. The traffic volumes, vehicle distributions, speeds, and assumptions used to calculate existing peak, future no build, and future build (Alternatives C and D) noise levels are presented in Table 4.1.

Table 4.1: Vehicle Distribution and Vehicle Speed

Roadway	Vehicle (%)			Vehicle Speed (mph)		
	Automobiles	Medium Trucks	Heavy Trucks	Automobiles	Medium Trucks	Heavy Trucks
U.S. 50	96.9	2.6	0.5	35	35	30
Lake Parkway	96.9	2.6	0.5	35	35	30
Park Avenue	96.9	2.6	0.5	30	30	30
Pioneer Trail	96.9	2.6	0.5	30	30	30
Stateline Avenue	96.9	2.6	0.5	30	30	30

Source: LSA Associates, Inc. (December 2011).
mph = miles per hour

4.4 METHODS FOR IDENTIFYING TRAFFIC NOISE IMPACTS AND CONSIDERATION OF ABATEMENT

Traffic noise impacts are considered to occur at receptor locations where predicted 2035 noise levels are at least 12 dB greater than existing noise levels, or where predicted 2035 noise levels approach or exceed the NAC for the applicable activity category. Where traffic noise impacts are identified, noise

abatement must be considered for reasonableness and feasibility as required by 23 CFR 772 and the Protocol.

According to the Protocol, abatement measures are considered acoustically feasible if a minimum noise reduction of 5 dBA at impacted receptor locations is predicted with implementation of the abatement measure. In addition, barriers should be designed to intercept the line-of-sight from the exhaust stack of a truck to the first tier of receptors, as required by the *Highway Design Manual,* Chapter 1100 (Caltrans 2007). Other factors that affect feasibility include topography, access requirements for driveways and ramps, presence of local cross streets, utility conflicts, other noise sources in the area, and safety considerations. The overall reasonableness of noise abatement is determined by considering factors such as the construction cost of the barrier, noise reduction design goal (a noise level reduction of 7 dBA or more at one or more benefited receptors), and the viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

The Protocol defines the procedure for assessing the reasonableness of sound barriers from a cost perspective. A cost-per-residence allowance is calculated for each benefited residence (i.e., residences that receive at least 5 dBA of noise reduction from a sound barrier). The 2011 allowance is $55,000 per benefited residence. Total allowances are calculated by multiplying the cost per residence by the number of benefited residences.

5.0 EXISTING NOISE ENVIRONMENT

5.1 EXISTING LAND USES

Developed and undeveloped land uses in the project vicinity were identified through land use maps, aerial photography, and site inspection. Within each land use category, sensitive receivers were identified. Existing land uses in the project area include single-family residences, a picnic area, a golf course, hotels, motels, casinos, restaurants/bars, retail facilities, and vacant land.

5.2 EXISTING NOISE MEASUREMENT RESULTS

The existing noise environment in the project area is based on short-term and long-term 24-hour traffic noise level measurements. Also, interior and exterior noise level measurements were conducted at the school classroom building to evaluate potential interior noise impacts.

5.2.1 Short-Term Monitoring

The primary source of noise in the project area is traffic on U.S. 50 and local roadways in the project area. Short-term (15-minute) noise measurements were conducted to document existing noise levels at eight representative receptor locations. Noise level measurements were conducted using Larson Davis Model 720 Type 2 sound level meter. Table 5.1 contains the results of the short-term noise level measurements.

Table 5.1: Short-Term Ambient Noise Monitoring Results

Monitor No.	Date	Start Time	Duration	dBA L_{eq}
ST-1	8/25/2011	7:25 a.m.	15 minutes	67.8
ST-2	8/25/2011	8:05 a.m.	15 minutes	57.9
ST-3	8/25/2011	8:45 a.m.	15 minutes	48.2
ST-4	8/25/2011	9:20 a.m.	15 minutes	66.2
ST-5	8/25/2011	9:45 a.m.	15 minutes	62.6
ST-6	8/25/2011	10:15 a.m.	15 minutes	48.8
ST-7	8/25/2011	11:15 a.m.	15 minutes	59.6
ST-8	8/25/2011	12:00 p.m.	15 minutes	63.1

Source: LSA Associates, Inc. (December 2011).
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

Table 5.2 describes the physical locations of the noise monitoring. These short-term noise measurements were used to document the existing noise environment within the project area. The short-term monitoring locations are shown on Figures 5-1 through 5-3. These short-term noise measurements were used to calibrate the noise model and to predict the noise levels at all 124 modeled sensitive receptors in the project area.

Table 5.2: Physical Location of Noise Level Measurements

Monitor No.	Location Description	Noise Sources	Comments
M-1	At the Edgewood Tahoe Golf Course located on the west side of U.S. 50 between Lake Parkway and Kingsbury Grade Road.	Traffic on U.S. 50	Approximately 20 ft from the fence.
M-2	55 U.S. 50; at the Montebleu Casino and Resort; located on the southeastern intersection of U.S. 50 and Lake Parkway.	Traffic on U.S. 50 and Lake Parkway	Approximately 20 ft from Lake Parkway.
M-3	1 Lake Parkway; at the Forest Suites Resort; located on the northwestern intersection of Lake Parkway and Park Avenue.	Traffic on Lake Parkway and Park Avenue	Approximately 120 ft from Lake Parkway.
M-4	3892 Lake Tahoe Boulevard; at the Vagabond Inn; located on east side of Lake Tahoe Boulevard and south of Pioneer Trail.	Traffic on U.S. 50	Approximately 40 ft from Lake Tahoe Boulevard.
M-5	4061 Lake Tahoe Boulevard; at the Stardust Lodge; located on the west side of Tahoe Boulevard between La Salle Street and Friday Avenue.	Traffic on U.S. 50	Approximately 20 ft from Lake Tahoe Boulevard.
M-6	3670 Primrose Road; at Primrose Cabins; located near the intersection of Pioneer Trail and Primrose Trail.	Some traffic on Primrose Road and faint aircraft noise.	Approximately 10 ft from Primrose Road.
M-7	3900 Pioneer Trail: near Monte Verdi Apartment; located northwest of Midway Road and Pioneer Trail.	Traffic on Pioneer Trail	Approximately 20 ft from Pioneer.
M-8	3961 Lake Tahoe Boulevard; at the Holiday Inn Express; located at the intersection of Lake Tahoe Boulevard and Pioneer Trail.	Traffic on U.S. 50 and Pioneer Trail.	Approximately 20 ft from Lake Tahoe Boulevard.

