3.6 NOISE

3.6.1 INTRODUCTION

This section includes a description of applicable noise regulations, acoustic fundamentals, existing ambient noise conditions, and an analysis of potential short- and long-term noise impacts associated with implementation of the Regional Plan Update alternatives.

ACOUSTIC FUNDAMENTALS

Acoustics is the scientific study that evaluates perception and properties of sound waves. Sound that is loud, disagreeable, unexpected, or unwanted is generally defined as noise. Common sources of environmental noise and noise levels are presented in Table 3.6-1.

Table 3.6-1. Typical Noise Levels

Common Outdoor Activities	Noise Level (dB)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet	100	
Gas lawnmower at 3 feet	90	
Diesel truck moving at 50 mph at 50 feet	80	Food blender at 3 feet, garbage disposal at 3 feet
Noisy urban area, gas lawnmower at 100 feet	70	Vacuum cleaner at 10 feet, normal speech at 3 feet
Commercial area, heavy traffic at 300 feet	60	
Quiet urban daytime	50	Large business office, dishwasher in next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime	30	Library, bedroom at night, concert hall (background)
Quiet rural nighttime	20	Broadcast/recording studio
	10	
Threshold of human hearing	0	Threshold of human hearing

Notes: dB=A-weighted decibels; mph=miles per hour
Source: Caltrans 2009:p. 2-21

Sound levels are measured using the decibel (dB) scale, developed to relate to the range of human hearing. The dB scale is logarithmic; it does not follow normal algebraic methods and cannot be directly summed. For example, a 65-dB source of sound, such as a truck, joined by another 65-dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). A sound-level increase of 10 dB corresponds to a 10-fold increase in acoustical energy, and an increase of 20 dB equates to a 100-fold increase in acoustical energy.

The human ear is not equally sensitive to loudness at all frequencies in the audible spectrum. To better relate overall sound levels and loudness to human perception, frequency-dependent weighting networks were developed, identified as A through E. There is a strong correlation between the way humans perceive sound and A-weighted sound levels. For this reason, the A-weighted sound levels are used to predict community response to noise from the environment, including noise from transportation and stationary sources; these are expressed

as A-weighted decibels (dBA). All sound levels discussed in this section are A-weighted decibels unless otherwise noted.

Noise can be generated by a number of sources, including mobile sources such as automobiles, trucks, and airplanes and stationary sources such as activity at construction sites, machinery, and commercial and industrial operations. As sound travels from the source to the receiver, noise levels attenuate (i.e., decrease) depending on ground absorption characteristics, atmospheric conditions, and the presence of physical barriers. Noise generated from mobile sources generally attenuates at a rate of 4.5 dB per doubling of distance from the source. Noise from stationary sources spreads with a more spherical dispersion pattern that attenuates at a rate of 6–7.5 dB per doubling of distance from the source.

Atmospheric conditions such as wind speed, wind direction, turbulence, temperature gradients, and humidity also alter the propagation of noise and affect levels at a receiver. Furthermore, the presence of a barrier (e.g., topographic feature, intervening building, or dense vegetation) between the source and the receptor can provide substantial attenuation of noise levels at the receiver. Both natural (e.g., berms, hills, and dense vegetation) and built features (e.g., buildings and walls) may function as noise barriers.

All buildings provide some exterior-to-interior noise reduction. A building constructed with a wood frame and a stucco or wood sheathing exterior typically provides a minimum exterior-to-interior noise reduction of 25 dB with its windows closed, whereas a building constructed of a steel or concrete frame, a curtain wall or masonry exterior wall, and fixed plate glass windows of one-quarter-inch thickness typically provides an exterior-to-interior noise reduction of 30–40 dB with its windows closed (California Department of Transportation [Caltrans] 2002: p. 7-37).

With respect to how humans perceive and react to changes in noise levels, a 1-dB increase is imperceptible, a 3-dB increase is barely perceptible, a 6-dB increase is clearly noticeable, and a 10-dB increase is subjectively perceived as approximately twice as loud (Egan 2007: p.21).

COMMON NOISE DESCRIPTORS

The intensity of environmental noise fluctuates over time, and several different descriptors of time-averaged noise levels are used. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of both the noise source and the environment. The noise descriptors most often used to characterize environmental noise are defined below (Caltrans 2009: p.2-52).

- **Equivalent Noise Level (L_{eq})**: The average noise level during a specified time period; that is, the equivalent steady-state noise level in a stated period of time that would contain the same acoustic energy as the time-varying noise level during the same period.
- **Maximum Noise Level (L_{max})**: The highest instantaneous noise level during a specified time period.
- **Minimum Noise Level (L_{min})**: The lowest instantaneous noise level during a specified time period.
- **Day-Night Noise Level (L_{dn})**: The 24-hour L_{eq} with a 10-dB penalty applied during the noise-sensitive hours from 10 p.m. to 7 a.m., which are typically reserved for sleeping.
- **Community Noise Equivalent Level (CNEL)**: Similar to the L_{dn} described above with an additional 5-dB penalty applied during the noise-sensitive hours from 7 p.m. to 10 p.m., which are typically reserved for relaxation, conversation, reading, and watching television.
- **Single Event Noise Levels (SEL)**: Sounds that occur in an irregular or non-repetitive manner, which makes them difficult to anticipate; these are usually measured by L_{max} noise levels.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. The L_{eq} can be thought of as the average

noise level over a period of time. The L_{eq} is the foundation of composite noise descriptors such as L_{dn} and CNEL, as defined above, which effectively indicate community response to ambient noise levels.

EFFECT OF NOISE ON HUMANS

Excessive and chronic (long-term) exposure to elevated noise levels can result in auditory and non-auditory effects on humans. Auditory effects of noise on people are those related to temporary or permanent hearing loss caused by loud noises. Non-auditory effects of exposure to elevated noise levels are those related to behavior and physiology. The non-auditory behavioral effects of noise on humans are primarily subjective effects such as annoyance, nuisance, and dissatisfaction, which lead to interference with activities such as communications, sleep, and learning. The non-auditory physiological health effects of noise on humans have been the subject of considerable research into possible correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research implies that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induced response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

Negative effects of noise exposure include physical damage to the human auditory system, interference with daily activities, sleep disturbance, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. Gradual and traumatic hearing loss both may be permanent. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal (for example) may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise and the exposure time (Caltrans 2009:p. 2-65, 2-66).

GROUND VIBRATION

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of ground vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, and landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, and construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions). Vibration levels can be depicted in terms of amplitude and frequency, relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root mean square (RMS) vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well with the stresses experienced by buildings (FTA 2006:p.7-3, Caltrans 2004:p.5). PPV and RMS vibration velocity are normally described in inches per second (in/sec).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2006:p.7-3). This is based on a reference value of 1 micro (μ) in/sec.

The typical background vibration-velocity level in residential areas is approximately 50 VdB. Ground vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2006).

Table 3.6-2 describes the general human response to different levels of ground vibration-velocity levels.

Table 3.6-2. Human Response to Different Levels of Ground Noise and Vibration

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Notes: VdB = vibration decibels referenced to 1 µ inch/second and based on the root mean square (RMS) velocity amplitude.
Source: FTA 2006: p.7-8

3.6.2 REGULATORY BACKGROUND

TAHOE REGIONAL PLANNING AGENCY

ENVIRONMENTAL THRESHOLD CARRYING CAPACITIES

In August 1982, TRPA adopted Resolution No. 82-11, which included threshold standards related to noise, and other resource topics, for the Lake Tahoe Region. TRPA conducts a comprehensive evaluation of threshold status every 5 years. The most recent evaluation was completed in 2011 and is scheduled for approval in April 2012 (TRPA 2012a).

Table 3.6-3 summarizes the numerical Single-Event Noise Threshold Standards for aircraft and other vehicle types, and Table 3.6-4 summarizes the CNEL Threshold Standards for land use categories.

Table 3.6-3. TRPA Environmental Threshold Carrying Capacity Noise Standards for Single Events (L_{max})

Single Event	Threshold
Aircraft	Departures (all aircraft): 80 dB at 6,500 m from start to take off roll. 77.1 dB at 6,500 m from start to take off roll between 8 p.m. and 8 a.m. Arrivals: 80 dB at 2,000 m from the runway threshold approach (general aviation commuter aircraft). 86 dB at 2,000 m from the runway threshold approach (transport category aircraft) 77.1 dB (all aircraft) 2,000 m from runway threshold approach between 8 p.m. and 8 a.m.
Motorized Watercraft[1]	Pass-By Test: 82.0 dB at 50 feet with the engine operating at 3,000 rotations per minute; Shoreline Test: 75.0 dB, microphone 5 ft. above water, 2 ft. above curve of shore, dock or platform (watercraft in lake, no minimum distance); Stationary Test: Microphone 3.3 ft. from exhaust outlet, 5 ft. above water. 88 dB for motorized watercraft manufactured before January 1, 1993. 90 dB for motorized watercraft manufactured after January 1, 1993.
Motor Vehicles	< 6,000 lb GVW: 76.0 dB at 50 feet (< 35 mph), 82.0 dB at 50 feet (> 35 mph). > 6,000 lb GVW: 82.0 dB at 50 feet (< 35 mph), 86.0 dB at 50 feet (> 35 mph).

