Section 4.5

Noise and Vibration

4.5.1 Introduction

This section presents an overview of noise and vibration and evaluates the construction and operational noise and vibration impacts associated with the Coastal Transportation Corridor Specific Plan (CTCSP) and West Los Angeles Transportation Improvement and Mitigation Specific Plan (WLA TIMP) Specific Plans Amendment Project (Proposed Project).

The section is organized as follows:

- **Regulatory Framework** summarizes the applicable federal, state, and local regulations, policies, and guidelines pertaining to noise and vibration.
- **Existing Setting** describes the existing noise sources and noise levels in the project area.
- **Methodology** identifies the approach and models used to determine project impacts.
- **Thresholds of Significance** lists the thresholds used in identifying significant impacts, as identified in Appendix G of the State CEQA Guidelines and the City of Los Angeles' L.A. CEQA Thresholds Guide.
- The **Impacts and Mitigation Measures** section presents the analysis of noise and vibration impacts, and provides mitigation measures, where appropriate, to reduce significant impacts. The **Significance of Impacts After Mitigation** is also identified.

4.5.2 Regulatory Framework

This section describes applicable noise and vibration laws, rules, regulations, and policies at the federal, state, and local level. Noise standards are typically established at the local level, while the U.S. Environmental Protection Agency (USEPA) and the State of California provide general guidelines.

4.5.2.1 Federal

The Noise Control Act of 1972 and the Quiet Communities Act of 1978 promote protection of human health and welfare from excessive noise. Title IV – Noise Pollution, of the Clean Air Act established the Office of Noise Abatement and Control (ONAC) to coordinate all federal noise control activities and investigations. However, in 1981, Congress concluded that noise issues were best handled at the state or local government level. As a result, the USEPA phased out the office's funding in 1982 as part of a shift in federal noise control policy to transfer the primary responsibility of regulating noise to state and local governments. The Noise Control Act of 1972 and the Quiet Communities Act of 1978 were not rescinded by Congress and remain in effect today, but they are not funded. Title IV of the Clean Air Act provides guidance to state and local entities in establishing appropriate noise control standards.

The U.S. Department of Transportation Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) have published guidance documents for assessing noise and vibration impacts associated with transit and roadway projects. Methodology and significance thresholds from these documents are used, as appropriate, for this analysis, and are described in Section 4.5.4.

4.5.2.2 State

Governor's Office of Planning and Research

While the State of California does not directly regulate noise, it provides guidance for the preparation of general plans and noise ordinances. In 1976, the State Department of Health Services (now the Department of Public Health [CDPH]) issued Noise Element Guidelines (Health and Safety Code Section 46050.1). In 1977, the CDPH State Office of Noise Control (ONC) published a model noise ordinance and mandated that each county develop a noise element as part of its general plan (Section 65302(f) of the California Government Code). The purpose of a jurisdiction's noise element is to identify and appraise noise problems in the community. The ONC's model ordinance recommends limits on temporary construction noise levels and operational noise levels in residential, commercial, and industrial areas.

The state's General Plan Guidelines state that local governments must "'analyze and quantify noise levels and the extent of noise exposure through actual measurement or the use of noise modeling." In addition to other requirements, the guidelines state that "technical data relating to mobile and point sources must be collected and synthesized into a set of noise control policies and programs that 'minimizes the exposure of community residents to excessive noise'" (California Governor's Office of Planning and Research [OPR], 2003).

As part of the county-level planning process, analysis of existing conditions and community tolerance for noise are used to dictate the normally acceptable community noise exposure. Terms used by the state to analyze community noise exposure are:

- Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
- Conditionally Acceptable – New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.
- Normally Unacceptable – New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
- Clearly Unacceptable – New construction or development should generally not be undertaken.

The City of Los Angeles has adopted these community noise exposure levels with some adjustments, as discussed below.

4.5.2.3 Local

Local plans, policies, and ordinances pertaining to noise are discussed below.

General Plan Noise Element

The Noise Element of the City of Los Angeles General Plan (1999) contains goals, objectives, and policies to reduce or eliminate conflicts between land uses relative to noise levels and to minimize noise impacts from transportation sources, such as rail, aircraft, and freeways. Programs intended to implement policies presented in the Noise Element that are relevant to the Proposed Project include:

- **P5** Continue to enforce, as applicable, federal, State, and City regulations intended to abate or eliminate disturbances of the peace and other intrusive noise.
- **P10** Continue to encourage public transit and rail systems operating within the city's borders, but which are not within the jurisdiction of the city, to be constructed and operated in a manner that will assure compliance with the city's noise ordinance standards.
- **P13** Continue to plan, design, and construct or oversee construction of public projects, and projects on city owned properties, so as to minimize potential noise impacts on noise sensitive uses and to maintain or reduce existing ambient noise levels.
- **P17** Continue to encourage the California Department of Transportation (Caltrans), the Los Angeles County Metropolitan Transportation Authority (Metro), or their successors, and other responsible agencies, to plan and construct transportation systems so as to reduce potential noise impacts on adjacent land uses, consistent with the standards and guidelines contained in the noise element.

Los Angeles Municipal Code

The City of Los Angeles has established regulations concerning noise levels that could adversely affect its citizens and noise sensitive land uses. Section 41.40 of the Los Angeles Municipal Code (LAMC) prohibits construction or repair work to be performed between the hours of 9:00 p.m. and 7:00 a.m., since such activities would generate loud noises and could disturb sleep. No person, other than an individual homeowner engaged in the repair or construction of his/her single family dwelling, shall perform any construction or repair work of any kind, or perform such work within 500 feet of land so occupied, before 8:00 a.m. or after 6:00 p.m. on any Saturday or on a federal holiday, or at any time on Sunday. For limited construction activities during these prohibited times, the City may grant a variance permit.

Presumed ambient noise levels from LAMC Section 111.03 for various land uses are presented in **Table 4.5-1**. The City of Los Angeles uses these noise levels when measured noise levels are lower than the presumed ambient noise level or where noise measurements are not available to determine minimum existing ambient noise levels for impact analysis. The minimum ambient noise levels allow for a conservative estimate of noise increases above existing levels.

Section 112.05 of the LAMC prohibits the use of powered equipment or hand tools that produce a maximum noise level exceeding 75 A-weighted decibel scale (dBA) at 50 feet. This noise limitation does not apply where compliance is technically infeasible, or the noise limitation cannot be met despite the use of abatement measures, such as mufflers, shields, or sound barriers, during the operation of equipment.

Table 4.5-1 Presumed Ambient Noise Levels at Various Land Uses

Land Use	Presumed Ambient Noise Level (dBA)	
	Day (7:00 a.m.-10:00 p.m.)	Night (10:00 p.m.-7:00 a.m.)
Residential (A1, A2, RA, RE, RS, RD, RW1, RW2, R1, R2, R3, R4, R5)	50	40
Commercial (P, PB, CR, C1, C1.5, C2, C4, C5, CM)	60	55
Manufacturing (M1, MR1, MR2)	60	55
Heavy Manufacturing (M2, M3)	65	65

Source: LAMC, Section 111.03.

Key:
dBA = A-weighted decibel scale

City of Los Angeles L.A. CEQA Thresholds Guide

The L.A. CEQA Thresholds Guide (City of Los Angeles, 2006) describes significance thresholds to be used in noise analyses and outlines methodologies for determining significance. Significance thresholds are described further in Section 4.5.5. **Table 4.5-2** shows the ranges of acceptable and unacceptable community noise exposure levels presented in the L.A. CEQA Thresholds Guide.

Table 4.5-2 Noise Compatible Land Use Planning

Land Use	Community Noise Exposure CNEL (dBA)			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential – Low Density Single Family, Duplex, Mobile Homes	50-60	55-70	70-75	70+
Residential – Multi Family	50-65	60-70	70-75	70+
Transient Lodging – Motels, Hotels	50-65	60-70	70-80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-70	60-70	70-80	80+
Auditoriums, Concert Halls, Amphitheaters	N/A	50-70	N/A	65+
Sports Arena, Outdoor Spectator Sports	N/A	50-75	N/A	70+
Playgrounds, Neighborhood Parks	50-70	N/A	65-75	72+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-75	N/A	70-80	80+
Office Buildings, Business Commercial and Professional	50-70	67-77	75+	N/A
Industrial, Manufacturing, Utilities, Agriculture	50-75	70-80	75+	N/A

Source: City of Los Angeles, 2006.