Source: LSA Associates, Inc. (December 2011).
ft = feet

5.2.2 Noise Model Calibration

A total of eight separate model runs were conducted using the traffic counts collected during the ambient noise monitoring. The results of these model runs were compared to the measured ambient noise levels to ensure the accuracy of TNM 2.5. Correction factors known as K-factors were applied to each of the modeled receptor locations so that the monitored and modeled noise levels were the same. Table 5.3 shows the measured ambient noise level, the modeled noise levels using traffic counts during noise monitoring, and the K-factor at each of the eight monitored locations. The model input and output data for the calibration model runs are included in Appendix B.

Table 5.3: Model Calibration

Monitor No.	Measured Noise Level (dBA L_{eq})	Modeled Noise Level (dBA L_{eq})	K-Factor (dBA)
M-1	67.8	66.4	1.4
M-2	57.9	58.7	-0.8
M-3	48.2	44.0	4.2
M-4	66.2	66.0	0.2
M-5	62.6	65.0	-2.4
M-6	48.8	50.4	-1.6
M-7	59.6	58.0	1.6
M-8	63.1	64.9	-1.8

Source: LSA Associates, Inc. (December 2011).
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

As shown in Table 5.3, monitoring location M-3 has a K-factor greater than 3 dBA. Based on the TeNS in Section N-5460, K-factors between 3 and 4 can be calibrated unless the validity of the noise measurement conducted is in serious doubt. Also, differences of 5 dBA or greater should be approached with caution by retaking measurements and looking for obvious causes for the difference such as meteorology, pavement conditions, obstructions, reflections, etc. Monitoring location M-3 was rechecked, and the noise level measurements and field surveys of existing features and the TNM 2.5 modeled input data were also reexamined and it was determined that there was contamination in the noise measurement, and was therefore disregarded. Therefore, as all other predicted sound levels were found to be within 3 dBA of the measured sound levels, the model results were considered to be in reasonable agreement with the measured sound levels. Therefore, no calibration of the model was made.

5.2.3 Long-Term Monitoring

Long-term traffic noise level measurement was conducted to document the peak traffic noise hour. Long-term ambient noise monitoring was conducted using a Larson Davis Model 720 Type 2 sound level meter (Serial Number 0519) at one location. The long-term noise level measurement was performed along the east side of Lake Parkway, at the edge of the right-of-way on Wednesday, August 24, 2011, from 7:00 p.m. to 7:00 p.m. on Thursday, August 25, 2011. The long-term noise monitoring location is shown on Figure 4-2. Table 5.4 shows that traffic noise peaks during the 4:00 p.m. to 5:00 p.m. hours.

5.3 EXISTING NOISE LEVELS

Existing p.m. peak traffic volumes obtained from the traffic study prepared by Wood Rogers, Inc. were coded into TNM 2.5 with existing roadway conditions. The model input and output data for the existing conditions is included in Appendix C. The results of the existing traffic noise modeling are shown in Table 5.5. Currently, of the 124 modeled receptor locations, none of the receptors approach or exceed the 67 dBA equivalent continuous sound level (L_{eq}) NAC. Figures 4-1 through 4-3 show the locations of the modeled receptors.

Table 5.4: Long-Term 24-hour Traffic Noise Level Measurement Results

Hour	Start Time	Date	Noise Level (dBA L_{eq})
1	7:00 PM	8/24/11	66
2	8:00 PM	8/24/11	64
3	9:00 PM	8/24/11	65
4	10:00 PM	8/24/11	61
5	11:00 PM	8/24/11	59
6	12:00 AM	8/25/11	61
7	1:00 AM	8/25/11	56
8	2:00 AM	8/25/11	57
9	3:00 AM	8/25/11	53
10	4:00 AM	8/25/11	54
11	5:00 AM	8/25/11	57
12	6:00 AM	8/25/11	59
13	7:00 AM	8/25/11	64
14	8:00 AM	8/25/11	65
15	9:00 AM	8/25/11	66
16	10:00 AM	8/25/11	64
17	11:00 AM	8/25/11	65
18	12:00 PM	8/25/11	67
19	1:00 PM	8/25/11	65
20	2:00 PM	8/25/11	66
21	3:00 PM	8/25/11	66
22	4:00 PM	8/25/11	**68**[1]
23	5:00 PM	8/25/11	66
24	6:00 PM	8/25/11	81[2]

Source: LSA Associates, Inc. (December 2011).
[1] Bold numbers represent peak traffic noise hour.
[2] The 24th hour was omitted from the long-term noise level measurement due to contamination.
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

Table 5.5: Existing Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Type of Land Use	Activity Category	Modeled Existing Noise Level
1	U.S. 50	Golf Course	C(67)	50.5
2	U.S. 50	Golf Course	C(67)	53.1
3	U.S. 50	Golf Course	C(67)	64.3
4	U.S. 50	Golf Course	C(67)	51.7
5	U.S. 50	Golf Course	C(67)	49.8
6	Lake Parkway	Golf Course	C(67)	51.0
7	U.S. 50	Residential	B(67)	52.5
8	Lake Parkway	Office	E(72)	52.9
9	U.S. 50	Hotel	E(72)	51.9
10	U.S. 50	Hotel	E(72)	33.8
11	U.S. 50	Hotel	E(72)	37.5
12	U.S. 50	Hotel	E(72)	41.0
13	U.S. 50	Hotel	E(72)	60.3
14	Stateline Ave.	Hotel	E(72)	52.9
15	Stateline Ave.	Hotel	E(72)	47.0
16	Lake Parkway	Picnic Area	C(67)	62.8
17	Lake Parkway	Hotel	E(72)	52.1
18	Lake Parkway	Hotel	E(72)	44.5
19	Lake Parkway	Hotel	E(72)	42.2
20	U.S. 50	Hotel	E(72)	52.1
21	U.S. 50	Hotel	E(72)	35.5
22	U.S. 50	Hotel	E(72)	41.7
23	U.S. 50	Hotel	E(72)	57.5
24	U.S. 50	Hotel	E(72)	67.6
25	Transit Way	Hotel	E(72)	44.5
26	U.S. 50	Restaurant	E(72)	70.1
27	U.S. 50	Restaurant	E(72)	65.4
28	U.S. 50	Hotel	E(72)	36.1
29	U.S. 50	Hotel	E(72)	35.8
30	U.S. 50	Hotel	E(72)	49.8
31	Lake Parkway	Hotel	E(72)	44.5
32	Lake Parkway	Hotel	E(72)	48.9
33	Lake Parkway	Hotel	E(72)	41.1
34	Lake Parkway	Hotel	E(72)	40.9
35	Lake Parkway	Office	E(72)	50.6
36	Park Avenue	Hotel	E(72)	44.5
37	U.S. 50	Hotel	E(72)	39.9
38	U.S. 50	Hotel	E(72)	39.3
39	Park Avenue	Restaurant	E(72)	63.9
40	U.S. 50	Hotel	E(72)	43.9
41	Manzanita Avenue	Hotel	E(72)	49.8
42	Manzanita Avenue	Hotel	E(72)	47.9
43	U.S. 50	Hotel	E(72)	48.8
44	U.S. 50	Hotel	E(72)	45.7
45	Manzanita Avenue	Hotel	E(72)	47.8