Table 3.6-3. TRPA Environmental Threshold Carrying Capacity Noise Standards for Single Events (L_{max})	
Single Event	**Threshold**
Motorcycles	77.0 dB at 50 feet (< 35 mph). 86.0 dB at 50 feet (> 35 mph).
Off-Road Vehicles	72.0 dB at 50 feet (< 35 mph). 86.0 dB at 50 feet (> 35 mph).
Over-Snow Vehicles (snowmobiles)	82.0 dB at 50 feet.

Notes: dB = A-weighted decibels; GVW = gross vehicle weight; lb = pounds; L_{max} = maximum noise level; m = meters; mph = miles per hour.
[1] There is a recommendation in the 2011 Threshold Evaluation to reassess the current Single Event Threshold Standards for motorized watercraft due to are safety and feasibility concerns regarding the Pass-By and Stationary Tests (TRPA 2012a). This may potentially result in the removal of or re-delegation of enforcement of threshold standards.
Source: TRPA 2007: pp. 9-3, 9-4

Table 3.6-4. TRPA Environmental Threshold Carrying Capacity Noise Standards	
Land Use Category	**CNEL Noise Standard**
High Density Residential	55
Low Density Residential	50
Hotel	60
Commercial	60
Industrial	65
Urban Outdoor Recreation	55
Rural Outdoor Recreation	50
Wilderness and Roadless	45
Critical Wildlife Habitat	45
Highway Corridors[1]	
US 50	65
SR 89, 207, 28, 267, and 431	55
Lake Tahoe Airport	60

Notes: CNEL = community noise equivalent level; dB = A-weighted decibels; SR = State Route; US = U.S. Highway
[1] Highway corridors expand to 300 feet from the highway curb on each side. In any instance of overlap between highway corridor noise standards and a Plan Area Statement or Community Plan noise standard, the highway corridor noise standard supersedes all others. The airport CNEL standard applies to those areas affected by the approved flight plans.
Source: TRPA 2007: pp. 9-3,4

REGIONAL PLAN

The elements of the TRPA Regional Plan related to noise include the following: Goals and Policies, Noise Sub-element; TRPA Code of Ordinances (Code), Chapter 68, Noise Limitations (TRPA 2012b); and Plan Area Statements (PASs).

Goals and Policies – Noise Subelement

The Noise Subelement of the Goals and Policies document contains applicable goals and policies, as described below. (Note: Non-substantive revisions to the Noise Subelement are proposed as part of Alternative 3. See Appendix A for those revisions.)

- **Goal 1: Single Event Noise Standards Shall Be Attained and Maintained.** In an effort to reduce impacts associated with single event noise, threshold standards were adopted in 1986 that apply to aircraft, motorized watercraft, motor vehicles, off-road vehicles, and snowmobiles.
  - **Policy 1.** An ordinance and enforcement program shall be developed to permit only aircraft that meet the Single Event Noise Threshold Standards to use the Lake Tahoe Airport.
  - **Policy 2.** Motorized watercraft will only be allowed to use Lake Tahoe if they comply with the Single-Event Threshold Standards.
  - **Policy 3.** Motor vehicles and motorcycles shall comply with the appropriate Noise Threshold Standards.
  - **Policy 4.** Off-road vehicle use is prohibited in the Lake Tahoe Region except on specified roads, trails, or designated areas where the noise impacts can be mitigated.
  - **Policy 5.** The use of snowmobiles will be restricted to designated areas where noise impacts can be mitigated.
  - **Policy 6.** The plan will permit uses only if they are consistent with the noise standards. Sound-proofing practices may be required on all structures containing uses that would otherwise adversely impact the prescribed noise levels.
- **Goal 2: Community Noise Equivalent Levels Shall Be Attained and Maintained.** CNEL Threshold Standards were adopted in 1986 to address the annoyance associated with cumulative noise events on people and wildlife. The main sources of noise in the Region are attributed to the major transportation corridors and the airport. Therefore, policies are directed toward reducing the transmission of noise from those sources. Implementation of the following policies will assist in attainment of the CNEL Threshold Standards.
  - **Policy 1.** Transmission of noise from transportation corridors shall be reduced. The noise associated with the transportation corridors can be decreased by reducing the number of trips and by installing mitigation measures. Trip reduction will be accomplished by the transit improvements identified in the Transportation Element. Ordinances will establish specific site design criteria for projects to help reduce the transmission of noise from the transportation corridors. The design criteria will also be incorporated into the water quality and transportation improvement programs. The mitigation measures may include set-backs, earth berms, and barriers.
  - **Policy 2.** Reduce noise-related impacts associated with the airport to acceptable levels.
  - **Policy 3.** TRPA will further define CNELs for wilderness and roadless areas, and for critical wildlife habitat areas. The noise sub-element also established the following CNEL values for transportation corridors:
    - U.S. Highway 50 (US 50)—65 dB
    - State Routes (SR) 89, 207, 28, 267, and 431—55 dB
    - Lake Tahoe Airport—60 dB
  - **Policy 4.** The highway CNEL standards override the land use–based CNELs and are limited to an area within 300 feet from the edge of the road. The airport CNEL standard applies to those areas affected by the approved flight plans.

Code of Ordinances

Chapter 68, Noise Limitations, of the Code establishes noise limitations for single noise events from aircraft, motorized watercraft motor vehicles, motorcycles, off-road vehicles, and over-snow vehicles (TRPA 2012b). Section 68.3 states that TRPA shall use the maximum level recorded on a noise meter, L_{max} (see "Noise Descriptors" above) for measuring single noise events. The noise levels set forth in Section 68.3 are the maximum permissible noise levels for the types of operations listed, unless specifically exempted under Section 68.9. Section 68.4 states that TRPA shall use CNELs to measure community noise levels. The PASs shall set forth CNELs that shall not be exceeded by any one activity or combination of activities. The CNELs set forth in the PASs are based on the land use classification, the presence of transportation corridors, and the applicable threshold standard. Section 68.8.1 specifies that TRPA shall not approve a project that causes a CNEL to be exceeded. The

noise limitations established in Chapter 68 of the Code, including the noise standards of individual PASs, do not apply to noise from TRPA-approved construction or maintenance projects or the demolition of structures, provided that such activities are limited to the hours between 8:00 a.m. and 6:30 p.m.

COMMUNITY PLANS

As a means for providing orderly growth and development consistent with the TRPA Regional Plan, various Community Plans have been developed for specific urbanized areas, as determined by the Goals and Policies document. Each Community Plan establishes goals, objectives, special policies, programs, and strategies for funding and implementation of the unique community area. Each Community Plan contains unique maximum CNEL noise standards for the entire Community Plan area and for any Special Areas that it may contain. Following adoption of a Community Plan, all projects within the plan area must be consistent with the Community Plan.

PLAN AREA STATEMENTS

TRPA has established 181 PASs to direct development and preserve the natural character of the land surrounding Lake Tahoe. Boundaries for each of the plan areas have been established based upon similar land uses and the unique character of each geographic area. Each PAS contains unique noise standards based on the intensity of development in the PAS and generally are consistent with the environmental threshold standards for the land uses shown in Table 3.6-4. Maximum CNEL standards range from as low as 40 dBA CNEL in PASs where residential density is low and undisturbed land is ample (i.e., Mount Rose) to 65 dBA CNEL in PASs that contain entire communities (e.g., Ponderosa Ranch). Where a highway corridor overlaps a PAS with a lower maximum CNEL standard, the highway corridor CNEL standard supersedes the PAS-established CNEL standard. Additionally, in areas where a Community Plan has been adopted, the Community Plan overrides the underlying PAS.

FEDERAL

FEDERAL NOISE CONTROL ACT OF 1972

The Federal Noise Control Act of 1972 established a requirement that all federal agencies must comply with applicable federal, state, and local noise control regulations. Federal agencies are directed to administer their programs in a manner that promotes an environment free from noise that jeopardizes public health or welfare.