Key:
CNEL = community noise equivalent level
dBA = A-weighted decibel scale
N/A = not applicable

Mayoral Executive Directive No. 2

Mayor Antonio Villaraigosa's Executive Directive No. 2, issued on August 12, 2005 and reissued on October 20, 2005, prohibits construction in the public right-of-way between 6:00 a.m. and 9:00 a.m. and between 3:30 p.m. and 7:00 p.m., including actual construction as well as staging of equipment and materials (City of Los Angeles, 2005). The purpose of the directive is to improve traffic in the City and reduce delays. The directive instructed the Board of Public Worlds to develop appropriate administrative penalties and procedures aimed at enforcing the ban. Exemptions from the prohibition include construction activities related to emergency maintenance and repair, and construction associated with major public works projects with mitigation plans. "Major public works projects" were to be defined by criteria to be developed by the Board of Public Works, which later delegated policy development to the City Engineer. The City Engineer published guidelines to be used to evaluate requests for an exemption from the rush hour prohibitions on April 14, 2006 (Bureau of Engineering, 2006). The Directive and related guidelines are still in effect.

4.5.3 Existing Setting

The existing noise and vibration environment near the study area is influenced by various transportation and non-transportation sources. Vehicular traffic is the predominant source of transportation-related noise, along with aircraft noise in the areas near LAX and Santa Monica Airport.

4.5.3.1 Characteristics of Noise and Vibration

Noise Characteristics

Noise is defined as any unwanted or objectionable sound. When noise levels increase, there may be adverse impacts to humans and the natural environment. Noise impacts can be short-term, such as temporary noise generated from construction activities, or long-term, such as the permanent operation of new facilities.

The human ear perceives sound, which is mechanical energy, as pressure on the ear. Sound level meters measure the air pressure fluctuations caused by sound waves. The decibel (dB) scale for describing sound uses a logarithmic scale to account for the large range of audible sound intensities, with zero dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain. Most sounds consist of a broad range of sound frequencies, and several frequency-weighting schemes have been used to develop composite dB scales that approximate the way the human ear responds to noise levels. The most widely used measure for environmental noise assessments is the A-weighted dB scale (designated as dBA). The scale relates sound amplitude to human sensitivity by deemphasizing the low and high-end frequencies that humans cannot hear well. **Table 4.5-3** illustrates the range of typical A-weighted sound levels associated with common indoor and outdoor activities in dBA.

Table 4.5-3 Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet		
	100	
Gas lawnmower at 3 feet		
	90	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80	Garbage disposal at 3 feet
Noise urban area, daytime		
Gas lawnmower, 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 in next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quite suburban nighttime		
	30	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20	
		Broadcast/recording studio
	10	
	0	

Source: Caltrans, 2013a.

Key:
dBA = A-weighted decibel scale
mph = miles per hour

Because sounds in the environment usually vary with time, they cannot simply be described with a single number. The time-varying characteristic of environmental noise is described using statistical noise descriptors.

- Leq (Equivalent Energy Level) – L_{eq} provides a methodology for combining noise from individual events and steady state sources into a measure of cumulative noise exposure. L_{eq} is the A-weighted sound level corresponding to a steady-state sound level that contains the same total energy as a varying signal over a given monitoring period. This is typically computed over 1-, 8-, and 24-hour monitoring periods.
- Ldn (Day-Night Average Level) – (L_{dn}) was developed to account for human sensitivity to nighttime noise. (L_{dn}) represents the 24-hour average sound level with a 10 dBA penalty applied to all noise events occurring at night between 10:00 p.m. and 7:00 a.m. This is a useful measure for community noise impact because people in their homes are much more sensitive to noise at night when they are relaxing or sleeping than they are in the daytime.

- CNEL (Community Noise Equivalent Level) – The CNEL is also a 24-hour cumulative noise descriptor that considers the sensitivity of humans to noise at night. However, in addition to the 10-dBA penalty between 10:00 p.m. and 7:00 a.m., the CNEL adds a 5-dBA penalty for nighttime hours between 7:00 p.m. and 10:00 p.m. The CNEL is commonly used in California instead of the L_{dn}.

Effects of Noise on People

Human response to noise is subjective, and noise effects on humans can range from annoyance to physical discomfort and harm. Sleeping patterns, speech communication, mental acuity, and heart and breathing rates can all be disturbed by noise. Perception of the noise is affected by its pitch, loudness, duration, and time of the day.

Noise-sensitive locations include areas where an excessive amount of noise would interfere with normal operations or activities and where a high degree of noise control may be necessary. Examples include schools, hospitals, and residential areas. Recreational areas may be considered noise-sensitive where quiet and solitude may be an important aspect of the specific recreational experience.

Noise Attenuation and Audible Noise Changes

Noise, often described as unwanted sound, is known to have several adverse effects on humans. These noise effects may include hearing loss (not a factor with typical community noise), communication interference, and annoyance. Hearing loss is generally not a concern in community noise problems, even very near a major freeway. Environmental noise does not have an effect on hearing threshold levels particularly due to the fact that environmental noise does not approximate occupational noise exposures in heavy industry, very noisy work environments with long-term exposure, or certain very loud recreational activities such as target shooting, motorcycle or automobile racing, etc. Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud to cause hearing loss.

From the source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise level as the distance from the source increases. Sound levels from isolated point sources of noise typically decrease by about 6 to 7.5 dBA for every doubling of distance from the noise source (i.e., if the noise level is 70 dBA at 25 feet, it is 64 dBA at 50 feet and 58 dBA at 100 feet). Sound from a line source, such as vehicle traffic on a highway, decreases by about 3 to 4.8 dBA for every doubling of distance. Noise levels can also be affected by several factors other than the distance from the noise source. Topographic features, surface types (e.g. absorptive like dirt or grass or reflective like asphalt), and structural barriers that absorb, reflect, or scatter sound waves can affect the reduction of noise levels. A barrier that breaks the line of sight between a noise source and a receiver will typically provide at least a 5 dB noise reduction. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) and the presence of dense vegetation can also affect the degree to which sound is attenuated over distance.

A key concept in evaluating potential noise impacts is the perceived effect of incremental increase in existing noise levels. Human perception of noise has no simple correlation with acoustical energy. Due to subjective thresholds of tolerance, the annoyance of a given noise source is perceived very differently from person to person. Two noise sources do not “sound twice as loud” as one source. A doubling of noise sources results in a noise level increase of 3 dBA. For example, 60 dB plus 60 dB equals 63 dB, and 80 dB plus 80 dB equals 83 dB. However, where ambient noise levels are high in comparison to a new noise source, there will only be a small change in noise levels. For example, when

70 dB ambient noise levels are combined with a 60 dB noise source, the resulting noise level equals 70.4 dB.

Table 4.5-4 presents the effect of increasing noise levels. As shown in the table, an increase of 3 dBA is barely perceptible, an increase of 5 dBA is noticeable, and an increase of 10 dBA would be perceived by someone to be a doubling of noise.

Table 4.5-4 Decibel Changes, Loudness, and Energy Loss

Sound Level Change (dBA)	Relative Loudness/ Impact	Acoustical Energy Gain (%)
0	Reference	0
+3	Barely Perceptible Change	50
+5	Readily Perceptible Change	67
+10	Twice as Loud	90
+20	Four Times as Loud	99
+30	Eight times as Loud	99.9

Source: FHWA, 2011.