Table 5.5: Existing Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Type of Land Use	Activity Category	Modeled Existing Noise Level
46	U.S. 50	Hotel	E(72)	46.2
47	U.S. 50	Hotel	E(72)	62.0
48	U.S. 50	Hotel	E(72)	67.3
49	U.S. 50	Hotel	E(72)	48.5
50	U.S. 50	Hotel	E(72)	63.1
51	Park Avenue	Hotel	E(72)	65.2
52	Park Avenue	Hotel	E(72)	63.3
53	Manzanita Avenue	Hotel	E(72)	50.0
54	U.S. 50	Hotel	E(72)	65.7
55	U.S. 50	Restaurant	E(72)	71.9
56	U.S. 50	Hotel	E(72)	66.5
57	U.S. 50	Hotel	E(72)	60.7
58	U.S. 50	Hotel	E(72)	60.9
59	U.S. 50	Hotel	E(72)	49.9
60	U.S. 50	Residential	B(67)	60.9
61	U.S. 50	Residential	B(67)	56.2
62	U.S. 50	Residential	B(67)	48.8
63	U.S. 50	Residential	B(67)	49.1
64	U.S. 50	Residential	B(67)	60.5
65	U.S. 50	Residential	B(67)	60.2
66	U.S. 50	Residential	B(67)	59.7
67	U.S. 50	Residential	B(67)	60.1
68	U.S. 50	Residential	B(67)	52.6
69	U.S. 50	Residential	B(67)	54.8
70	U.S. 50	Residential	B(67)	56.8
71	U.S. 50	Residential	B(67)	59.0
72	U.S. 50	Residential	B(67)	57.9
73	U.S. 50	Residential	B(67)	61.0
74	U.S. 50	Hotel	E(72)	65.2
75	U.S. 50	Hotel	E(72)	54.1
76	U.S. 50	Hotel	E(72)	51.9
77	U.S. 50	Hotel	E(72)	46.8
78	Paradise Avenue	Residential	B(67)	42.0
79	Paradise Avenue	Residential	B(67)	43.0
80	Paradise Avenue	Residential	B(67)	44.6
81	Paradise Avenue	Residential	B(67)	42.2
82	Pioneer Trail	Residential	B(67)	43.2
83	Pentagon Road	Residential	B(67)	44.7
84	Pentagon Road	Residential	B(67)	48.7
85	Pentagon Road	Residential	B(67)	48.3
86	U.S. 50	Hotel	E(72)	61.4
87	U.S. 50	Hotel	E(72)	66.0
88	U.S. 50	Hotel	E(72)	67.2
89	U.S. 50	Hotel	E(72)	61.1
90	Pioneer Trail	Hotel	E(72)	46.6

Table 5.5: Existing Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Type of Land Use	Activity Category	Modeled Existing Noise Level
91	Pioneer Trail	Hotel	E(72)	58.9
92	Pioneer Trail	Commercial	E(72)	64.3
93	Pioneer Trail	Hotel	E(72)	61.8
94	Glen Road	Residential	B(67)	43.9
95	Glen Road	Residential	B(67)	42.1
96	Glen Road	Residential	B(67)	41.3
97	Chonokis Road	Residential	B(67)	55.6
98	Primrose Road	Residential	B(67)	55.1
99	Primrose Road	Residential	B(67)	45.8
100	Chonokis Road	Residential	B(67)	44.0
101	Chonokis Road	Residential	B(67)	42.9
102	Pioneer Trail	Hotel	E(72)	58.5
103	Moss Road	Residential	B(67)	43.8
104	Moss Road	Residential	B(67)	47.1
105	Moss Road	Residential	B(67)	46.6
106	Pioneer Trail	Hotel	E(72)	54.3
107	Echo Road	Residential	B(67)	50.7
108	Echo Road	Residential	B(67)	49.6
109	Echo Road	Residential	B(67)	48.4
110	Echo Road	Residential	B(67)	47.7
111	Echo Road	Residential	B(67)	46.4
112	Echo Road	Residential	B(67)	46.5
113	Echo Road	Residential	B(67)	52.7
114	Echo Road	Residential	B(67)	51.0
115	Echo Road	Residential	B(67)	49.7
116	Pioneer Trail	Residential	B(67)	50.5
117	Pioneer Trail	Residential	B(67)	53.3
118	Pioneer Trail	Residential	B(67)	56.2
119	U.S. 50	Restaurant	E(72)	65.1
120	U.S. 50	Restaurant	E(72)	52.5
121	U.S. 50	Restaurant	E(72)	53.9
122	U.S. 50	Commercial	E(72)	60.3
123	Park Avenue	Commercial	E(72)	48.1
124	Park Avenue	Commercial	E(72)	52.5

Source: LSA Associates Inc., December 2011.
dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

6.0 FUTURE NOISE ENVIRONMENT, IMPACTS, AND CONSIDERED ABATEMENT

6.1 FUTURE NOISE ENVIRONMENT AND IMPACTS

Potential long-term noise impacts associated with project operations are solely from traffic noise. Traffic noise was evaluated for future 2035 traffic noise impacts. The proposed project was modeled using TNM 2.5. Using coordinates obtained from topographic maps, 124 receptor locations associated with existing single-family residences, a picnic area, a golf course, hotels, motels, casinos, restaurants/bars, retail facilities, and vacant land were evaluated in the model.