LOCAL

Local jurisdictions (i.e., counties and the City of South Lake Tahoe) have established noise standards for different types of land uses as well as transportation and non-transportation noise sources, noise-level performance standards for sensitive receptors, and airport noise guidance and policies. Although the local jurisdictions have established noise-level standards, such policies are not described in detail here because, for all projects within the Lake Tahoe Region, the TRPA-adopted noise threshold standards and Code take precedence over local jurisdictions' noise ordinances.

3.6.3 AFFECTED ENVIRONMENT

SOURCES AND AMBIENT LEVELS

Noise is produced from various sources throughout the Region, but vehicle traffic on the regional roadways is generally considered the dominant noise source. During the winter months, tire chains on vehicles generate

higher noise levels than non-chain–equipped vehicles. Other noise sources include aircraft, motorized watercraft, construction vehicles and equipment, machinery associated with refuse collection and snow removal, and off-road vehicles (i.e., snowmobiles). Less pronounced noise sources in the area include those typical of urban and suburban environments, such as landscaping activities (e.g., grass cutting, leaf blowing, snow blowing), heating and air conditioning units, and conversation.

Existing traffic noise levels were modeled for major roadway segments in the Region in accordance with the Federal Highway Administration (FHWA) Traffic Noise Model (FHWA 2006) and traffic data specific to each of the Regional Plan Update alternatives (see Section 3.3, Transportation, and Appendix E). Truck usage and vehicle speeds on study area roadways were derived from the traffic analysis (Section 3.3) and, where available, data from Caltrans and Nevada Department of Transportation (NDOT) (Caltrans 2010, NDOT 2011).

Table 3.6-5 summarizes the modeled existing traffic noise levels at 100 feet from the centerline of each major roadway in the Region and identifies the distances from each roadway centerline to the 70-dB, 65-dB, 60-dB, and 55-dB CNEL/L_{dn} traffic noise contours. Existing traffic noise levels were modeled in accordance with the FHWA Traffic Noise Model (FHWA 2006). The modeled traffic noise levels provide a simple and direct mechanism for comparing alternatives. The traffic noise modeling results presented in Table 3.6-5 are based on existing (2010) average daily traffic (ADT) volumes and speeds from the traffic analysis and assume no natural or constructed shielding. As shown in Table 3.6-5, the 55-dB CNEL/L_{dn} traffic noise contours along many roadway segments in the Region extend beyond the highway corridor (defined as 300 feet from the highway edge). The extent to which existing land uses in the Region are affected by existing traffic noise depends on their proximity to the roadways and sensitivity to noise.

According to the 2011 Draft Threshold Evaluation Report (TRPA 2012a), the status of single noise events (i.e., aircraft, motorized watercraft, and other motorized vehicles) and cumulative noise events is “somewhat worse than target.”

None of the Regional Plan Update alternatives would result in changes to goals, policies, or implementation measures pertaining to single-event noise, and no features of any of the alternatives would be expected to affect the frequency or intensity of single-event noise incidents. No changes to the noise environment from aircraft activity surrounding Lake Tahoe Airport are anticipated from any of the Regional Plan Update alternatives because they would not result in increased takeoffs and landings or a change to the mix of aircraft types that use the airport. Similarly, no changes to levels of activity by motorized watercraft, motorcycles, off-road vehicles, and over-snow vehicles are anticipated under any of the Regional Plan Update alternatives because they are not expected to result in additional boating facilities, trails, or recreation areas for these types of vehicles. Furthermore, the types of motorized watercraft, motorcycles, off-road vehicles, and over-snow vehicles, as well as on-road vehicles, are not expected to change as a result of the Regional Plan Update alternatives and TRPA single event noise standards, shown in Table 3.6-3, would continue to apply to all of these noise sources. The cumulative noise level from changes in on-road motor vehicle traffic would be affected by new, trip-generating developments that would occur under each Regional Plan Update alternative and associated changes to traffic noise levels are discussed in the next section.

Table 3.6-5. Summary of Modeled Existing Traffic Noise Levels[1]							
Roadway Segment	State	County	CNEL/L_{dn}(dB) at 100 feet from Roadway Centerline	Distance (feet) from Roadway Centerline to CNEL/L_{dn}(dB)			
				70	65	60	55
US 50 mp 70.62	CA	ED	64.2	41	88	190	410
US 50 mp 71.48	CA	ED	64.2	41	89	192	413
US 50 mp 75.45	CA	ED	66.2	56	120	259	559
US 50 mp 76.41	CA	ED	66.0	54	116	250	539
US 50 mp 77.33	CA	ED	65.7	52	112	240	518
US 50 mp 80.14	CA	ED	65.2	48	104	223	481
US 50atr 0521109	NV	DO	65.4	50	107	231	497
US 50 sta 0041	NV	DO	64.5	43	93	201	432
US 50 mp 65.62 Echo Lake Road	CA	ED	61.7	28	60	130	280
US 50 atr 252125	NV	DO	66.3	57	122	262	566
SR 28 sta 0035	NV	DO	61.9	29	62	134	288
SR 28 atr 3122409	NV	WA	62.7	32	70	150	324
SR 28 mp 11.00	CA	PL	62.7	33	71	152	328
SR 28 mp 9.34	CA	ED	64.0	40	86	185	399
SR 28 mp 1.85	CA	PL	64.7	44	95	205	442
SR 89 mp 19.54	CA	ED	59.6	20	43	94	202
SR 89 mp 11.69	CA	ED	58.0	16	34	74	159
SR 89 mp 8.67	CA	ED	63.7	38	82	176	380
SR 89 mp 0.00	CA	ED	64.0	40	86	185	400
SR 89 mp 13.72	CA	PL	65.3	49	105	227	490
SR 207 ATR 0531509- sta 0024	NV	DO	63.1	35	75	161	347
SR 431 sta 770	NV	WA	61.8	28	61	132	284
SR 267 mp 6.23	CA	PL	66.2	55	119	257	554
SR 267 mp 9.28	CA	PL	64.2	28	60	129	278

Notes: CNEL = Community Noise Equivalent Level; dB = A-weighted decibels; L_{dn} = day-night average noise level; mp = mile post; sta= station; atr= automatic traffic recorder; ED= El Dorado County; WA= Washoe County; PL= Placer County; DO= Douglas County

[1] Existing traffic noise levels were modeled in accordance with the U.S. Department of Transportation Federal Highway Administration Traffic Noise Model (FHWA 2006) and are based on 2010 traffic counts.

Refer to Appendix G for detailed modeling input data and output results.

Source: Data modeled by Ascent Environmental in 2011

3.6.4 ENVIRONMENTAL CONSEQUENCES AND RECOMMENDED MITIGATION MEASURES

METHODS AND ASSUMPTIONS

The potential long-term changes in traffic noise resulting from changes in traffic volumes associated with each of the Regional Plan Update alternatives were assessed by modeling affected roadway segments. Traffic noise modeling was consistent with FHWA Traffic Noise Model (FHWA 2006) and used traffic volume data developed for the transportation analysis (Section 3.3, Transportation). The noise analysis is based on the reference noise levels for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and default ground attenuation factors. Truck usage and vehicle speeds on study area roadways were calculated based on data from Caltrans and NDOT. The effect of each Regional Plan Update alternative on traffic noise levels was analyzed by comparing the modeled traffic noise levels for each alternative, based on the appropriate Transportation Strategy Package from the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) (see Appendix C), with modeled existing traffic noise levels. Changes in traffic noise levels from existing conditions were also calculated for each Regional Plan Update alternative.

It is important to note that the noise modeling output is limited for several reasons and likely is not representative of actual noise levels under each alternative. First, the noise modeling does not account for any natural or constructed shielding (e.g., the presence of dense vegetation, berms, walls, or buildings) that may exist along modeled roadway segments. Nor does it account for changes in ground cover (e.g., grass, shrubbery, pavement) or lack thereof, which may influence the way sound is absorbed or reflected; changes in topography along modeled roadway segments; or the type of roadway surface (e.g., asphalt, concrete). The modeling also assumed that travel speeds would remain constant regardless of the volume of traffic traveling on the roadways although, typically, travel speeds decrease with increases in traffic volumes. This point is important because both travel speed and traffic volume are positively correlated with traffic noise, particularly in areas that become more urbanized and more densely developed.