Key:
dBA = A-weighted decibel scale

Vibration Characteristics

Vibration is the periodic movement of mass over time. As with noise levels, groundborne vibration can have a significant effect on persons and buildings. Groundborne vibration from construction activities is caused by operation of equipment such as large bulldozers, vibratory rollers, pile drivers, and loaded trucks. Vibration generated by construction activity has the potential to damage structures. This damage could be structural damage (e.g., cracking of floor slabs, foundations, columns, beams, or wells) or cosmetic architectural damage (e.g., cracked plaster, stucco, or tile).

Ground vibration can also be a source of annoyance to people. The primary effect of perceptible vibration is often a concern. However, secondary effects, such as the rattling of a china cabinet, can also occur, even when vibration levels are well below perception. Any effect (primary perceptible vibration, secondary effects, or a combination of the two) can lead to annoyance. The degree to which a person is annoyed depends on the activity in which they are participating at the time of the disturbance. For example, someone sleeping or reading will be more sensitive than someone who is running on a treadmill. Reoccurring primary and secondary vibration effects often lead people to believe that the vibration is damaging their home, even when vibration levels may be well below minimum thresholds for damage potential.

In order to assess the potential for structural damage associated with vibration, the vibratory ground motion in the vicinity of the affected structure is measured in terms of peak particle velocity (PPV) in the vertical and horizontal directions, typically in units of inches per second (in/sec). The PPV is defined as the maximum instantaneous peak of the vibration signal. Since it is related to the stresses that are experienced by buildings, PPV is often used in monitoring blasting vibration and the vibration of heavy construction equipment.

The root mean square (rms) amplitude is most frequently used to describe the effect of vibration on the human body. The rms amplitude is defined as the average of the squared amplitude of the signal and is approximately 70 percent of the PPV for a single frequency vibration. Vibration velocity level in dB notation (VdB) is commonly used to measure rms. The dB notation acts to compress the range of numbers required to describe vibration and are referenced to 1 x 10^{-6} in/sec in the U.S. Typical rms vibration velocity levels (Lv) and their human or structural responses are summarized in **Table 4.5-5**.

Table 4.5-5 Typical Root Mean Square Vibration Levels

Human/Structural Response	Lv (VdB)	Typical Sources (50 ft from source)
Minor cosmetic damage to fragile buildings	100	Blasting from construction projects
		Bulldozers and other heavy tracked construction equipment
Difficulty with tasks such as reading a video display screen	90	
		Commuter rail (upper range)
Residential annoyance for infrequent events (e.g. commuter rail)	80	Rapid transit (upper range)
		Commuter rail (typical)
Residential annoyance for frequent events (e.g. rapid transit)		Bus/truck over bumpy street
	70	Rapid transit (typical)
Limit for vibration sensitive equipment Threshold for human perception		
		Bus/truck (typical)
	60	
		Typical background vibration
	50	

Source: FTA, 2006.

Key:
ft = feet
Lv = root mean square vibration velocity level
VdB = decibel vibration velocity level

Construction activities can either result in continuous or single-impact vibration impacts. Typical sources of continuous vibration impacts include excavation equipment, traffic, vibratory pile drivers, and vibratory compaction equipment; examples of single-impact vibration sources include blasting and drop balls. Damage thresholds for continuous sources are approximately half of the thresholds for single-impact sources. Typical road traffic induced vibration levels on smooth roads are near the threshold for human perception (FTA, 2006).

Effects of Vibration

Construction activities have the potential to produce vibration levels that may be annoying or disturbing to humans and may cause damage to structures.

While "safe" levels (i.e., levels at which damage to buildings would not occur) of continuous vibration are not well understood, research has been conducted to evaluate the effects of different vibration levels on buildings. The way in which a building is constructed and its condition influence the degree to which it can handle vibration effects. According to FTA guidelines, the construction vibration damage criterion for non-engineered timber and masonry buildings is 0.2 in/sec and that of engineered concrete and masonry is 0.3 in/sec (FTA, 2006).

The human threshold of perception is typically around 64 VdB, and the threshold of human annoyance to ground-borne vibration at residences and buildings where people normally sleep is 72 to 80 VdB. The threshold for institutional land use with primarily daytime use is 75 to 83 VdB. Furthermore, vibration is seldom annoying to people who are outdoors because without the effects of the shaking of a building, the motion does not provoke the same human reaction (FTA, 2006).

4.5.3.2 Existing Noise in the Project Area

The L.A. CEQA Thresholds Guide refers to the LAMC Section 111.03 as a method for determining existing ambient noise levels. The daytime and nighttime ambient noise levels for residential areas are presumed to be 50 and 40 dBA, respectively, as presented in Table 4.5-1. Many neighborhoods in the study area may experience higher noise levels, particularly near major roadways and airports.

Various average daily roadway volumes were modeled using the FHWA Highway Traffic Noise Model (TNM2.5) to give perspective to roadway noise levels. Noise levels for average daily volumes ranging from 10,000 to 60,000 are presented in **Table 4.5-6**, and example roadways in the study area with the same approximate average daily volumes are listed for reference. A receptor was modeled at 50 feet from the centerline of a simple four lane road (i.e., two lanes in each direction) with vehicles traveling at 35 miles per hour, the average speed in the County of Los Angeles based on the EMFAC2014 database. The default fleet mix for the County of Los Angeles from the California Air Resources Board's (CARB) EMFAC2014 Mobile Source Emission Inventory Model was used for all hours of the day.

Table 4.5-6 CNEL Associated with Various Average Daily Volumes

Approximate Average Daily Roadway Volume	Example Roads	CNEL (dBA) at 50 ft from Roadway Centerline
10,000	Overland Ave (low range = 8,100) Jefferson Blvd (low range = 9,900)	70
20,000	Sepulveda Blvd (low range = 25,000) Culver Blvd (low range = 18,300)	73
30,000	Sawtelle Blvd (high range = 33,300) Santa Monica Blvd (low range = 30,900)	75
40,000	Lincoln Blvd (low range = 34,800) Wilshire Blvd (low range = 45,000)	76
50,000	Bundy Dr/Centinela Ave (high range = 48,300) Venice Blvd (high range = 50,400)	77
60,000	Lincoln Blvd (high range = 61,200) Olympic Blvd (high range = 61,500)	78

Source: CDM Smith, 2015; Fehr & Peers, 2015.

Key:
CNEL = community noise equivalent level
dBA = A-weighted decibel scale
ft = feet

4.5.3.3 Existing Vibration in the Project Area

Based on field observations, the only source of groundborne vibration in the project vicinity is vehicular travel (including delivery trucks and transit buses) on local roadways. Typical road traffic induced vibration levels are unlikely to be perceptible by people. Typical background velocity level in residential areas is usually 50 VdB or lower, or below the threshold of perception for humans (FTA, 2006).

4.5.3.4 Sensitive Receptors

The study area is in the western portion of the City of Los Angeles, including all or parts of Westchester, Playa Del Ray, LAX, Playa Vista, Venice, Mar Vista, Palms, Westwood, West Los Angeles, and Brentwood. Various land uses exist within these urbanized areas including residential developments of various densities, commercial, industrial, institutional, and public facilities, and open space. Some land uses, such as residences, schools, hospitals, hotels, and libraries, are typically more sensitive to changes in noise and vibration levels.

4.5.4 Methodology

The focus of this analysis is on potential temporary construction and long-term impacts to local sensitive receptor sites located near the proposed alternatives.

4.5.4.1 Noise

Construction

Typical noise levels of construction equipment are presented in the L.A. CEQA Thresholds Guide and summarized in **Table 4.5-7**. These are noise levels of construction equipment without noise control devices. The noise level at nearby sensitive receptors during construction was estimated by attenuating the construction sound level for distance to the receptor and logarithmically adding the attenuated construction noise source level to the ambient noise level. Construction noise was predicted using the equations and guiding principles from the FHWA Roadway Construction Noise Model (RCNM).

Table 4.5-7 Construction Equipment Noise Level

Equipment Types	Noise Level at 50 feet (dBA)
Concrete Mixers	75-88
Crane	75-88
Front End Loaders	73-86
Jackhammers	81-98
Pavers	85-88
Pile Driver (peaks)	95-107
Saws	72-82
Trucks	82-95

Source: City of Los Angeles, 2006.