The predicted 2035 noise levels at the representative receptor locations within the project area were determined using 2035 p.m. peak-hour traffic volumes (2011) as described in Section 5.2. The model input and output data for the future 2035 no build conditions are included in Appendix D. The model input and output data for Alternatives C and D are included in Appendices E and F, respectively. Table 6.1 shows the existing and future 2035 traffic noise level results. The modeled future noise levels with the project were compared to the modeled existing noise levels from TNM 2.5 to determine whether a substantial noise increase would occur. The modeled future noise levels with the project were also compared to the NAC under Activity Categories B, C, and E to determine whether a traffic noise impact would occur.

Traffic noise impacts occur when either of the following occurs: (1) if the traffic noise level at a sensitive receptor location is predicted to “approach or exceed” the NAC, or (2) if the predicted traffic noise level is 12 dBA or more over the corresponding modeled existing peak noise level at the sensitive receptor locations analyzed. When traffic noise impacts occur, noise abatement measures must be considered. Of the 124 modeled receptors, 1 receptor would approach or exceed the 67 dBA equivalent continuous sound level (L_{eq}) NAC under Alternatives C and D. In addition, of the 124 modeled receptors, 4 receptors would experience a substantial increase of 12 dBA or more over their corresponding modeled existing noise levels.

The following receptor locations would be or would continue to be exposed to noise levels that approach or exceed the NAC and/or would experience a substantial noise increase of 12 dBA or more over their modeled existing noise level under Activity Categories B and E for both Alternatives C and D.

- **Receptor 90:** This receptor location represents an outdoor frequent human use area associated with a hotel located on the west side of Pioneer Trail. Currently there are no existing walls that shield this residence. No noise barriers were modeled because the property would be completely acquired as part of Alternative C.
- **Receptors 114, 115, and 116:** These receptor locations represent existing residences located along Echo Road and Pioneer Trail. Currently there are no existing walls that shield these residences. No noise barriers were modeled because the properties would be completely acquired as part of Alternatives C and D.

Table 6.1: Predicted Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Existing Modeled Noise Level	Future No Build (2035) Noise Level	Alternative C (2035) Noise Level	Change from Existing Noise Level	Alternative D (2035) Noise Level	Change from Existing Noise Level
1	U.S. 50	50.5	49.5	52.1	1.6	53.7	3.2
2	U.S. 50	53.1	52.5	54.7	1.6	53.2	0.1
3	U.S. 50	64.3	63.5	65.3	1.0	64.4	0.1
4	U.S. 50	51.7	51.9	53.7	2.0	58.4	6.7
5	U.S. 50	49.8	49.9	51.8	2.0	54.9	5.1
6	Lake Parkway	51.0	52.6	53.7	2.7	53.8	2.8
7	U.S. 50	52.5	52.0	54.2	1.7	55.7	3.2
8	Lake Parkway	52.9	54.9	57.0	4.1	54.7	1.8
9	U.S. 50	51.9	52.6	49.1	-2.8	54.0	2.1
10	U.S. 50	33.8	34.5	36.0	2.2	35.3	1.5
11	U.S. 50	37.5	38.0	38.6	1.1	37.7	0.2
12	U.S. 50	41.0	42.8	43.8	2.8	43.1	2.1
13	U.S. 50	60.3	60.7	56.6	-3.7	57.8	-2.5
14	Stateline Avenue	52.9	53.4	51.7	-1.2	52.5	-0.4
15	Stateline Avenue	47.0	47.5	46.1	-0.9	47.3	0.3
16	Lake Parkway	62.8	64.6	64.8	2.0	64.9	2.1
17	Lake Parkway	52.1	53.6	55.7	3.6	54.7	2.6
18	Lake Parkway	44.5	46.3	48.7	4.2	48.3	3.8
19	Lake Parkway	42.2	43.6	47.2	5.0	47.2	5.0
20	U.S. 50	52.1	52.5	51.1	-1.0	53.2	1.1
21	U.S. 50	35.5	36.4	36.9	1.4	36.8	1.3
22	U.S. 50	41.7	43.1	47.7	6.0	47.3	5.6
23	U.S. 50	57.5	57.9	55.0	-2.5	55.6	-1.9
24	U.S. 50	67.6	68.1	64.2	-3.4	64.5	-3.1
25	Transit Way	44.5	45.1	44.1	-0.4	44.0	-0.5
26	U.S. 50	70.1	70.7	67.0	-3.1	67.1	-3.0
27	U.S. 50	65.4	66.0	62.8	-2.6	62.9	-2.5
28	U.S. 50	36.1	37.2	38.5	2.4	38.4	2.3
29	U.S. 50	35.8	36.6	37.3	1.5	37.2	1.4
30	U.S. 50	49.8	50.2	47.1	-2.7	47.7	-2.1
31	Lake Parkway	44.5	45.8	51.1	6.6	50.8	6.3
32	Lake Parkway	48.9	50.3	55.9	7.0	55.5	6.6
33	Lake Parkway	41.1	42.4	44.4	3.3	44.2	3.1
34	Lake Parkway	40.9	42.3	44.3	3.4	44.1	3.2