In addition, the level of refinement in which the modeling was performed is considered to be approximate given that 24 roadway segments were modeled to analyze Region-wide changes in traffic noise (as shown in Exhibit 3.3-2 in Section 3.3, Transportation. However, this scale of analysis is appropriate for a policy-level review of a long-term, regional-scale plan. In other words, the modeling uses regional changes in traffic conditions to characterize regional changes in traffic noise levels rather than analyzing individual roadway segments between pairs of consecutive intersections, as would be typical for a project-level analysis. Thus, the modeled traffic noise levels are conservative and likely overestimate resultant traffic noise levels. However, the modeling accurately represents the relative *change* in traffic noise that would occur based on the projected change in traffic volumes, and is most valuable for an overall comparison of alternatives. Further, because other parameters are assumed to stay the same (e.g., travel speed), the estimated *changes in traffic noise* are considered to be conservative.

SIGNIFICANCE CRITERIA

Noise impacts would be considered significant if implementation of the Regional Plan Update would result in any of the following:

- short-term, construction-related noise levels that exceeds an Environmental Threshold Carrying Capacity noise standard established by TRPA during times of day other than the hours between 8:00 a.m. and 6:30 p.m., which are exempt from TRPA noise standards by TRPA Code Section 68.9, or that expose noise-sensitive receptors to excessive noise levels without implementing all feasible noise control measures;

- a long-term noise level that exceeds an Environmental Threshold Carrying Capacity noise standard established by TRPA for different land use categories and highway corridors (as shown in Table 3.6-3), including the CNEL standards designated for different land use types by Community Plans and Plan Area Statements;
- a long-term perceptible increase in the ambient noise level (i.e., 3-dBA CNEL or greater) in an area where the applicable TRPA Environmental Threshold Carrying Capacity noise standard is not exceeded;
- a long-term noise level increase, of any magnitude, in an area where the applicable TRPA Environmental Threshold Carrying Capacity noise standard is already exceeded;
- exposure of persons or structures to excessive groundborne vibration levels; or
- a new land use in a location where it would be incompatible with ambient noise levels.

IMPACT ANALYSIS AND MITIGATION MEASURES

Impact 3.6-1	**Long-Term Traffic Noise Levels.** Each of the Regional Plan Update alternatives would authorize different numbers of new allocations that would prescribe the levels of new development of different types that could be constructed over the planning horizon of the Regional Plan. Different policies and redevelopment incentives proposed under each of the alternatives would influence the amount and location of new development. Traffic modeling conducted for each combination of development level, distribution, and transportation improvements generated projected ADT for road segments in the Region, which were used as inputs to the traffic noise model. Long-term traffic noise levels under any of the five Regional Plan Update alternatives could exceed threshold standards established by TRPA for different land use categories and highway corridors; create a perceptible long-term increase to the ambient noise level (i.e., 3 dBA CNEL or greater) in an area where the applicable TRPA threshold standard is not exceeded; and/or result in a long-term noise level increase, of any magnitude, in an area where the applicable TRPA threshold standard is already exceeded. This would be a **significant** impact.

Implementation of the Regional Plan Update would not result in the development of new major stationary noise sources, or of any new types of noise sources to the Region. However, each Regional Plan Update alternative would result in some level of new development, both from allocations remaining from the 1987 Regional Plan (Alternative 1) and from allocations that would be authorized under each action alternative (Alternatives 2 through 5). New development would result in increases in vehicle travel and traffic volumes on roadways in the Region. As shown in Table 3.6-5 above, many areas in the Region are nonattainment with respect to their applicable CNEL standards, including the corridors for SR 28, 89, 207, 267, and 431 (TRPA 2012a). Traffic noise levels were modeled with and without implementation of each alternative and changes in traffic noise levels from existing conditions were also calculated for each alternative (Appendix G). Alternative 1 would perpetuate the existing 1987 Regional Plan land use patterns, Code, and Goals and Policies. Therefore, Alternative 1 represents future (2035), no-project conditions. Alternatives 2 through 5 represent potential future (2035) Regional conditions.

The traffic noise modeling was based on ADT volumes and their distribution over the roadway network in the Region (see Section 3.3, Transportation, for a detailed discussion of traffic volume projections). Table 3.6-6 summarizes the traffic noise modeling results, including the net difference in traffic noise levels with respect to existing (2010) conditions. As described above, the modeled noise levels presented in Table 3.6-6, including the noise levels under existing conditions, were estimated in accordance with the FHWA Traffic Noise Model (FHWA 2006). Because the primary focus of this analysis is to determine whether changes in traffic volumes and traffic patterns would result in incremental increases in traffic noise and to assess the magnitude of these increases, the resultant modeled noise levels were not adjusted using on-the-ground 24-hour roadside noise

measurements. Based on the 2011 Draft Threshold Evaluation Report, it is understood that existing noise levels in many highway corridors currently exceed the applicable CNEL standards, particularly along segments of SR 28, 89, 207, 431, and 267 (TRPA 2012a).

Table 3.6-6. Summary of Modeled Traffic Noise Level Changes

Roadway Segment	CNEL/L_{dn} (dB) at 100 feet from Roadway Centerline										
	Existing (2010) (No Project) Conditions	Existing (2010 Plus Alt. 1 (No Plan) Conditions	Net Change	Existing (2010) Plus Alt. 2 Conditions	Net Change	Existing (2010) Plus Alt. 3 Conditions	Net Change	Existing (2010) Plus Alt. 4 Conditions	Net Change	Existing (2010) Plus Alt. 5 Conditions	Net Change
US 50 mp 70.62	64.2	64.4	+0.2	64.5	+0.3	64.4	+0.2	64.7	+0.5	64.9	+0.7
US 50 mp 71.48	64.2	64.5	+0.2	64.6	+0.3	64.4	+0.2	64.8	+0.5	64.9	+0.7
US 50 mp 75.45	66.2	66.4	+0.2	66.4	+0.2	66.4	+0.2	66.5	+0.3	66.5	+0.3
US 50 mp 76.41	66.0	66.1	+0.1	66.1	+0.1	66.2	+0.2	66.3	+0.4	66.4	+0.4
US 50 mp 77.33	65.7	65.9	+0.2	65.9	+0.1	65.9	+0.2	66.1	+0.4	66.1	+0.4
US 50 mp 80.14	65.2	65.5	+0.2	65.3	+0.1	65.4	+0.2	65.5	+0.3	65.7	+0.5
US 50 atr 0521109	65.4	65.7	+0.3	65.6	+0.2	65.6	+0.2	65.8	+0.4	66.0	+0.6
US 50 sta 0041	64.5	65.0	+0.4	64.8	+0.3	64.9	+0.3	65.1	+0.6	64.5	0.0
US 50 mp 65.62	61.7	62.0	+0.3	61.9	+0.2	62.0	+0.3	62.1	+0.4	62.2	+0.5
US 50 atr 252125	66.3	66.6	+0.3	66.7	+0.4	66.3	0.0	66.9	+0.6	67.1	+0.8
SR 28 sta 0035	61.9	63.0	+1.1	63.2	+1.3	62.9	+1.0	63.7	+1.8	64.0	+2.1
SR 28 atr3122409	62.7	62.9	+0.3	62.7	0.0	62.9	+0.2	63.0	+0.4	63.4	+0.7
SR 28 mp 11.00	62.7	62.8	0.0	62.8	0.0	62.8	0.0	62.8	0.0	62.9	+0.2
SR 28 mp 9.34	64.0	64.2	+0.2	64.8	+0.1	64.2	+0.2	64.5	+0.5	64.6	+0.5
SR 28 mp 1.85	64.7	65.1	+0.4	65.1	+0.2	65.1	+0.4	65.3	+0.6	65.5	+0.8
SR 89 mp 19.54	59.6	59.6	0.0	60.6	+1.0	60.4	+0.8	60.8	+1.2	60.9	+1.3
SR 89 mp 11.69	58.0	59.0	+1.0	58.9	+0.9	58.9	+0.9	59.1	+1.1	59.2	+1.2
SR 89 mp 8.67	63.7	63.9	+0.2	64.0	+0.3	64.0	+0.3	64.1	+0.4	64.1	+0.4
SR 89 mp 0.00	64.0	64.0	0.0	64.5	+0.5	64.4	+0.4	64.7	+0.7	64.8	+0.8
SR 89 mp 13.72	65.3	65.9	+0.5	65.6	+0.3	65.8	+0.4	66.0	+0.7	66.1	+0.8
SR 207 atr 0531509- sta 0024	63.1	63.2	+0.1	63.1	0.0	63.1	0.0	63.3	+0.2	63.5	+0.4
SR 431 sta 770	61.8	62.0	+0.3	61.9	+0.1	62.0	+0.2	62.3	+0.5	62.5	+0.7
SR 267 mp 6.23	66.2	66.5	+0.4	66.3	+0.1	66.5	+0.4	66.7	+0.5	66.8	+0.6
SR 267 mp 9.28	61.7	61.9	+0.3	62.9	+0.2	62.0	+0.3	62.1	+0.5	62.3	+0.6