Key*:*
dBA = A-weighted decibel scale

For the purpose of this analysis, potential noise levels were estimated at a program level of detail, because detailed plans have not been developed for implementation of any of the projects on the proposed CTCSP or WLA TIMP project lists. Based on the general project features and descriptions, types of improvements were rated as requiring a high, medium, or low level of construction intensity, which reflected the anticipated noise level associated with the improvement type. In general, low construction intensity improvements would require no construction or would require minor construction, including minimal construction equipment, ground disturbance, and removal or replacement of asphalt. Moreover, construction of these improvements would occur over short periods of time. Medium construction intensity improvements would involve minor to moderate construction, such as more removal and replacement of asphalt and concrete. High construction intensity improvements would involve substantial construction activity using heavy construction equipment over a larger area and a longer period of time.

The projects most likely to involve high construction intensity include: (1) the Lincoln Boulevard Bridge Enhancement, (2) the center-running bus rapid transit (BRTs) on Lincoln and Sepulveda boulevards, particularly the construction of BRT platforms, and (3) the I-10 Ramp Reconfiguration at Bundy Drive. For purposes of the noise analysis, it was assumed that the Lincoln Boulevard and Sepulveda Boulevard BRTs would require excavation down to the subsurface to install appropriate foundations for the BRT platforms. Similar to the Lincoln Boulevard and Sepulveda Boulevard BRT improvements, it was assumed that the I-10 Ramp Reconfiguration at Bundy Drive would require excavation down to the subsurface to remove and replace off-ramps.

This analysis assumes that any improvement that involves low or medium intensity construction would generally require a front end loader, a truck, a jackhammer, a concrete mixer, and a paver. This equipment is typically used for construction activities that would be required by these improvements, such as removal and replacement of asphalt and concrete that may be associated with the construction of cycle tracks, sidewalk improvements, traffic calming features, and bicycle transit centers, or the installation of minor new facilities, such as bus shelters, signage, streetscape improvements, and ITS equipment.

The higher intensity construction projects were assumed to require additional construction equipment. A list of construction equipment assumed for these projects is provided in Table 4.1-8 in Section 4.1, *Air Quality*. In addition to the equipment listed in this table, for purposes of the noise analysis, it was assumed that construction of the Lincoln Bridge Enhancement Project could involve a drill or hammer type of pile driving. As conceptual project designs have not been completed for any of the projects on the lists of transportation improvements, there is a level of uncertainty regarding the actual location of construction activity and equipment. For each individual improvement project, a project-level analysis of noise impacts would be required prior to project approval to provide a more detailed analysis.

Operation

Because details regarding the individual transportation improvements have not been developed, operational noise associated with the Proposed Project was not modeled. Instead, impacts were evaluated based on general project characteristics and information generated by the transportation analysis conducted for this EIR (see Section 4.6, *Transportation*).

4.5.4.2 Vibration

Construction

In addition to noise, construction activities have the potential to produce vibration that may be annoying or disturbing to humans and may cause damage to structures. The highest levels of vibration from construction projects are caused by soil compacting, jackhammering, and demolition.
Table 4.5-8 presents the PPV in in/sec and Lv in VdB for typical construction equipment as published by the FTA (2006). The equivalent PPV and Lv at the receptor were calculated based on the distance between the source of vibration and the receptors. The impact of all construction equipment was calculated for Lv, like noise, but a separate PPV was evaluated for each equipment, as PPVs are generally not additive.

Table 4.5-8 Vibration Levels for Construction Equipment

Equipment Types	PPV at 25 feet (in/sec)	L_v at 25 feet (VdB)
Pile Driver (impact)	0.644	104
Vibratory Roller	0.210	94
Large Bulldozer / Hoe Ram	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Source: FTA 2006.

Key:
PPV = peak particle velocity
in/sec = inches per second
L_v = velocity level
VdB = decibel vibration velocity level

Operation

As noted in Section 4.5.3.3, typical road traffic-induced vibration levels are unlikely to be perceptible by people. Therefore, operational vibration impacts were not modeled but, rather, are evaluated qualitatively.

4.5.5 Thresholds of Significance

The significance criteria described below were developed consistent with the State CEQA Guidelines (applicable to this project) to determine the significance of potential impacts on noise that could result from implementation of the project. Impacts on noise would be considered potentially significant if the project would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, exposure of people residing or working in the study area to excessive noise levels; and/or
- For a project within the vicinity of a private airstrip, exposure of people residing or working in the study area to excessive noise levels.

The L.A. CEQA Thresholds Guide has significance thresholds to be used in noise analyses. These thresholds are identified below.

Construction Noise

Based on the L.A. CEQA Thresholds Guide, the Proposed Project would have significant impact relative to construction noise if:

- Construction activities lasting more than one day would exceed existing ambient noise levels by 10 dBA or more at a noise sensitive use;
- Construction activities lasting more than ten days in a three-month period would exceed existing ambient noise levels by 5 dBA or more at a noise sensitive use; and/or
- Construction activities would exceed the ambient noise level by 5 dBA at a noise sensitive use between the hours of 9:00 p.m. and 7:00 a.m. Monday through Friday, before 8:00 a.m. or after 6:00 p.m. on Saturday, or anytime on Sunday.

Operational Noise

Based on the L.A. CEQA Thresholds Guide, the Proposed Project would have significant operational noise impacts if:

- Ambient noise level measured at the property line of affected uses increases by 3 dBA CNEL to or within the "normally unacceptable" or "clearly unacceptable" categories, as shown in Table 4.5-2, or any 5 dBA or more increase in noise level.

The significance criteria described above apply to the noise receptors that could be affected by the project and are used to determine substantial temporary or permanent increase in ambient noise levels.

Vibration

There are no adopted City standards or significance threshold for vibration. Based on FTA guidelines (2006) and the Caltrans Transportation and Construction Vibration Manual (2013), the Proposed Project would have a significant impact related to vibration if:

- Vibration levels would exceed the building damage criteria listed in **Table 4.5-9**.

Table 4.5-9 Vibration-Related Structural Damage Criteria

Building Category	PPV (in/sec)
I. Reinforced-concrete, steel, or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12

Source: FTA, 2006.

Key:
PPV = peak particle velocity
in/sec = inches per second

- Vibration levels would exceed the human annoyance criteria listed in **Table 4.5-10**.

Table 4.5-10 Groundborne Vibration Impact Criteria for Human Annoyance

Land Use Category	Vibration Impact Level for Frequent Events[1] (VdB)	Vibration Impact Level for Occasional Events[2] (VdB)	Vibration Impact Level for Infrequent Events[3] (VdB)
Category 1: Building where low ambient vibration is essential for interior operations[4]	65	65	65
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime use	75	78	83

Source: FTA, 2006.

Notes:

1. Frequent event is defined as more than 70 vibration events of the same source per day (e.g. rapid transit)
2. Occasional events is defined as between 30 and 70 vibration events of the same source per day (e.g. commuter trunk lines)
3. Infrequent events is defined as fewer than 30 vibration events of the same source per day (e.g. commuter rail)
4. Category 1 is for manufacturing or research building with equipment that are moderately sensitive to vibration, such as optical microscopes.

4.5.6 Impacts and Mitigation Measures

The proposed update to the Transportation Impact Fee program and the administrative and minor revisions of the specific plans would not result in any physical impacts that could affect noise or vibration. Therefore, the following analysis addresses whether implementation of the proposed updates to the lists of transportation improvements in the CTCSP and WLA TIMP would result in significant impacts on noise or vibration. No specific construction projects would be implemented based on this EIR; rather, the transportation improvements are evaluated at a conceptual level of detail.

Impact 4.5-1: Implementation of the Proposed Project would expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. This would be a *significant and unavoidable impact* for construction and operations.