Table 6.1: Predicted Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Existing Modeled Noise Level	Future No Build (2035) Noise Level	Alternative C (2035) Noise Level	Change from Existing Noise Level	Alternative D (2035) Noise Level	Change from Existing Noise Level
35	Lake Parkway	50.6	52.0	54.0	3.4	53.7	3.1
36	Park Avenue	44.5	46.8	49.6	5.1	49.6	5.1
37	U.S. 50	39.9	41.5	42.0	2.1	42.0	2.1
38	U.S. 50	39.3	40.6	40.4	1.1	41.1	1.8
39	Park Avenue	63.9	66.3	68.5	4.6	68.5	4.6
40	U.S. 50	43.9	45.6	47.2	3.3	47.7	3.8
41	Manzanita Avenue	49.8	50.5	48.3	-1.5	54.4	4.6
42	Manzanita Avenue	47.9	48.8	46.6	-1.3	46.9	-1.0
43	U.S. 50	48.8	49.4	46.5	-2.3	52.5	3.7
44	U.S. 50	45.7	46.7	44.7	-1.0	46.3	0.6
45	Manzanita Avenue	47.8	49.3	47.9	0.1	48.0	0.2
46	U.S. 50	46.2	48.4	47.5	1.3	47.6	1.4
47	U.S. 50	62.0	62.4	59.2	-2.8	59.8	-2.2
48	U.S. 50	67.3	67.7	64.1	-3.2	64.9	-2.4
49	U.S. 50	48.5	50.2	48.0	-0.5	48.3	-0.2
50	U.S. 50	63.1	65.2	64.2	1.1	64.3	1.2
51	Park Avenue	65.2	68.8	68.8	3.6	68.8	3.6
52	Park Avenue	63.3	65.4	66.7	3.4	66.7	3.4
53	Manzanita Avenue	50.0	52.6	51.6	1.6	51.8	1.8
54	U.S. 50	65.7	67.1	62.9	-2.8	63.3	-2.4
55	U.S. 50	71.9	73.2	68.3	-3.6	68.8	-3.1
56	U.S. 50	66.5	68.0	64.8	-1.7	65.2	-1.3
57	U.S. 50	60.7	62.2	59.9	-0.8	60.5	-0.2
58	U.S. 50	60.9	62.5	60.5	-0.4	61.1	0.2
59	U.S. 50	49.9	51.6	51.1	1.2	52.1	2.2
60	U.S. 50	60.9	62.4	62.5	1.6	62.6	1.7
61	U.S. 50	56.2	57.7	58.2	2.0	58.3	2.1
62	U.S. 50	48.8	50.5	51.3	2.5	52.1	3.3
63	U.S. 50	49.1	50.7	51.8	2.7	52.5	3.4
64	U.S. 50	60.5	62.1	63.1	2.6	63.1	2.6
65	U.S. 50	60.2	61.8	63.3	3.1	63.2	3.0
66	U.S. 50	59.7	61.4	62.2	2.5	62.2	2.5
67	U.S. 50	60.1	61.7	62.6	2.5	62.6	2.5
68	U.S. 50	52.6	54.3	55.0	2.4	54.9	2.3

Table 6.1: Predicted Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Existing Modeled Noise Level	Future No Build (2035) Noise Level	Alternative C (2035) Noise Level	Change from Existing Noise Level	Alternative D (2035) Noise Level	Change from Existing Noise Level
69	U.S. 50	54.8	56.6	56.0	1.2	56.0	1.2
70	U.S. 50	56.8	58.6	57.5	0.7	57.5	0.7
71	U.S. 50	59.0	60.6	60.5	1.5	60.5	1.5
72	U.S. 50	57.9	59.6	59.0	1.1	59.0	1.1
73	U.S. 50	61.0	62.7	62.4	1.4	62.4	1.4
74	U.S. 50	65.2	67.0	67.0	1.8	67.0	1.8
75	U.S. 50	54.1	55.8	55.6	1.5	55.6	1.5
76	U.S. 50	51.9	53.5	53.3	1.4	54.4	2.5
77	U.S. 50	46.8	48.4	48.1	1.3	49.6	2.8
78	Paradise Avenue	42.0	43.6	44.4	2.4	46.8	4.8
79	Paradise Avenue	43.0	44.7	45.3	2.3	47.4	4.4
80	Paradise Avenue	44.6	46.4	46.6	2.0	49.5	4.9
81	Paradise Avenue	42.2	43.9	44.3	2.1	47.9	5.7
82	Pioneer Trail	43.2	44.8	49.2	6.0	50.5	7.3
83	Pentagon Road	44.7	46.3	47.7	3.0	48.8	4.1
84	Pentagon Road	48.7	50.3	51.8	3.1	51.8	3.1
85	Pentagon Road	48.3	49.9	51.9	3.6	52.6	4.3
86	U.S. 50	61.4	63.1	62.8	1.4	62.8	1.4
87	U.S. 50	66.0	67.6	69.2	3.2	69.0	3.0
88	U.S. 50	67.2	68.9	69.2	2.0	69.1	1.9
89	U.S. 50	61.1	62.8	63.0	1.9	63.0	1.9
90	Pioneer Trail	46.6	48.3	**60.8**[1]	14.2	**60.8**	14.2
91	Pioneer Trail	58.9	60.5	62.7	3.8	62.7	3.8
92	Pioneer Trail	64.3	65.9	66.2	1.9	66.4	2.1
93	Pioneer Trail	61.8	63.4	68.2	6.4	68.2	6.4
94	Glen Road	43.9	45.4	51.0	7.1	51.4	7.5
95	Glen Road	42.1	43.7	50.0	7.9	51.5	9.4
96	Glen Road	41.3	42.8	48.5	7.2	51.2	9.9
97	Chonokis Road	55.6	57.2	64.4	8.8	64.4	8.8
98	Primrose Road	55.1	56.7	62.3	7.2	62.3	7.2
99	Primrose Road	45.8	47.2	52.6	6.8	53.1	7.3
100	Chonokis Road	44.0	45.6	51.7	7.7	52.3	8.3
101	Chonokis Road	42.9	44.4	50.0	7.1	51.5	8.6
102	Pioneer Trail	58.5	60.1	62.9	4.4	62.9	4.4

Table 6.1: Predicted Traffic Noise Levels, dBA L_{eq}

Receptor No.	Location	Existing Modeled Noise Level	Future No Build (2035) Noise Level	Alternative C (2035) Noise Level	Change from Existing Noise Level	Alternative D (2035) Noise Level	Change from Existing Noise Level
103	Moss Road	43.8	45.2	48.3	4.5	50.5	6.7
104	Moss Road	47.1	48.5	52.0	4.9	53.1	6.0
105	Moss Road	46.6	48.1	51.8	5.2	53.3	6.7
106	Pioneer Trail	54.3	55.8	57.9	3.6	58.0	3.7
107	Echo Road	50.7	52.1	59.7	9.0	60.3	9.6
108	Echo Road	49.6	51.0	58.0	8.4	58.2	8.6
109	Echo Road	48.4	49.8	58.5	10.1	58.8	10.4
110	Echo Road	47.7	49.1	57.9	10.2	58.1	10.4
111	Echo Road	46.4	47.7	55.0	8.6	56.6	10.2
112	Echo Road	46.5	47.6	54.1	7.6	56.3	9.8
113	Echo Road	52.7	53.4	62.1	9.4	61.9	9.2
114	Echo Road	51.0	51.8	**63.7**	12.7	**63.7**	12.7
115	Echo Road	49.7	50.8	**66.8**	17.1	**67.1**	17.4
116	Pioneer Trail	50.5	51.8	**62.8**	12.3	**62.9**	12.4
117	Pioneer Trail	53.3	54.7	62.0	8.7	62.5	9.2
118	Pioneer Trail	56.2	57.6	61.7	5.5	62.3	6.1
119	U.S. 50	65.1	66.5	63.0	-2.1	63.3	-1.8
120	U.S. 50	52.5	53.9	51.5	-1.0	52.3	-0.2
121	U.S. 50	53.9	55.3	50.9	-3.0	53.0	-0.9
122	U.S. 50	60.3	61.7	57.9	-2.4	58.1	-2.2
123	Park Avenue	48.1	49.6	48.6	0.5	52.4	4.3
124	Park Avenue	52.5	54.3	53.9	1.4	54.0	1.5

Source: LSA Associates Inc. (December 2011).