Notes: CNEL = Community Noise Equivalent Level; dB = A-weighted decibels; L_{dn} = day-night average noise level; mp = mile post; sta= station; atr= automatic traffic recorder; ED= El Dorado County; WA= Washoe County; PL= Placer County; DO= Douglas County
All traffic noise modeling was performed to conservatively estimate the maximum change in roadside noise levels due to changes in traffic volumes in accordance with the FHWA Traffic Noise Model (FHWA 2006). The absolute noise levels produced by the modeling are not intended to be representative of actual projected noise levels. The net change in traffic noise levels may not add exactly due to rounding because noise levels are presented only to the tenths place. Refer to Appendix G for detailed modeling input data and output results.
Under Alternatives 2, 3, and 4 the segment of US 50 between its intersection with Pioneer Trail in South Lake Tahoe and its intersection with Lake Parkway in Douglass County would undergo realignment; resultant changes in ambient noise levels are analyzed under Impact 3.6-5.
Source: Data modeled by Ascent Environmental in 2012

ALTERNATIVE 1: NO PROJECT

Land uses and development densities under Alternative 1 would continue to be implemented in the manner prescribed by the 1987 Regional Plan. Alternative 1 would include implementation of Transportation Strategy Package A (fewer improvements than other packages) (described in Appendix C), which includes roadway improvements, community revitalization projects, construction of bicycle and pedestrian trails, and the Lake Tahoe Waterborne Transit project. As shown in Table 3.3-14 of Section 3.3, Transportation, the total vehicle miles traveled (VMT) from trips that originate and/or terminate in the Region would increase from existing conditions by approximately 7.6 percent to 1,570,454 VMT/day in 2035. Increased vehicle trips on highways in the Region would result in nominal increases in traffic noise levels (i.e., less than 3 dB), as shown in Table 3.6-6. However, increases in traffic noise levels would occur in highway corridors (i.e., within 300 feet of the highway edge) that are currently not in attainment with respect to the CNEL standards established by TRPA for highway corridors. In addition, traffic noise levels beyond the highway corridor (i.e., at distances greater than 300 feet from the highway edge) may also exceed CNEL standards established by TRPA for particular land use types, including the 55 dBA CNEL standard for high-density residential land uses, the 50 dBA CNEL standard for low-density residential land uses, the 55 dBA CNEL standard for urban outdoor recreation uses, and the 50 dBA CNEL standard for rural outdoor recreation areas. This would be a **significant** impact.

ALTERNATIVE 2: LOW DEVELOPMENT, INCREASED REDEVELOPMENT

Alternative 2 would include allocations remaining from the 1987 Regional Plan and would authorize a limited number of new allocations. Alternative 2 would implement Transportation Strategy Package B (described in Appendix C), which includes similar types of projects as Transportation Strategy Package A but with a substantially greater number of bicycle and pedestrian improvements and inter-regional bus services. As shown in Table 3.3-14 of Section 3.3, Transportation, the total VMT from trips that originate and/or terminate in the Region would increase from existing conditions by approximately 8.2 percent to 1,579,027 VMT/day in 2035. Increased vehicle trips on highways in the Region would result in nominal increases in traffic noise levels (i.e., less than 3 dB), as shown in Table 3.6-6. However, increases in traffic noise levels would occur in highway corridors (i.e., within 300 feet of the highway edge) that are currently not in attainment with respect to the CNEL standards established by TRPA for highway corridors. In addition, traffic noise levels beyond the highway corridor (i.e., at distances greater than 300 feet from the highway edge) may also exceed CNEL standards established by TRPA for particular land use types, including the 55 dBA CNEL standard for high-density residential land uses, the 50 dBA CNEL standard for low-density residential land uses, the 55 dBA CNEL standard for urban outdoor recreation uses, and the 50 dBA CNEL standard for rural outdoor recreation areas. This would be a **significant** impact.

ALTERNATIVE 3: LOW DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 3 would include allocations remaining from the 1987 Regional Plan and would authorize a limited number of new allocations. Alternative 3 would implement Transportation Strategy Package C (described in Appendix C), which includes new bicycle and pedestrian facilities, capital improvement projects, transit service and capital enhancements, and waterborne transit, but not as many new pedestrian/bicycle facilities as included in Alternative 2. As shown in Table 3.3-14 of Section 3.3, Transportation, the total VMT from trips that originate and/or terminate in the Region would increase from existing conditions by approximately 4.1 percent to 1,519,650 VMT/day in 2035, which is the lowest increase in VMT among all the alternatives being considered. Increased vehicle trips on highways in the Region would result in nominal increases in traffic noise levels (i.e., less than 3 dB), as shown in Table 3.6-6. However, increases in traffic noise levels would occur in highway corridors (i.e., within 300 feet of the highway edge) that are currently not in attainment with respect to the CNEL standards established by TRPA for highway corridors. In addition, traffic noise levels beyond the highway corridor (i.e., at distances greater than 300 feet from the highway edge) may also exceed CNEL standards

established by TRPA for particular land use types, including the 55 dBA CNEL standard for high-density residential land uses, the 50 dBA CNEL standard for low-density residential land uses, the 55 dBA CNEL standard for urban outdoor recreation uses, and the 50 CNEL standard for rural outdoor recreation areas. This would be a **significant** impact.

ALTERNATIVE 4: REDUCED DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 4 would include allocations remaining from the 1987 Regional Plan and would authorize more new allocations than Alternatives 1, 2, and 3 but less than Alternative 5. Alternative 4 introduces a transect-based zoning system, that is, a model wherein a transect defines a series of districts that transition from wilderness and open space to the denser urban core. Transect districts would allow for a mix of land uses and housing types and would result in an appropriate distribution of uses across the landscape. Each transect district would include specific measures to regulate the physical form of the built environment to produce desired relationships between buildings and outdoor public areas, including streets.

Alternative 4 would implement Transportation Strategy C (described in Appendix C). Transportation improvements would include new bicycle and pedestrian facilities, roadway improvement projects, transit service and capital enhancements, and waterborne transit. As shown in Table 3.3-14 of Section 3.3, Transportation, the total VMT from trips that originate and/or terminate in the Region would increase from existing conditions by approximately 13.1 percent to 1,650,574 VMT/day in 2035. Increased vehicle trips on highways in the Region would result in nominal increases in traffic noise levels (i.e., less than 3 dB), as shown in Table 3.6-6. However, increases in traffic noise levels would occur in highway corridors (i.e., within 300 feet of the highway edge) that are currently nonattainment with respect to the CNEL standards established by TRPA for highway corridors. In addition, traffic noise levels beyond the highway corridor (i.e., at distances greater than 300 feet from the highway edge) may also exceed CNEL standards established by TRPA for particular land use types, including the 55 dBA CNEL standard for high-density residential land uses, the 50 dBA CNEL standard for low-density residential land uses, the 55 dBA CNEL standard for urban outdoor recreation uses, and the 50 dBA CNEL standard for rural outdoor recreation areas. This would be a **significant** impact.

ALTERNATIVE 5: SIMILAR RATE OF DEVELOPMENT AND REGULATORY STRUCTURE TO THE 1987 REGIONAL PLAN

Alternative 5 would include allocations remaining from the 1987 Regional Plan and would authorize the greatest number of new allocations of all the alternatives. Alternative 5 would include similar types and numbers of transportation projects as Alternative 1 because they both would implement Transportation Strategy Package A; however, Alternative 5 would result in a greater amount of new development over time because of the higher number of authorized allocations. As shown in Table 3.3-14 of Section 3.3, Transportation, the total VMT from trips that originate and/or terminate in the Region would increase from existing conditions by approximately 14.7 percent to 1,673,473 VMT/day in 2035. This is the highest increase among the five alternatives being considered.

Increased vehicle trips on highways in the Region would result in nominal increases in traffic noise levels (i.e., less than 3 dB), as shown in Table 3.6-6. However, increases in traffic noise levels would occur in highway corridors (i.e., within 300 feet of the highway edge) that are currently not in attainment with respect to the CNEL standards established by TRPA for highway corridors. In addition, traffic noise levels beyond the highway corridor (i.e., at distances greater than 300 feet from the highway edge) may also exceed CNEL standards established by TRPA for particular land use types, including the 55 dBA CNEL standard for high-density residential land uses, the 50 dBA CNEL standard for low-density residential land uses, the 55dBA CNEL standard for urban outdoor recreation uses, and the 50 dBA CNEL standard for rural outdoor recreation areas. This would be a **significant** impact.