Construction

Construction of the proposed transportation improvements could result in temporary increases in noise levels generated by construction equipment, construction-related truck trips, and worker commute trips. Noise levels would fluctuate depending on the construction activities, equipment type, duration of activity, distance between the noise source and receptor, and presence of barriers that attenuate noise.

Table 4.5-11 identifies the types of transportation improvements associated with the Proposed Project and the level of construction noise intensity associated with each type. As shown in the table, for most of the proposed transportation improvements, the noise levels associated with the construction of proposed transportation improvements would be at the low to medium end of the intensity range of construction activities that occur in the region. Some of the project types identified as low or medium may result in a brief period where noise levels would be high; however, the short duration was taken into account when determining the overall level of noise intensity associated with the different project types. Projects with the greatest level of construction activity and associated noise would include the addition of center-running BRT on Sepulveda and Lincoln boulevards, and roadway projects, such as the Lincoln Boulevard Bridge Enhancement and the I-10 Ramp Reconfiguration at Bundy Drive.

Table 4.5-11 Construction Noise Intensity

Project Type	Project Description	Construction Noise Intensity/Duration
Transit Improvements	New center-running bus rapid transit on Sepulveda Boulevard and Lincoln Boulevard	High
	Curb-running bus rapid transit on other corridors, including enhanced stop amenities	Low/Medium
	Enhance bus service through expanded service routes and frequency as well as bus stop improvements	Low
	Establish circulator/shuttles to connect activity centers to major transit centers	None
Bicycle and Pedestrian Improvements	Improve connectivity at major Metro stations (shading, lighting, directional signage, shelters, crosswalks)	Low
	Implement bicycle friendly street design as an alternate route to major corridors	Low/Medium
	Install mobility hubs near Metro stations and satellite hubs (bike parking, car/bicycle sharing)	Low/Medium
	Implement streetscape plans	Low/Medium
	Implement bicycle lanes, cycle tracks, multi-use tracks	Low/Medium
	Complete gaps in sidewalk network and provide pedestrian enhancements	Medium
	Establish bikesharing and bicycle transit centers that offer bicycle parking, rentals, repairs, lockers, showers, and transit information	Low/Medium
Roadway Projects	Turn-lane or safety improvements at major intersections	Medium
	Improve traffic flow along major arterials, including changes to lane configurations	Medium
	Widen Lincoln Boulevard Bridge	High
	Establish measures to encourage use of arterials and discourage through-traffic from using local streets	Low
	Reconfigure I-10 ramps at Bundy Drive	High
Intelligent Transportation Systems	Implement traffic signal updates as part of the automated traffic surveillance and control system that provides real-time monitoring and adjustment of signal timing	Low
	Install CCTV cameras & associated infrastructure	Low
Trip Reduction Programs	Update parking requirements, establish systems for real-time parking information	Low
	Provide guidance and implementation of travel demand management programs	None
	Develop online TDM Toolkit with information for transit users, cyclists, and pedestrians	None

Source: CDM Smith, 2015.

Key:
Low = Involves a small area (less than one acre), short duration, and minimal disturbance of the ground/existing pavement, including installation of minor new facilities.
Medium = Involves an area generally ranging from one acre to approximately three acres in size and requires removal and replacement of some asphalt and concrete.
High = Involves an area generally greater than three acres in size, occurs over a longer duration, and requires construction of substantial new facilities/infrastructure.

Generally, project-related construction would take place within existing roadways, sidewalks, and right-of-ways and, with the exception of the projects identified above, would not involve construction of major new facilities or infrastructure. Rather, the majority of the projects would involve only minor construction activities, such as removal and replacement of asphalt and concrete, which would be associated with the construction of cycle tracks, sidewalk improvements, traffic calming features, and bicycle transit centers for example; restriping, which would be associated with implementation of curb-running BRT, enhanced pedestrian cross-walks, and turn-lane designations, for example; or the installation of minor new facilities, such as bus shelters, signage, streetscape improvements, and ITS equipment. Nevertheless, as described below, even these activities can result in high levels of noise for short periods of time in specific locations.

Typical noise levels associated with equipment that could be used during the construction of the Lincoln Boulevard and Sepulveda Boulevard BRT platforms and the I-10/Bundy Drive ramp reconfiguration are presented by construction phase in **Table 4.5-12**. In addition to using construction equipment associated with these improvements, the Lincoln Boulevard Bridge Enhancement project may also involve pile driving activities. Estimated noise levels associated with equipment that would be used for the Lincoln Boulevard Bridge Enhancement are shown by construction phase in **Table 4.5-13**. Other transportation improvements would require a lower intensity of construction than the Lincoln Boulevard Bridge Enhancement, the Lincoln Boulevard and Sepulveda Boulevard BRTs, or the I-10 Ramp Reconfiguration at Bundy Drive. Typical noise levels associated with equipment that could be used during the construction of these improvements are shown in **Table 4.5-14**. In order to determine maximum noise levels associated with these lower intensity construction projects, combined equipment noise was evaluated. Of the construction equipment listed in Table 4.5-14, the most conservative combination of construction equipment likely to operate simultaneously includes truck operations and jackhammering; therefore, combined noise levels from a truck and a jackhammer are presented. Detailed modeling results of noise from construction equipment associated with each project type are provided in Appendix E, *Noise and Vibration*.

Table 4.5-12 Construction Noise Levels for Lincoln/Sepulveda BRT and I-10/Bundy Drive Ramp Reconfiguration

	Typical Noise Levels (dBA)		
Phase	**50 feet**	**100 feet**	**500 feet**
Grubbing/Land Clearing	92	86	74
Grading/Excavation	97	91	79
Drainage/Utilities/Subgrade	95	89	76
Paving	94	88	76

Source: CDM Smith, 2015.

Key:
dBA = A-weighted decibel scale

Table 4.5-13 Construction Noise Levels for Lincoln Boulevard Bridge Enhancement

	Typical Noise Levels (dBA)		
Phase	**60 feet[1]**	**100 feet**	**400 feet**
Grubbing/Land Clearing	91	86	74
Grading/Excavation	95	92[2]	80[2]
Drainage/Utilities/Subgrade	94	89	77
Paving	92	88	76

Source: CDM Smith, 2015.

Notes:

1. Noise levels at 60 feet would be associated with widening of Lincoln Boulevard south of the bridge, which would not involve pile driving. The closest receptor during pile driving activities would be 100 feet or more from the construction site.
2. Includes pile driving.

Key:
dBA = A-weighted decibel scale

Table 4.5-14 Typical Construction Equipment Noise Levels for Other Transportation Improvements

	Typical Noise Levels (dBA)		
Equipment Type	**50 feet**	**100 feet**	**500 feet**
Front End Loaders	80	74	60
Trucks	89	83	69
Jackhammers	90	84	70
Concrete Mixers	82	76	62
Pavers	87	81	67
Trucks and Jackhammers Operating Simultaneously[1]	92	86	72

Source: CDM Smith, 2015.

Note:

1. Trucks and jackhammers are likely to operate simultaneously and would result in a higher noise level than combinations of other equipment, such as a concrete mixer and a paver. Combined noise levels from a truck and a jackhammer are used to represent the highest noise level associated with other transportation improvement projects.

Key:
dBA = A-weighted decibel scale

To meet the goals and policies of the City of Los Angeles Noise Element, noise from construction of the proposed transportation improvements would be minimized, as feasible. Construction would be conducted in accordance with regulations found in the LAMC and in mayoral directives. Specifically, Mayor Antonio Villaraigosa's Executive Directive No. 2, still in effect, prohibits construction in the public right-of-way between 6:00 a.m. and 9:00 a.m. and between 3:30 p.m. and 7:00 p.m., with some exceptions. This prohibition would apply to construction of any of the proposed transportation improvements that would occur within public roads, such as BRT and other transit projects, cycle tracks, and intersection improvements, but would not apply to non-road projects, such as sidewalk improvements, streetscape improvements, and bicycle facilities. All construction activities would be subject to the general noise provisions of the LAMC found in Section 41.40, which limits construction within 500 feet of residential uses to the hours of 7:00 a.m. to 9:00 p.m. on weekdays and 8:00 a.m. to 6:00 p.m. on Saturdays and national holidays, and prohibits construction activity on Sundays. In addition, Section 112.05 of the LAMC prohibits the use of powered equipment within 500 feet of a residential zone that produces a maximum noise level exceeding 75 dBA at 50 feet without the use of noise abatement technologies, such as mufflers and sound barriers, to meet this level, unless technically infeasible.