[1] Numbers in **bold** represent receptor locations with noise levels that "approach or exceed" the NAC and/or would experience a substantial increase of 12 dBA or more over their corresponding existing noise level.

dBA L_{eq} = equivalent continuous sound level measured in A-weighted decibels

NAC = Noise Abatement Criteria

6.2 CONCLUSION

Based on this study, no noise abatement measures were identified because the 4 impacted receptors (Receptors 90, 114, 115, and 116) out of the 124 modeled receptors would be completely acquired by the proposed project under Alternatives C and D. As there are no noise abatement measures evaluated in this report, the preparation of a NADR is not required.

6.2.1 CEQA Noise Analysis

CEQA provides a broad basis for analyzing and abating highway traffic noise effects. CEQA requires a strict baseline versus build analysis to assess whether a proposed project will have a noise impact. If a proposed project is determined to have a significant noise impact under CEQA, then CEQA dictates that mitigation measures must be incorporated into the project unless such measures are not feasible. As the project would not result in any substantial noise level increases over their corresponding modeled existing noise levels in the project area for both Alternatives C and D, no significant noise effect would occur under CEQA. Therefore, long-term effects are considered less than significant.

6.2.2 TRPA Noise Analysis

It is TRPA's purpose to implement the Goals and Policies, Land Use Element, Noise Sub element and to attain and maintain the TRPA noise thresholds. TRPA regulates and evaluates traffic noise using the CNEL noise metric. CNEL is the time varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). TRPA's noise threshold standard for land uses within the U.S. 50 corridor is 65 dB CNEL. The TNM 2.5 model generates results in terms of the noise metric L_{eq}(h). L_{eq}(h) is the average noise level on the peak hour. The TNM 2.5 model is the required prediction model for use on Federal-aid traffic noise studies. The traffic noise model results summarized in Table 6.1, show that implementation of the proposed project would not result in a significant increase in peak hour noise levels above those that would exist without the project at any of the modeled receptor locations. In addition, none of the modeled receptors would experience noise levels in excess of 65 dBA L_{eq}(h) for any of the modeled receptor locations that will remain after implementation of the project. In noise environments where the evening and nighttime noise levels drop compared to peak noise hour levels, the hourly L_{eq}(h) measurement is always higher than the 24-hour average CNEL measurement. Therefore, since none of the modeled receptor locations would experience noise levels in excess of 65 dBA L_{eq}(h), neither would any of them experience noise levels in excess of TRPA's noise threshold standard for land uses adjacent within the U.S. 50 corridor of 65 dBA CNEL. Therefore, all project-related traffic noise impacts would be less than significant.

7.0 CONSTRUCTION NOISE

During construction of the project, noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. Two types of short-term noise impacts would occur during project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the project site and would incrementally raise noise levels on local roads leading to the site. The pieces of heavy equipment for grading and construction activities will be moved on site, will remain for the duration of each construction phase, and will not add to the daily traffic volume in the project vicinity. A high single-event noise exposure potential at a maximum level of 87 dBA maximum instantaneous noise level (L_{max}) from trucks passing at 50 feet (ft) will exist. However, the projected construction traffic will be minimal when compared to existing traffic volumes on U.S. 50 and other affected streets, and its associated long-term noise level change will not be perceptible. Therefore, short-term construction-related worker commutes and equipment transport noise impacts would be less than substantial.

The second type of short-term noise impact is related to noise generated during excavation, grading, and roadway construction. Construction is performed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated and, therefore, the noise levels along the project alignment as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table 7.1 lists typical construction equipment noise levels (L_{max}) recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receptor.

Table 7.1: Typical Construction Equipment Maximum Noise Levels, dBA L_{max}

Type of Equipment	Range of Maximum Sound Levels (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)
Pile Drivers	81 to 96	93
Rock Drills	83 to 99	96
Jackhammers	75 to 85	82
Pneumatic Tools	78 to 88	85
Pumps	74 to 84	80
Scrapers	83 to 91	87
Haul Trucks	83 to 94	88
Cranes	79 to 86	82
Portable Generators	71 to 87	80
Rollers	75 to 82	80
Dozers	77 to 90	85
Tractors	77 to 82	80

Table 7.1: Typical Construction Equipment Maximum Noise Levels, dBA L_{max}

Type of Equipment	Range of Maximum Sound Levels (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)
Front-End Loaders	77 to 90	86
Hydraulic Backhoe	81 to 90	86
Hydraulic Excavators	81 to 90	86
Graders	79 to 89	86
Air Compressors	76 to 89	86
Trucks	81 to 87	86

Source: Bolt, Beranek, and Newman (1987).
dBA L_{max} = maximum instantaneous noise level measured in A-weighted decibels

Typical noise levels at 50 ft from an active construction area range up to 90 dBA L_{max} during the noisiest construction phases. The site preparation phase, which includes grading and paving, tends to generate the highest noise levels because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backfillers, bulldozers, and front loaders. Earthmoving and compacting equipment include compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full power operation followed by 3 or 4 minutes at lower power settings.

Construction of the proposed project is expected to require the use of earthmovers, bulldozers, water trucks, and pickup trucks. Noise associated with the use of construction equipment is estimated between 79 and 89 dBA L_{max} at a distance of 50 ft from the active construction area for the grading phase. As seen in Table 8.1, the maximum noise level generated by each excavator is assumed to be approximately 86 dBA L_{max} at 50 ft from the earthmover in operation. Each bulldozer would generate approximately 85 dBA L_{max} at 50 ft. The maximum noise level generated by water trucks and pickup trucks is approximately 86 dBA L_{max} at 50 ft from these vehicles. Each doubling of the sound source with equal strength increases the noise level by 3 dBA. Each piece of construction equipment operates as an individual point source. The worst-case composite noise level at the nearest residence during this phase of construction would be 90 dBA L_{max} (at a distance of 50 ft from an active construction area).