MITIGATION MEASURES

The following mitigation is required for Alternatives 1, 2, 3, 4, and 5.

Mitigation Measure 3.6-1: Establish and Implement a Region-Wide Traffic Noise Mitigation Program.

Within 12 months of adoption of an updated Regional Plan, TRPA will coordinate implementation of a Region-wide traffic noise reduction program through TRPA-approved plans, project permitting, or projects/programs developed in coordination with local or other governments that will implement measures for reducing attaining and maintaining traffic noise levels to below applicable CNEL standards. Until that time, TRPA will continue its existing practice of requiring measures to be developed on a project-specific basis. Measures may include those required as conditions of approval for development projects and those to be implemented by TRPA to address cumulative, regional noise levels. Traffic noise mitigation measures will be implemented through local government and/or TRPA permitting activities. Such measures may include, but are not limited to, the following:

- *Construction of barriers, berms, and/or acoustical shielding—Any barriers shall blend into the overall landscape and have an aesthetically pleasing appearance that is compatible with the color and character of the general area, and not become the dominant visual element of the community. Relocation of existing vegetation and/or landscaping may also be necessary to achieve an aesthetically pleasing appearance;*

- *Replacement of driveways that provide access from highways to individual buildings with a common access way that routes ingress and egress traffic to nearby intersections in order to reduce the number of gaps in barriers and berms;*

- *Planting of dense vegetation in key locations where noise absorption is needed;*

- *Use of noise-reducing pavement, including repaving existing roadways with noise-reducing pavement —All pavement must be suitable for the climate of the Tahoe Region, snow removal needs, and particulate matter standards;*

- *Reduction of speed limits and/or implementation of traffic-calming measures that slow travel speeds, if feasible and practical;*

- *Establishment of setback requirements for new development in specific areas exposed to highway noise;*

- *Realignment of segments of the highway, if feasible, to reduce noise-sensitive areas to exposure of traffic noise from that highway segment;*

- *Acquisition of additional right-of-way adjacent to specific roadway segments to remove existing noise-sensitive receptors, including existing residences;*

- *Establishment of programs to pay for noise reduction such as low-cost loans to owners of noise-affected property or establishment of developer fees;*

- *Noise-reducing acoustical treatment of existing buildings; and*

- *Additional measures that would, based on substantial evidence, reduce the number of vehicle trips associated with project operations, such as an employee carpool or van pool program, shuttle bus service for residents or tourists, parking fees, and bicycle amenities.*

Prior to adoption of the traffic noise reduction program, TRPA will continue to evaluate individual projects at the project level and enforce CNEL standards on a project-by–project basis pursuant to the noise limitations in Chapter 68 of the Code.

For projects that do not require environmental documentation beyond a checklist, TRPA may apply general noise reduction measures in the twelve months proceeding adoption of the Region-wide traffic noise reduction plan.

Significance After Mitigation

It is unknown at this time whether all individual proposed projects would be able to incorporate design and operational measures that would prevent an increase in traffic noise levels that exceed applicable TRPA-designated CNEL standards and would not result in increased traffic noise levels in areas where TRPA-designated CNEL standards are already exceeded. However, TRPA would only approve projects that can demonstrate compliance with TRPA's threshold standards (i.e., CNEL standards). Therefore, this impact would be **less than significant** for all Regional Plan Update alternatives.

Impact 3.6-2	**Short-Term Project-Related Construction Noise Levels.** Projects proposed under the Regional Plan may include development, redevelopment, commercial and tourist uses, transit and transportation, recreation, public/quasi-public facilities, and natural resources restoration. Construction activities to implement such projects could potentially expose noise-sensitive receptors to levels that exceed TRPA threshold standards and/or expose noise-sensitive receptors to excessive noise levels. This would be a **significant** impact for all alternatives.

Implementation of any of the five Regional Plan Update alternatives would result in the construction of some new development. Alternative 1 would authorize only those allocations remaining from the 1987 Regional Plan and would result in the lowest levels of new development. Alternatives 2 through 5 would authorize progressively more new allocations. Incentives proposed under Alternative 3, and to a lesser extent Alternative 4, are intended to substantially incentivize redevelopment and concentration of uses in already developed areas of the Region. Proposed projects may include development, redevelopment, commercial and tourist uses, transit and transportation, recreation, public/quasi-public facilities, and natural resources restoration.

Construction activities associated with new development and redevelopment could include site preparation (e.g., demolition, clearing, excavation, grading), foundation work, paving, building construction, utility installation, finishing, and cleanup. These activities typically involve the use of noise-generating equipment such as cranes, excavators, dozers, graders, dump trucks, generators, backhoes, compactors, and loaders. Table3.6-7 shows the maximum noise levels generated by the types of equipment and activities that are anticipated to be used for construction activities within the Region.

Table 3.6-7. Typical Equipment Noise Levels

Type of Equipment	Noise Level (L_{max}) at 50 feet
Impact Pile Driver	101
Vibratory Pile Driver	101
Blasting	94
Crane	85
Excavator	85
Dozer	85
Grader	85

Table 3.6-7. Typical Equipment Noise Levels	
Type of Equipment	**Noise Level (L_{max}) at 50 feet**
Dump Truck	84
Generator	82
Backhoe	80
Compactor	80
Front End Loader	80
Chain Saw	84
Wood Chipper	75[1]

Notes: [1] The reference sound level for a wood chipper is based on sound levels provided in Berger, Neitzel, and Kladden 2006.
Source: All noise levels are from FHWA 2006: p.3, unless otherwise noted.

ALTERNATIVE 1: NO PROJECT

Development under Alternative 1 would be limited to the allocations remaining under the 1987 Regional Plan. The limited construction of new commercial, tourist, and residential development under Alternative 1 would likely involve noise-generating equipment (as described above).

As shown in Table 3.6-7, construction-related noise could range from 75 to 101 dB at 50 feet from a project site. Thus, nearby residences and other noise-sensitive receptors could be exposed to noise levels that exceed applicable TRPA standards outside of the exempt hours between 8:00 a.m. and 6:30 p.m. and/or expose nearby noise-sensitive receptors to excessive noise levels without implementation of all feasible noise control measures. This would be a **significant** impact.

ALTERNATIVE 2: LOW DEVELOPMENT, INCREASED REDEVELOPMENT

Alternative 2 would include allocations remaining from the 1987 Regional Plan and would authorize a limited number of new allocations. Based on the construction noise levels summarized in Table 3.6-7, nearby residences and other noise-sensitive receptors could be exposed to noise levels that exceed applicable TRPA standards outside of the exempt hours between 8:00 a.m. and 6:30 p.m. and/or expose nearby noise-sensitive receptors to excessive noise levels without implementation of all feasible noise control measures. This would be a **significant** impact.

ALTERNATIVE 3: LOW DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 3 would include allocations remaining from the 1987 Regional Plan and would authorize slightly more new allocations than Alternative 2. Based on the construction noise levels summarized in Table 3.6-7, nearby residences and other noise-sensitive receptors could be exposed to noise levels that exceed applicable TRPA standards outside of the exempt hours between 8:00 a.m. and 6:30 p.m. and/or expose nearby noise-sensitive receptors to excessive noise levels without implementation of all feasible noise control measures. This would be a **significant** impact.

ALTERNATIVE 4: REDUCED DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 4 would include allocations remaining from the 1987 Regional Plan and would authorize more new allocations than Alternatives 1, 2, and 3 but less than Alternative 5. Alternative 4 introduces a transect-based zoning system, that is, a model wherein a transect defines a series of districts that transition from wilderness and open space to the denser urban core. This means that construction of new development projects and

redevelopment projects would more likely occur in close proximity to existing noise-sensitive receptors. Based on the construction noise levels summarized in Table 3.6-7, nearby residences and other noise-sensitive receptors could be exposed to noise levels that exceed applicable TRPA standards outside of the exempt hours between 8:00 a.m. and 6:30 p.m. and/or expose nearby noise-sensitive receptors to excessive noise levels without implementation of all feasible noise control measures. This would be a **significant** impact.

ALTERNATIVE 5: SIMILAR RATE OF DEVELOPMENT AND REGULATORY STRUCTURE TO THE 1987 REGIONAL PLAN

Alternative 5 would include allocations remaining from the 1987 Regional Plan and would authorize the greatest number of new allocations. This means that more new construction would occur than other alternatives, and associated construction noise could adversely affect nearby noise-sensitive receptors. Based on the construction noise levels summarized in Table 3.6-7, nearby residences and other noise-sensitive receptors could be exposed to noise levels that exceed applicable TRPA standards outside of the exempt hours between 8:00 a.m. and 6:30 p.m. and/or expose nearby noise-sensitive receptors to excessive noise levels without implementation of all feasible noise control measures. This would be a **significant** impact.