Even with adherence to the LAMC, construction activities associated with the Proposed Project could exceed ambient noise levels by 10 dBA or more for more than one day at a noise sensitive use or exceed ambient noise levels by 5 dBA or more for more than ten days over a three month period at a noise sensitive use. Many of the medium construction intensity projects, such as streetscape improvements, cycle tracks, bike transit centers, and traffic calming features, would occur curb side, which could be close to noise sensitive receptors, depending on the location. As shown in Table 4.5-14, these transportation improvements may at times generate noise levels exceeding 90 dBA at 50 feet. In many cases, construction of these improvements may occur over a period of just a few days in any one location; nevertheless, if located within a right-of-way that is right in front of a sensitive use, such as an apartment building, the activity could exceed ambient noise levels by 10 dBA or more for more than one day, without mitigation. This would be a potentially ***significant impact.***

Construction of the center-running BRT platforms along Lincoln and Sepulveda boulevards, and the I-10 Ramp Reconfiguration at Bundy Drive would involve a high level of construction activity over a lengthy construction period (assumed to be 24 months for purposes of this analysis). As stated previously, the specific design features associated with these projects, such as the BRT platform locations or the exact ramp configuration, have not yet been determined. Depending on the platform locations, construction could occur within 50 feet of a residential use. At this distance, as shown in Table 4.5-12, construction equipment could result in noise levels over 97 dBA. Construction of the I-10/Bundy Drive ramp reconfiguration could have greater construction impacts; if the eastern leg of the off ramp were reconfigured, construction could occur within 40 feet of residences on W. Ayres Way. Construction of the Lincoln Boulevard and Sepulveda Boulevard BRTs and the I-10/Bundy Drive Ramp Reconfiguration could exceed ambient noise levels by 10 dBA or more for more than one day at a noise sensitive use. Because of the duration and construction intensity of the project, construction could also exceed ambient noise levels by 5 dBA or more at a noise sensitive use for more than ten days over a three month period. Construction-related noise levels associated with the Lincoln Boulevard and Sepulveda Boulevard BRTs and the I-10 Ramp Reconfiguration at Bundy Drive would be a potentially ***significant impact.***

The Lincoln Boulevard Bridge Enhancement project would likely take over 18 months and would also involve a high level of construction activity. In addition to widening the Lincoln Bridge over Ballona Channel, the project would require widening Lincoln Boulevard south of the bridge. Construction activities related to the bridge widening would occur approximately 100 to 400 feet from the nearest residence. Widening of Lincoln Boulevard south of the bridge would involve construction within approximately 60 feet of multi-family residences. In addition, the bridge widening may involve intermittent use of a pile driver, which could generate high noise levels for a short duration (likely less than six weeks). Overall, as shown in Table 4.5-13, the Lincoln Boulevard Bridge Enhancement would require operation of construction equipment at times that could result in noise levels exceeding 90 dBA at 60 feet without mitigation. This improvement would exceed ambient noise levels by 10 dBA or more for more than one day at a noise sensitive use. Moreover, because of the duration and construction intensity of the project, construction would also exceed ambient noise levels by 5 dBA or more at a noise sensitive use for more than ten days over a three month period. This would be a potentially ***significant impact***.

Operation

Existing operational noise levels could be affected by a change in vehicle operations in the project area as a result of implementing the proposed transportation improvement projects. Although the Proposed Project would not introduce any new roadways in the project area, and all improvements would occur within existing right-of-ways, enhancing mobility may change vehicle speeds on some roadways, which could result in changes in noise levels. For example, implementation of bus-only lanes would result in increased average bus speeds. In addition, intersection and ITS improvements would increase vehicle speeds on some roadways during some time periods. Conversely, other improvements may involve reducing the number of travel lanes on a roadway to provide bus rapid transit lanes and bicycle lanes. This may shift vehicles onto the remaining travel lane(s) and may result in lower traveling speeds during certain time periods. While decreased vehicle speeds could result in lower vehicle noise levels compared to existing conditions, increases in bus and private vehicle speeds could result in higher vehicle noise levels compared to existing conditions. **Table 4.5-15** shows the change in noise level as a result of changing vehicle speeds.

Table 4.5-15 Vehicle Noise Level as a Function of Speed (50 feet from centerline)

Speed (mph)	Auto (dBA)	Medium Truck (dBA)	Heavy Truck (dBA)
40	67	75	81
44	69	77	82

Source: Caltrans, 2013a.

Key:
dBA = A-weighted decibel scale
mph = miles per hour

Vehicle Traffic

The overall study area speed is not anticipated to change substantially. Overall, study area vehicle trips are anticipated to increase between 2014 and 2035 by approximately 11 percent without the Proposed Project (i.e., Future without Project) and 8 percent with the Proposed Project. A hypothetical doubling of traffic would increase the noise level by 3 dBA. As the projected increase in private vehicle trips is substantially less than double, impacts to overall ambient noise levels from increases in private vehicles would be ***less than significant.***

Buses

The Proposed Project includes a number of improvements to bus service, including center-running BRT on Lincoln Boulevard and Sepulveda Boulevard, curb-running BRT on other corridors, expanded service routes and frequency, and other improvements. The frequency of activity on new and improved bus routes has not been determined. For purposes of this EIR, it is assuming that the frequency of bus service would double in the project area. A doubling of bus service could result in higher noise levels than levels associated with vehicular traffic. The overall effect of the bus improvements would likely not result in significant impacts at sensitive receptors. However, it is possible that curb-running BRT could increase noise levels at some sensitive land uses by more than 3 dBA.

The level of noise that would be generated by buses would vary depending upon the fuel source, which could include conventional diesel, diesel-electric hybrid, compressed natural gas (CNG), electric trolleybus with overhead catenary, and battery-electric. Some of these, in particular battery-electric buses, are not currently in widespread use. Noise generated by buses varies depending upon the phase of operations (e.g., idle, acceleration, wide-open-throttle, etc.) and the speed at which the bus is traveling. When idling, the differences in noise emissions from conventional diesel, diesel-electric hybrid, and CNG buses are small (0 to 2 dBA). Under wide-open-throttle, the differences between hybrid buses and conventional buses are greater (7 dBA). Some studies have shown CNG buses to be louder than conventional and hybrid buses. Noise level differences are greatest under low speed (below 40 mph); at speeds of 40 mph and above, noise from the interaction between tires and pavement dominate bus noise, and the maximum levels of noise between the various technologies show less variation. Electric trolleybuses have notably lower noise levels than other technologies; battery-electric buses would be expected to be similar, or even less noisy, than electric trolleybuses (Ross and Staiano, 2007).

For purposes of this EIR, it is conservatively estimated that the buses that would be in operation would be conventional diesel or CNG buses. As noted above, curb-running BRT could increase noise levels at some sensitive land uses by more than 3 dBA. Therefore, noise levels from improvements to bus service, particularly curb-running BRT, would be a potentially ***significant impact.***

Pedestrian and Bicyclists

The Proposed Project includes enhanced pedestrian and bicycle facilities. Implementation of these projects would expose increased numbers of pedestrians and cyclists to vehicle noise. This noise exposure would be similar to existing roadway noise levels experienced by cyclists and pedestrians in the project area. The fact that increased numbers of pedestrians and cyclists would be exposed to vehicle noise would not, by itself, constitute a significant impact because (1) it would be an impact from the environment on the project and (2) because it does not exceed the adopted threshold. This is a ***less than significant impact.***

Mitigation Measures

Construction

Mitigation Measure (MM)-N-1: Construction Noise. Prior to construction, a noise control plan (NCP) shall be developed by a qualified noise specialist, as approved by the City of Los Angeles Department of Building and Safety. The NCP shall identify the procedures for predicting construction noise levels at sensitive receptors and shall describe the reduction measures required to minimize construction noise. Construction activity lasting more than one day and increasing ambient noise by more than 10 dBA or more at a noise sensitive use, or resulting in increases in ambient noise of 5 dBA or more at a noise sensitive use more than ten days in a three-month period, shall incorporate noise-reducing measures. These measures may include, but are not limited to:

- Install temporary sound barriers (e.g., soundwall) between the construction site and sensitive receptors and/or place portable sound blankets around sandblasting and jackhammering operations, as well as around construction activities that involve vibratory rollers.