The closest sensitive receptors that would not be acquired as part of the project are located within 50 ft of project construction areas. Therefore, these sensitive receptor locations may be subject to short-term noise reaching 90 dBA L_{max} generated by construction activities along the project alignment. Compliance with the construction hours specified by the TRPA, City of South Lake Tahoe, Douglas County, and Caltrans SSP will be required to minimize construction noise impacts on sensitive land uses adjacent to the project site. Construction noise is regulated by Caltrans Standard Specifications in Section 14-8.02, “Noise Control,” and also by SSP S5-310, “Noise Control.” Noise control shall conform to the provisions in Section 14-8.02 and SSP S5-310. The noise levels from the contractor’s operations between the hours of 9:00 p.m. and 6:00 a.m. shall not exceed 86 dBA L_{max} at a distance of 50 ft.

Temporary effects from construction are considered less than significant because construction would be conducted in accordance with Caltrans Standard Specifications Section 14-8.02, SSP S5-310, and applicable local noise standards. Construction noise would be short term, intermittent, and overshadowed by existing local traffic noise. The following measures would further minimize short-term construction-related noise impacts resulting from the proposed project:

- During all project excavation and on-site grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.
- During all project construction, the project contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.
- During all project construction, the construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site.

8.0 REFERENCES

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APPENDIX A

TRAFFIC COUNTS

Traffic Counts for Model Calibration (Short-Term Noise Level Measurements)

Monitoring Location	Traffic Counts (15 min)				Distribution				Traffic Volume (Hourly)				Vehicle Speed (mph)		
	Auto	Medium	Heavy		Auto	Medium	Heavy		Auto	Medium	Heavy		Auto	Medium	Heavy
ST-1															
U.S. 50 NB	184	7	2		0.95	0.04	0.01		736	28	8		35	35	35
U.S. 50 SB	165	12	2		0.92	0.07	0.01		660	48	8		35/40	35/40	35/40
ST-2															
U.S. 50 NB	164	6	8		0.92	0.03	0.04		656	24	32		35	35	35
U.S. 50 SB	107	6	6		0.90	0.05	0.05		428	24	24		35	35	35
Lake Parkway NB	13	0	3		0.81	0.00	0.19		52	0	12		35		35
Lake Parkway SB	8	0	0		1.00	0.00	0.00		32	0	0		35		
ST-3															
Lake Parkway NB	35	0	0		1.00	0.00	0.00		140	0	0		35		
Lake Parkway SB	23	0	0		1.00	0.00	0.00		92	0	0		35		
ST-4															
U.S. 50 NB	169	10	2		0.93	0.06	0.01		676	40	8		35	35	35
U.S. 50 SB	176	11	9		0.90	0.06	0.05		704	44	36		35	35	35
ST-5															
U.S. 50 NB	193	9	5		0.93	0.04	0.02		772	36	20		25/30	25/30	25/30
U.S. 50 SB	154	9	0		0.94	0.06	0.00		616	36	0		25/30	25/30	
ST-6															
Pioneer Trail	69	2	3		0.93	0.03	0.04		276	8	12		35	35	35
Primrose Road	15	0	0		1.00	0.00	0.00		60	0	0		20		
ST-7															
U.S. 50 NB	250	10	2		0.95	0.04	0.01		1000	40	8		35	35	35
Pioneer Trail	71	5	0		0.93	0.07	0.00		284	20	0		35	35	
Primrose Road	15	0	0		1.00	0.00	0.00		60	0	0		20		
ST-8															
U.S. 50 NB	250	10	2		0.95	0.04	0.01		1000	40	8		30	30	30
U.S. 50 SB	249	6	6		0.95	0.02	0.02		996	24	24		30	30	30

APPENDIX B

TRAFFIC NOISE MODEL (TNM) 2.5 PRINTOUTS FOR CALIBRATION RUNS

REFER TO CD-ROM

APPENDIX C

TRAFFIC NOISE MODEL (TNM) 2.5 PRINTOUTS FOR EXISTING CONDITIONS

REFER TO CD-ROM

APPENDIX D

TRAFFIC NOISE MODEL (TNM) 2.5 PRINTOUTS FOR FUTURE (2035) NO BUILD CONDITIONS

REFER TO CD-ROM

APPENDIX E

TRAFFIC NOISE MODEL (TNM) 2.5 PRINTOUTS FOR ALTERNATIVE C CONDITIONS

REFER TO CD-ROM

APPENDIX F

TRAFFIC NOISE MODEL (TNM) 2.5 PRINTOUTS FOR ALTERNATIVE D CONDITIONS

REFER TO CD-ROM

APPENDIX G

CALIBRATION CERTIFICATES

Certificate of Calibration

9201 Irvine Blvd., Irvine, CA 92618
Phone: 949-454-6603 Fax: 949-454-6642

Customer:

Lsa Associates
20 Executive Park, Suite 200
IRVINE, CA 92614
Contact: Jason Lui
Phone#: 949-553-0666

Certificate Number :	22803-1
Technician:	Dave Carpenter
Item Number:	1
Customer PO#:	AAA600
Calibration Date:	10/20/2010
Cycle:	12
Next Cal Due:	10/20/2011

Unit Under Test	**Manufacturer:** LARSON DAVIS	**Model:** 720	**Serial#:** 0519
	Description: SOUND LEVEL METER		**Asset#:** NAN
Device Conditions	**As Received:** In Tolerance		**As Returned:** In Tolerance
Environmental Conditions	**Field Calibration:** NO	**Temperature:** 23 °C	**Relative Humidity:** 50 %
Comments:	Received: Unit meets ANSI type 1 spcifications under laboratory conditions Returned:		
Accuracy:	ANSI TYPE 1	**Procedure:** 4226	

Standards Used

ID	Manufacturer	Model	Description	Next Cal Due	Traceability
EXC-878	BRUEL & KJAER	4226	SLM CALIBRATOR	02/02/2011	PHYS: ACOUSTICS82:

Excalibur Engineering is not liable for any damage, consequences, suitability of use or any legal remedy regarding this certification with the exception of the calibration within 30 days. Excalibur Engineering warrants only that the instrument meets the specifications above at time of test. Standards used, as noted above, are current and traceable to the National Institute of Standards and Technology (NIST) where possible. The quality management system and records of Excalibur Engineering are in compliance with ISO 17025:2005, ISO 10012 and ANSI Z540-3 where applicable. This certificate/report shall not be reproduced in any form without written approval of Excalibur Engineering, Inc.