MITIGATION MEASURES

The following mitigation is required for Alternatives 1, 2, 3, 4, and 5.

Mitigation Measure 3.6-2: Develop and Implement a Best Construction Practices Policy for the Minimization of Exposure to Construction-Generated Noise and Ground Vibration.

Within 12 months of adoption of an updated Regional Plan, TRPA will coordinate implementation of a Best Construction Practices Policy for Minimization of Construction-Generated Noise and Ground Vibration through TRPA-approved plans, project permitting, or projects/programs developed in coordination with local or other governments. Until that time, TRPA will continue the existing practice to require measures developed on a project-specific basis. The policy will require implementation of measures for the reduction of noise generated by demolition and construction activity in the Region. Where local ordinances already require Best Construction Practices for construction noise, no further action is necessary. Where local government ordinances do not adequately address Best Construction Practices, those practices will be implemented through local government and/or TRPA permitting activities. Measures for minimizing exposure to construction-generated noise may include, but are not limited to, the following:

- *All construction equipment shall be equipped with properly operating mufflers and engine shrouds, in accordance with manufacturers' specifications.*
- *Equipment engine doors shall be kept closed during equipment operation.*
- *Inactive construction equipment shall not be left idling for prolonged periods of time (i.e., more than 5 minutes).*
- *Stationary equipment (e.g., power generators) and staging areas for other equipment shall be located at the maximum distance feasible from nearby noise-sensitive receptors.*
- *Trucks hauling materials and goods to and from the construction site shall only do so during active construction periods.*
- *Temporary sound barriers shall be installed along the boundaries of the construction site or surrounding stationary sources of noise (e.g. pumps or generators) to protect nearby noise-sensitive receptors, where feasible and applicable.*

- *All construction and demolition activity using heavy-duty, off-road equipment shall be performed between 8:00 a.m. and 6:30 p.m. Construction-generated noise is exempt from TRPA noise standards during these hours by TRPA Code Section 68.9. Noise-generating construction activity may occur during other times of the day if the resultant noise levels would not exceed TRPA noise standards. TRPA will require all project applications to include a construction noise reduction plan, specific to the proposed project that fully complies with those applicable measures identified in the Region-wide Best Construction Practices Policy.*

Significance After Mitigation

Because TRPA would only approve projects with construction activity that complies with all applicable measures identified by the Best Construction Practices Policy, which may include but are not limited to the measures listed above, this impact would be **less than significant** for all Regional Plan Update Alternatives.

Impact 3.6-3	Ground Vibration. Projects proposed under the Regional Plan may include development, redevelopment, commercial and tourist uses, transit and transportation, recreation, public/quasi-public facilities, and natural resources restoration. Ground vibration generated during construction of these projects could result in damage to nearby buildings and structures and/or result in a negative human response to vibration-sensitive land uses. This would be a significant impact.

The Regional Plan Update does not contemplate any new major stationary sources of ground vibration; therefore, operation of projects that would result in ground vibration is not evaluated. New development and redevelopment are expected to result in ground vibration-generating construction activities in close proximity to existing structures and buildings.

Construction activities generate varying degrees of temporary ground vibration, depending on the specific construction equipment used and activities involved. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. Construction-related ground vibration is normally associated with impact equipment such as pile drivers, jackhammers, and the operation of some heavy-duty construction equipment, such as dozers and trucks. Blasting activities also generate high levels of ground vibration. Table 3.6-8 displays ground vibration levels for typical construction equipment. The effects of ground vibration may be imperceptible at the lowest levels, result in low rumbling sounds and detectable vibrations at moderate levels, and at high levels cause sleep disturbance or annoyance in buildings that are primarily used for daytime functions and sleeping.

Ground vibration can also potentially damage the foundations and exteriors of existing structures even if it does not result in a negative human response. Pile driving and blasting activities produce the highest levels of ground vibration, as shown in Table 3.6-8, and could result in structural damage to existing buildings. Impact pile drivers produce a high level of vibration for short periods (0.2 second) with sufficient time between impacts to allow the resonant effects on a building to decay before the next vibration event (FTA 2006: p. 12-14). Impact pile driving can produce vibration levels up to 1.518 in/sec PPV or 112 VdB at 25 feet, as shown in Table 3.6-8. Assuming normal propagation conditions, this level would propagate to below FTA's vibration standard of 0.20 in/sec PPV for structural damage at a distance of 100 feet and to levels below FTA's vibration standard of 80 VdB for human response at residential land uses at a distance of 300 feet. Ground vibration levels from sonic pile driving would propagate to below the FTA's vibration standard of 0.20 in/sec PPV for structural damage at a distance of 60 feet and to levels below FTA's vibration standard of 80 VdB for human response at residential land uses at a distance of 175 feet. Blasting is a method that might be used to remove rock outcroppings in locations of varying topography or varying soil conditions. Blasting can produce vibration levels of 1.130 in/sec PPV or 112 VdB at 25 feet, also shown in Table 3.6-8. Assuming normal propagation conditions, this level would propagate to below FTA's vibration standard of 0.20 in/sec PPV for structural damage at a distance of 85 feet and to levels below

FTA's vibration standard of 80 VdB for human response at residential land uses at a distance of 250 feet. All propagation adjustment calculations are included in Appendix G.

Table 3.6-8. Representative Ground Vibration and Noise Levels for Construction Equipment

Equipment	PPV at 25 feet (in/sec)[1]	Approximate L_v (VdB) at 25 feet[2]
Pile Driver (impact) upper range	1.518	112
Typical	0.644	104
Pile Driver (sonic) upper range	0.734	105
Typical	0.170	93
Blasting	1.13	109
Large Dozer	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Rock Breaker	0.059	83
Jackhammer	0.035	79
Small Dozer	0.003	58

PPV = peak particle velocity; L_V = the root mean square velocity expressed in vibration decibels (VdB), assuming a crest factor of 4; VdB = vibration decibels.
Source: FTA 2006:p.12-6,12-8

ALTERNATIVE 1: NO PROJECT

Alternative 1, No Project, would include allocations remaining from the 1987 Regional Plan but would not authorize any new allocations. Although levels of development and redevelopment would be low, new construction may include pile driving and blasting activities in close proximity to existing structures, including residential and tourist accommodation uses. Existing structures located within 100 feet of impact pile driving activity, within 60 feet of sonic pile driving, or within 85 feet of blasting activity, could experience structural damage. Moreover, people residing in dwellings located within 300 feet of impact pile driving, within 175 feet of sonic pile driving, or within 250 feet of blasting, could experience excessive ground vibration levels that exceed FTA's human response standards. Therefore, this would be a **significant** impact.

ALTERNATIVE 2: LOW DEVELOPMENT, INCREASED REDEVELOPMENT

Alternative 2 would include allocations remaining from the 1987 Regional Plan and would authorize a limited number of new allocations. As with Alternative 1, existing structures located within 100 feet of impact pile driving activity, within 60 feet of sonic pile driving, or within 85 feet of blasting activity, could experience structural damage. Moreover, people residing in dwellings located within 300 feet of impact pile driving, within 175 feet of sonic pile driving, or within 250 feet of blasting, could experience excessive ground vibration levels that exceed FTA's human response standards. Therefore, this would be a **significant** impact.

ALTERNATIVE 3: LOW DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Similar to Alternative 2, Alternative 3 would include allocations remaining from the 1987 Regional Plan and would authorize slightly more new allocations than Alternative 2. Existing structures located within 100 feet of impact pile driving activity, within 60 feet of sonic pile driving, or within 85 feet of blasting activity, could experience structural damage. Moreover, people residing in dwellings located within 300 feet of impact pile

driving, within 175 feet of sonic pile driving, or within 250 feet of blasting, could experience excessive ground vibration levels that exceed FTA's human response standards. Therefore, this would be a **significant** impact.

ALTERNATIVE 4: REDUCED DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 4 would include allocations remaining from the 1987 Regional Plan and would authorize more new allocations than Alternatives 1, 2, and 3 but less than Alternative 5. Alternative 4 introduces a transect-based zoning system, that is, a model wherein a transect defines a series of districts that transition from wilderness and open space to the denser urban core. Existing structures located within 100 feet of impact pile driving activity, within 60 feet of sonic pile driving, or within 85 feet of blasting activity, could experience structural damage. Moreover, people residing in dwellings located within 300 feet of impact pile driving, within 175 feet of sonic pile driving, or within 250 feet of blasting, could experience excessive ground vibration levels that exceed FTA's human response standards. Therefore, this would be a **significant** impact.