- Equip construction equipment with the most effective locally available commercial mufflers, along with any other suitable noise attenuation devices (e.g., acoustically attenuating shields, shrouds, or enclosures). Contractor shall be responsible for maintaining equipment consistent with the manufacturers' standards to assure that no additional noise would be generated due to improperly maintained and worn parts.

- Scheduling operations of high impact equipment (e.g., pile driver, vibratory roller, tractor/loader/backhoe, haul trucks) during the middle of the day so as to reduce early morning and late evening impacts when residents are likely to be home;
- Placing stationary construction equipment (e.g., compressors, generators) as far away from sensitive land uses, as feasible;
- Unnecessary idling of equipment and vehicles shall be prohibited. Idling of haul trucks shall be limited to five minutes or less, as required by the South Coast Air Quality Management District rules;
- The public shall be kept informed of the construction hours and days, especially those of pile driving. The public information shall provide contact information for complaints. Noise complaints shall be logged and construction activities shall be evaluated to determine if additional noise mitigation is necessary and feasible;
- A pre-construction meeting with contractors and project managers shall be conducted to confirm that noise mitigation procedures are in place.

Operation

There are no feasible mitigation measures to reduce the potential noise impact associated with increased bus service. Reducing bus frequency is not considered to be feasible because reduced frequency would not meet the primary project objectives, which include providing transportation options and accommodations for multiple modes of travel, including transit (i.e., buses), and producing fewer auto trips per capita. Replacing all buses with quieter vehicles such as electric trolleybuses or battery-electric buses is also not considered to be a feasible mitigation measure. Electric trolleybuses would require a substantial amount of new infrastructure, including exclusive right-of-way. Implementing electric trolleybus service would result in new environmental impacts not associated with the Proposed Project. Battery-electric buses are not yet widely in use. It is not technologically feasible at this time to consider an all-battery-electric bus fleet as mitigation for potential noise impacts.

Significance of Impacts After Mitigation

Construction

Implementation of mitigation measure MM-N-1 would reduce construction noise to the extent feasible. Sound barriers are effective in reducing sound levels by 3 dBA up to 15 dBA. However, if a barrier is not able to break the line-of-sight from the source to the receiver, its effectiveness is greatly reduced. Due to the proximity of some of the improvements to nearby sensitive receptors, it is expected that sound walls would only be effective in reducing construction noise impacts at the ground level of nearby buildings. It would not be technically feasible to construct a noise barrier that would effectively reduce the construction-related noise at the upper floors of nearby apartment buildings or multi-story homes. Noise level reductions attributable to noise shielding, muffling device, and limited idling, although not easily quantifiable, would also reduce noise impacts associated with construction activities to the extent practicable. Noise impacts associated with the majority of the construction activities would be infrequent and of short duration and would only affect a small number of sensitive receptors. As noted above, implementation of MM-N-1 would reduce noise impacts associated with project construction activities to the extent feasible; however, even with mitigation, impacts at some locations would remain ***significant and unavoidable***.

Operation
Impacts from private vehicular use would be ***less than significant***.

As there are no feasible mitigation measures to reduce bus frequency or to replace the bus fleet, noise impacts from buses associated with the Proposed Project are considered to be ***significant and unavoidable.***

Impact 4.5-2: Implementation of the Proposed Project would expose persons to or generate excessive groundborne vibration or groundborne noise levels. This would be a *less than significant* impact for operations and *a significant and unavoidable impact* for construction.

Construction

Construction of the proposed transportation improvements may result in temporary increases in vibration. Implementation of these transportation improvement projects would be subject to available funding collected through the proposed Transportation Impact Assessment (TIA) fees, which would be dependent on the rate of development within the project area, as well as funding obtained from other sources; therefore, the implementation schedules and specific designs of these transportation improvement projects are not yet available. Instead, potential vibration impacts were estimated based on anticipated construction activity.

Construction equipment, such as dozers and hammers, could generate vibrations that may affect nearby structures and sensitive receptors. As described above, it was assumed that construction of a typical improvement project would involve a front end loader, a truck, a jackhammer, a concrete mixer, and a paver. The higher intensity construction projects were assumed to require additional construction equipment. A list of construction equipment assumed for these projects is provided in Table 4.1-8 in Section 4.1, *Air Quality*. In addition to the equipment listed in this table, for purposes of the noise analysis, it was assumed that construction of the Lincoln Bridge Enhancement Project could involve a drill or hammer type of pile driving.

Vibration Resulting in Human Annoyance

Table 4.5-16 summarizes the total rms vibration levels produced by the equipment associated with construction of the Lincoln Boulevard and Sepulveda Boulevard BRT platforms and the I-10 Ramp Reconfiguration at Bundy Drive. As shown in the table, typical maximum vibration at 175 feet associated with these projects would be 72 VdB, which is equivalent to the significance threshold associated with frequent events. If the heavy construction activities, such as construction of BRT platforms or demolition of the existing I-10 off-ramps at Bundy Drive, were to occur less than 175 feet from a residence, the human annoyance vibration threshold for frequent events would be exceeded. This would be a potentially ***significant impact.***

Table 4.5-16 Center-Running BRT Station and Bundy Drive/I-10 Ramp Construction Vibration Levels

	Typical Vibration Levels (VdB)		
Phases	**50 feet**	**100 feet**	**175 feet**
Grubbing/Land Clearing	77	68	61
Grading/Excavation	88	79	72
Drainage/Utilities/Subgrade	77	68	61
Paving	88	79	72

Source: CDM Smith, 2015.

Key:
VdB = decibel vibration velocity level

In addition to the construction equipment associated with the Lincoln Boulevard and Sepulveda Boulevard BRT platforms and the I-10 Ramp Reconfiguration at Bundy Drive, construction of the Lincoln Boulevard Bridge Enhancement may also require pile driving. As noted previously, the closest receptor during pile driving activities would be 100 feet or more from the construction site. **Table 4.5-17** summarizes the total rms vibration level produced by the equipment associated with the Lincoln Boulevard Bridge Enhancement. As shown in the table, if pile driving were used for the Lincoln Boulevard Bridge Enhancement, vibration levels could result in an Lv of approximately 87 VdB at the nearest residential receptor. Sensitive receptors that are located less than 315 feet from the pile driving activity would experience vibration levels exceeding the human annoyance threshold. Although pile driving, if used at all, would be infrequent, vibration levels associated with human annoyance could result in significant impacts to the closest residences. Where Lincoln Blvd south of the bridge would require widening, then other equipment that may be used for construction would result in vibration levels of 75 to 86 VdB at the closest receptor distance of 60 feet. Because the project has the potential to result in vibration levels that would exceed thresholds for human annoyance, vibration associated with construction of the Lincoln Boulevard Bridge Enhancement would be a potentially ***significant impact.***

Table 4.5-17 Lincoln Boulevard Bridge Enhancement Construction Vibration Levels

	Typical Vibration Levels (VdB)		
Phases	**60 feet[1]**	**100 feet**	**315 feet**
Grubbing/Land Clearing	75	68	53
Grading/Excavation	86	87[2]	72[2]
Drainage/Utilities/Subgrade	75	68	53
Paving	86	79	64

Source: CDM Smith, 2015.