10/20/2010

Authorizing Signature Date

Certificate of Calibration

9201 Irvine Blvd., Irvine, CA 92618
Phone: 949-454-6603 Fax: 949-454-6642

Customer:

Lsa Associates
20 Executive Park, Suite 200
IRVINE, CA 92614
Contact: Jason Lui
Phone#: 949-553-0666

Certificate Number :	22803-2
Technician:	7
Item Number:	2
Customer PO#:	AAA600
Calibration Date:	10/20/2010
Cycle:	12
Next Cal Due:	10/20/2011

Unit Under Test	**Manufacturer:** LARSON DAVIS	**Model:** CA150		**Serial#:** 3420	
	Description: SOUND LEVEL CALIBRATOR			**Asset#:** NAN	
Device Conditions	**As Received:**	Out of Tolerance		**As Returned:**	In Tolerance
Environmental Conditions	**Field Calibration:**	NO	**Temperature:** 23 ° C	**Relative Humidity:**	50 %
Comments:	Received:	SPL out of tolerance. See data report			
	Returned:	Adjusted SPL to within 0.1dB of nominal			
Accuracy:	±0.5DB		**Procedure:**	1211	

Data Points

Data that is Out of Tolerance is indicated by a "*" next to it.

Range/Function	Applied	AsFound	AsLeft	Tolerance
S.P.L	114dB	114.82dB*	114.02dB	±0.5dB
	94dB	94.69dB*	94.08dB	±0.5dB
FREQUENCY	1000Hz	1000Hz	1000Hz	±1%IV
DISTORTION	---	0.49	0.49	<3%

Standards Used

ID	Manufacturer	Model	Description	Next Cal Due	Traceability
EXC-089	BRUEL & KJAER	4228	PISTONPHONE	08/02/2012	PHYS: ACOUSTICS82
EXC-043	BRUEL & KJAER	4190	FREE-FIELD 1/2" CONDENSER MICROPH	07/01/2011	1-7138
EXC-051	BRUEL & KJAER	2639	MICROPHONE PREAMPLIFIER	02/03/2011	AC: 1-6450
EXC-949	BRUEL & KJAER	2636	MEASURING AMPLIFIER	02/03/2011	AC: 1-6432
EXC-938	AGILENT	8903B	20HZ100KHZ AUDIO ANALYZER	06/14/2011	AC: 2453A372801
EXC-713	FLUKE	8920A	20 MHZ TRUE RMS VOLTMETER	06/17/2011	

Excalibur Engineering is not liable for any damage, consequences, suitability of use or any legal remedy regarding this certification with the exception of the calibration within 30 days. Excalibur Engineering warrants only that the instrument meets the specifications above at time of test. Standards used, as noted above, are current and traceable to the National Institute of Standards and Technology (NIST) where possible. The quality management system and records of Excalibur Engineering are in compliance with ISO 17025:2005, ISO 10012 and ANSI Z540-3 where applicable. This certificate/report shall not be reproduced in any form without written approval of Excalibur Engineering, Inc.

10/21/2010

Authorizing Signature Date

"ON TIME, YOUR WAY"

Customer Service Survey

Model Number and Asset Number:
22803-1,2

Dear Customer:
We would like to take this opportunity to thank you for choosing us as your calibration services provider. Please help us by taking a few minutes to tell us about the service that you have received so far. We appreciate your business and want to make sure we exceed your expectations.

1- Accuracy: Were you provided with complete and accurate information and/or resources as you requested?
- a- Complete and accurate
- b- Complete and accurate but not clear
- c- Some minor inaccuracies, resolved over the phone
- d- Completely inaccurate, unusable as presented

2- Timeliness: Did Excalibur Engineering complete services in the time promised?
- a- Yes
- b- No

If you answered No to question 2, please explain

3- Were the prices quoted competitive within the industry?
- a- Yes
- b- No

4- Professionalism/Communication: When communicating with Excalibur Engineering, were you treated with courtesy and professionalism?
- a- Very Satisfied
- b- Satisfied
- c- Unsatisfied
- d- Very Unsatisfied

5- Overall Satisfaction: Overall, how would you rate your interactions with the Excalibur Engineering staff?
- a- Very Satisfied
- b- Satisfied
- c- Unsatisfied
- d- Very Unsatisfied

6- Expectations: Did our knowledge and performance meet or exceed your expectations?
- a- Very Satisfied
- b- Satisfied
- c- Unsatisfied
- d- Very Unsatisfied

If you answered No to question 5, please explain.

7- Cleanliness: Were you satisfied with the cleanliness of your equipment upon return to your facility?
- a- Very Satisfied
- b- Satisfied
- c- Unsatisfied
- d- Very Unsatisfied

8- Main Office: Were your needs and concerns met to your complete satisfaction when contacting the main office?
- a- Yes
- b- No

9- Are you aware that Excalibur Engineering sells and rents Test equipment?
- a- Yes
- b- No

10- Are you aware that Excalibur Engineering is a distributor for Fluke and a rental partner for Tektronix?
- a- Yes, I am aware that Excalibur Engineering is a distributor for Fluke and a rental partner for Tektronix.
- b- Yes, I am aware that Excalibur Engineering is a distributor for Fluke but not a rental partner for Tektronix
- c- Yes, I am aware that Excalibur Engineering is a rental partner for Tektronix but not a distributor for Fluke
- d- No, I am not aware that Excalibur Engineering is a distributor for Fluke and a rental partner for Tektronix

11- Would you recommend Excalibur Engineering's services to colleagues or contacts within your industry?
- a- Yes
- b- No

12- Comments: Your comments are important; they can tell us specifically what you like about our services, and how we can improve our services to better serve you.

Name (Optional): Company Name (Optional):

Thank you for your feedback. We value you as a customer and will take your input into consideration while providing products and services in the future. Your input will be held in strict confidence should you advise.

If you have any comments or concerns about this survey please contact:
Excalibur Engineering Customer Care
9201 Irvine Blvd. Irvine, CA 92618 or lwinn@excaliburengineering.com