ALTERNATIVE 5: SIMILAR RATE OF DEVELOPMENT AND REGULATORY STRUCTURE TO THE 1987 REGIONAL PLAN

Alternative 5 would reauthorize allocations remaining from the 1987 Regional Plan and would authorize the greatest number of new allocations. Thus, there would likely be more instances in which existing structures located within 100 feet of impact pile driving activity, within 60 feet of sonic pile driving, or within 85 feet of blasting activity, would experience structural damage. Moreover, people residing in dwellings located within 300 feet of impact pile driving, within 175 feet of sonic pile driving, or within 250 feet of blasting, could experience excessive ground vibration levels that exceed FTA's human response standards. Therefore, this would be a **significant** impact.

MITIGATION MEASURES

The following mitigation is required for Alternatives 1, 2, 3, 4, and 5.

Mitigation Measure 3.6-3: Develop and Implement a Best Construction Practices Policy for the Minimization of Construction-Generated Noise and Ground Vibration.

The Best Construction Practices Policy for the Minimization of Construction Noise and Ground Vibration, which is required by Mitigation Measure 3.6-2, will also include measures to address vibration generated during construction and demolition activity. Measures required by the policy to reduce ground vibration may include, but are not limited to, the following:

- *Sonic pile driving shall be performed instead of impact pile driving, where feasible;*
- *To further reduce pile-driving ground vibration impacts, holes shall be predrilled to the maximum feasible depth to reduce the number of blows required to seat the pile;*
- *All construction equipment on construction sites shall be operated as far away from vibration-sensitive sites as reasonably possible;*
- *No construction or demolition activity shall be performed that would expose an existing structure to levels of ground vibration that exceeds 0.20 in/sec PPV. The vibration control program shall include minimum setback requirements for different types of ground vibration-producing activities (e.g., pile driving, blasting) for the purpose of preventing damage to nearby structures. Established setback requirements may be waived with a project-specific analysis conducted by a qualified specialist that indicates that no structural damage would occur at nearby buildings or structures.*

- *No construction or demolition activity shall be performed that would expose human activity in an existing building to levels of ground vibration that exceed FTA's 80 VdB standard. The vibration control program shall also include minimum setback requirements for different types of ground vibration-producing activities (e.g., pile driving, blasting) for the purpose of preventing negative human response. Established setback requirements may be waived with a project-specific analysis by a qualified specialist that indicates that the buildings would not be exposed to ground vibration levels in excess of 80 VdB, confirmed by monitoring.*

TRPA will only approve projects, plans, or programs that would comply with the requirements of the Best Construction Practices Policy.

Significance After Mitigation

Because TRPA would only approve projects with construction activity that would not generate ground vibration levels that would cause damage to nearby structures or negative human response, this impact would be **less than significant** for all Regional Plan Update alternatives.

Impact 3.6-4	**Land Use Compatibility.** The development of new residential and tourist accommodation uses under all five Regional Plan Update alternatives could place new, more noise-sensitive land uses in locations where ambient noise levels are incompatible. This would be a **significant** impact.

Implementation of any of the Regional Plan Update alternatives could result in the development of new residential and tourist accommodation uses in community centers where the noise environment is typically influenced by multiple noise sources, including highways and roadways; transit vehicles; delivery trucks serving commercial establishments; heating, air conditioning, and ventilation equipment on buildings; and landscape maintenance activities. All new residential units constructed in these areas would achieve an acceptable interior noise level of 45 dBA CNEL, as required by Section 1207 of the California Building Standards Code and the 2006 International Residential Code (International Code Council 2006), which is followed by Washoe, Carson City, and Douglas Counties (Washoe County 2012). However, depending on their design and location, the outdoor activity areas of new residential and tourist accommodation uses may be exposed to exterior noise levels that are incompatible with such uses.

Alternative 1: No Project

Development under Alternative 1 would include allocations remaining from the 1987 Regional Plan but would not authorize any new allocations. Although Alternative 1 would result in a very low level of new development and redevelopment relative to other alternatives, it is possible that new development could locate residential and tourist accommodation uses with outdoor activity areas that would be exposed to high exterior noise levels. This would be a **significant** impact.

Alternative 2: Low Development, Increased Redevelopment

Alternative 2 would include allocations remaining from the 1987 Regional Plan and would authorize a limited number of new allocations. Although levels of new development and redevelopment would be relatively low, and most new residential uses would be in the form of single-family units distributed throughout the Region primarily in residential areas outside of Community Plan areas, it is possible that new development could locate residential and tourist accommodation uses with outdoor activity areas that would be exposed to high exterior noise levels. This would be a **significant** impact.

ALTERNATIVE 3: LOW DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 3 would include allocations remaining from the 1987 Regional Plan, would authorize a limited number of new allocations, including additional residential bonus units. Central to Alternative 3 are incentives for redevelopment in the Town Centers, the Regional Center, and the High Density Tourist District, including incentives to transfer residential development from SEZ and other sensitive lands and from lands distant from the target areas. Therefore, Alternative 3, more than any of the other alternatives, has the potential to result in placement of residential and tourist accommodation uses with outdoor activity areas in areas that would be exposed to high exterior noise levels. This would be a **significant** impact.

ALTERNATIVE 4: REDUCED DEVELOPMENT, INCENTIVIZED REDEVELOPMENT

Alternative 4 would include allocations remaining from the 1987 Regional Plan, and would authorize new allocations, including new TAUs. Like Alternative 2, most single family residential units would continue to be distributed throughout the Region primarily in residential districts outside of Community Plan areas and Town and Neighborhood Districts. Alternative 4 also promotes mixed land uses, however, and some increase in new residential uses in PTODs would be expected due to increased height and density incentives. As such, Alternative 4 has the potential to result in new development of residential and tourist accommodation uses with outdoor activity areas that would be exposed to high exterior noise levels. This would be a **significant** impact.

ALTERNATIVE 5: SIMILAR RATE OF DEVELOPMENT AND REGULATORY STRUCTURE TO THE 1987 REGIONAL PLAN

Alternative 5 would include allocations remaining from the 1987 Regional Plan, would authorize the highest number of new allocations, including new TAUs, but would not include the incentives for development and redevelopment in the Community Plan areas. Like Alternative 2, most new residential uses would be in the form of single-family units distributed throughout the Region primarily in residential areas outside of Community Plan areas. Although not a focus of Alternative 5, new development and redevelopment could occur under existing rules that could locate residential and tourist accommodation uses with outdoor activity areas that would be exposed to high exterior noise levels. This would be a **significant** impact.

MITIGATION MEASURES

The following mitigation applies to all of the alternatives.

Mitigation Measure 3.6-4: Develop and Implement an Exterior Noise Policy for Mixed-Use Development.

Within 12 months of adoption of an updated Regional Plan, TRPA will coordinate implementation through TRPA-approved plans, project permitting, or projects/programs developed in coordination with local or other governments of an exterior noise standard, and related policies, for outdoor activity areas of mixed-use development. Until that time, TRPA will continue existing practice to require measures developed on a project-specific basis. Traffic noise mitigation measures will be implemented through local government and/or TRPA permitting activities. Development of the exterior noise standard will be based on health criteria for noise exposure and will take into account the following:

- *Pertinent guidance provided by the California Governor's Office of Research and Planning (OPR 2003: p.253-254);*
- *Noise exposure standards established by local jurisdictions in the Region, including Douglas County Code 20.690.030, the Placer County General Plan (Placer County 1994: p. 139, 141), and the El Dorado County General Plan (El Dorado County 2004: p.116-117);*

- *The health-related effects of noise exposure;*
- *Any unique characteristics of the noise environment in the Region; and*
- *Proximity and access to quiet outdoor areas from community centers in the Region (e.g., undeveloped areas, areas zoned by TRPA for urban outdoor recreation, rural outdoor recreation, or wilderness and roadless).*

TRPA will not approve any proposed land use development project, plan, or program that would expose outdoor activity areas of residential and tourist accommodation uses to exterior noise levels that exceed the identified standard.

Significance After Mitigation

It is unknown at this time whether all individual proposed projects would be able to incorporate measures to reduce noise levels at the outdoor activity areas of residential and tourist accommodation uses to levels below the identified noise standard. However, TRPA would only approve projects that can demonstrate compliance with the identified noise standard. Therefore, this impact would be **less than significant** for all Regional Plan Update alternatives.