Notes:
1. Vibration levels at 60 feet would be associated with widening of Lincoln Boulevard south of the bridge, which would not involve pile driving. The closest receptor during pile driving activities would be 100 feet or more from the construction site.
2. Includes pile driving.

Key:
VdB = decibel vibration velocity level

Table 4.5-18 summarizes the vibration levels produced by trucks and jackhammers that may be used to construct other transportation improvements. When combined, a truck and a jackhammer would result in a vibration level of 78 VdB at 50 feet. As shown in the table, construction activities associated with these transportation improvements that are located 81 feet or less from a sensitive land use would exceed the human annoyance vibration threshold for frequent events. This would be a potentially ***significant impact.***

Table 4.5-18 Other Transportation Improvements Construction Vibration Levels

	Typical Vibration Levels (VdB)		
Equipment Type	**50 feet**	**75 feet**	**81 feet**
Truck	77	72	71
Jackhammer	70	65	64
Combined Truck & Jackhammer[1]	78	72	71

Source: CDM Smith, 2015.

Note:

1. Trucks and jackhammers are likely to operate simultaneously and would result in higher vibration levels than combinations of other equipment, such as a concrete mixer and a paver. Combined vibration levels from a truck and a jackhammer are used to represent the highest noise level associated with other transportation improvement projects.

Key:
VdB = decibel vibration velocity level

Vibration Impacts to Structures

Table 4.5-19 summarizes the peak vibration level produced by each equipment type. For purposes of this EIR, a threshold of 0.3 ppv is used to determine the significance of vibration impacts to structures. The table identifies the distances beyond which structural vibration damage criteria of 0.3 in/sec would not be exceeded. Typical improvement projects that utilize typical construction equipment would likely not result in significant vibration at nearby structures. As indicated in Table 4.5-19, structures would need to be located less than 6 feet from a jackhammer, less than 10 feet from a truck, and less than 20 feet from a vibratory roller for the threshold to be exceeded. It is not anticipated that construction activities would occur within these distances from buildings. Vibration associated with pile driving would be greater than that associated with typical construction equipment. However, if it were used, pile driving associated with the Lincoln Boulevard Bridge Enhancement would occur more than 100 feet from the nearest residence. At this distance, vibration impacts to the nearest structures would not exceed the significance thresholds for structural vibration damage. Therefore, structural vibration impacts would be ***less than significant.***

Table 4.5-19 Typical Construction Equipment Peak Vibration Levels

	Typical Peak Vibration Levels (in/sec)			Distance (feet) beyond which structural vibration damage criteria of 0.3 in/sec would not be exceeded
Equipment Type	**25 feet**	**50 feet**	**75 feet**	
Trucks	0.076	0.027	0.015	10
Jackhammers	0.035	0.012	0.007	6
Vibratory Roller	0.210	0.074	0.040	20
Pile Driving	0.644	0.228	0.124	42

Source: City of Los Angeles, 2006; CDM Smith, 2015.

Key:
in/sec = inches per second

Operation

Operation of the Proposed Project would not involve any stationary sources of vibration. Vehicular traffic could generate vibration during operation. As described in Section 4.5.3.1, typical vibration from road traffic is near the threshold of perception for humans. Therefore, vibration impacts associated with project operation would be ***less than significant***.

Mitigation Measures

Construction

MM-N-2: **Construction Vibration**. An evaluation of project-specific vibration levels shall be completed by a qualified vibration specialist, as determined by the City of Los Angeles Department of Building and Safety for any project that is less than 81 feet from a residence. Vibration reducing measures, such as use of lighter weight equipment or use of equipment that produces less vibration, shall be implemented for potentially significant vibration impacts, if technically feasible. In addition, operation of high vibration impact equipment in proximity to sensitive receptors shall be scheduled during the middle of the day so as to reduce human annoyance in the early morning and late evening when residents are likely to be home.

Operation

No mitigation measures are required.

Significance of Impacts After Mitigation

Construction

The Proposed Project would not result in significant vibration impacts to structures.

Human annoyance impacts from vibration associated with the majority of construction activities would be infrequent and of short duration and would only affect a small number of sensitive receptors. Implementation of mitigation measure MM-N-2 is anticipated to reduce human annoyance impacts associated with vibration to the extent feasible; however, even with mitigation, vibration impacts at some locations would remain ***significant and unavoidable.***

Operation

Impacts from vibration associated with operations would be ***less than significant***.

Impact 4.5-3: Implementation of the Proposed Project would result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. This would be a *significant and unavoidable impact*.

Permanent increases in ambient noise levels associated with project operations are addressed in Impact 4.5-1. As identified in that analysis, impacts associated increases in ambient noise levels associated with proposed roadway, bicycle, and pedestrian improvements would be less than significant. However, the increased frequency of bus service associated with the Proposed Project could result in a permanent increase in ambient noise levels that would exceed 3 dBA. This would be a ***significant impact***.

Mitigation Measures

There are no feasible mitigation measures to reduce the potential noise impact associated with increased bus service. Reducing bus frequency is not considered to be feasible because reduced frequency would not meet the primary project objectives, which include providing transportation options and accommodations for multiple modes of travel, including transit (i.e., buses), and producing fewer auto trips per capita.

Significance of Impacts After Mitigation

As there are no feasible mitigation measures to reduce bus frequency, noise impacts from buses associated with the Proposed Project are considered to be ***significant and unavoidable***.

Impact 4.5-4: Implementation of the Proposed Project would result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. This impact would be *significant and unavoidable*.

Temporary or periodic increases in ambient noise levels associated with project construction are addressed in Impact 4.5-1. As identified in that analysis, construction of the proposed transportation improvements could exceed ambient noise levels by 10 dBA or more for more than one day at a noise sensitive use. In addition, construction activities associated with some of the proposed improvements, including the Lincoln Boulevard Bridge Enhancement, the Lincoln Boulevard and Sepulveda Boulevard BRTs, and the I-10 Ramp Reconfiguration at Bundy Drive, could exceed existing ambient noise levels by 5 dBA or more at a noise sensitive use for more than ten days over a three month period. These temporary and periodic increases in ambient noise levels would be a potentially ***significant impact***.

Mitigation Measures

Mitigation measure MM-N-1 is recommended to reduce construction-related noise.

Significance of Impacts After Mitigation

As discussed in Impact 4.5-1, implementation of mitigation measure MM-N-1 would reduce construction noise to the extent feasible. Moreover, noise impacts associated with the majority of the construction activities would be infrequent and of short duration and would only affect a small number of sensitive receptors. However, even with mitigation, impacts at some locations would remain ***significant and unavoidable***.

Impact 4.5-5: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, implementation of the Proposed Project would not expose people residing or working in the study area to excessive noise levels. This would be a *less than significant impact* for construction and operations.

Construction

Construction workers associated with the Proposed Project would be located within two miles of LAX, Hawthorne Airport, and Santa Monica Airport. Construction activity would not occur on airport property, and airport-related noise levels would be less than construction noise levels. Construction workers would not be exposed to excessive airport noise and, therefore, impacts would be ***less than significant***.

Operation

The Proposed Project would not change land uses in the project area. Therefore, the project would not expose residents to excessive airport-related noise. This impact is ***less than significant.***

Mitigation Measures

No mitigation measures are required.

Significance of Impacts After Mitigation

The Proposed Project would not have any significant impacts relative to excessive noise levels from a public airport. This impact is ***less than significant.***

Impact 4.5-6: For a project within the vicinity of a private airstrip, implementation of the Proposed Project would not expose people residing or working in the study area to excessive noise levels. There would be *no impact*.

There are no private airstrips located in the vicinity of the study area. Therefore, there would be ***no impact*** associated with excessive noise levels from a private airstrip.

Mitigation Measures

No mitigation measures are required.

Significance of Impacts After Mitigation

The Proposed Project would not have any significant impacts relative to excessive noise levels from a private airstrip. There are no private airstrips located in the vicinity of the study area. Therefore, there would be ***no impact*** associated with excessive noise levels from a private airstrip.