SUBCHAPTER 3.7

NOISE

3.7 NOISE

3.7.1 Introduction

The environmental setting section describes the noise, and noise sources in the Basin, which includes Orange County and portions of Los Angeles, Riverside and San Bernardino Counties.

Sound waves, traveling outward from a source, exert a sound pressure level (commonly called "sound level"), measured in decibels (dB). "Noise" is often defined as unwanted sound, and environmental noise is usually measured in "A-weighted" decibels, which is a decibel corrected for the variation in frequency response of the typical human ear at commonly-encountered noise levels. All noise levels discussed herein reflect A-weighted decibels. In general, people can perceive a two- to three-dB difference in noise levels; a difference of 10 dB is perceived as a doubling of loudness.

3.7.2 Regulatory Setting

The federal government sets noise standards for transportation-related noise sources that are closely linked to interstate commerce, such as aircraft, locomotives, and trucks, and, for those noise sources, the state government is preempted from establishing more stringent standards. The state government sets noise standards for those transportation noise sources that are not preempted from regulation, such as automobiles, light trucks, and motorcycles. Noise sources associated with industrial, commercial, and construction activities are generally subject to local control through noise ordinances and general plan policies.

3.7.2.1 Federal Agencies and Regulations

3.7.2.1.1 Code of Federal Regulations (CFR)

Federal regulations for railroad noise are contained in 40 CFR Part 201 and 49 CFR Part 210. The regulations set noise limits for locomotives and are implemented through regulatory controls on locomotive manufacturers.

Federal regulations also establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 CFR Part 205, Subpart B. The federal truck pass-by noise standard is dB at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers. The Federal Highway Administration (FHWA) regulations for noise abatement must be considered for federal or federally-funded projects involving the construction of a new highway or significant modification of an existing freeway when the project would result in a substantial noise increase or when the predicted noise levels approach or exceed the "Noise Abatement Criteria."

Under the regulations, a "substantial increase" is defined as an increase in Equivalent Continuous Level (Leq) of 12 dB during the peak hour of traffic noise. The Leq provides a time weighted average of the noise measured. For sensitive uses, such as residences, schools, churches, parks, and playgrounds, the Noise Abatement Criteria for interior and exterior spaces is Leq 57 and 66 dB, respectively, during the peak hour of traffic noise.

3.7.1.1.2 Federal Transit Administration (FTA)

The Federal Transit Administration has prepared guidance noise and vibration impacts assessments for proposed mass transit projects: Transit Noise and Vibration Impact Assessment (U.S. FTA, 2006). The May 2006 version is the second edition of a guidance manual originally issued in 1995, which presented procedures for predicting and assessing noise and vibration impacts of proposed mass transit projects. The guidance is required to evaluate the noise and vibration impacts in environmental review process for project proponents seeking funding from FTA. All types of bus and rail projects are covered. The guidance contains procedures for assessing impacts at different stages of project development, from early planning before mode and alignment have been selected through preliminary engineering and final design. The focus is on noise and vibration impacts during operations, but construction impacts are also covered. The guidance describes a range of measures for controlling excessive noise and vibration.

3.7.2.1.3 Federal Aviation Administration (FAA)

Aircraft operated in the U.S. are subject to certain federal requirements regarding noise emissions levels. These requirements are set forth in Title 14 of the Code of Federal Regulations (14 CFR), Part 36. Part 36 establishes maximum acceptable noise levels for specific aircraft types, taking into account the model year, aircraft weight, and number of engines. Pursuant to the federal Airport Noise and Capacity Act of 1990, the FAA established a schedule for complete transition to Part 36 "Stage 3" standards by year 2000. This transition schedule applies to jet aircraft with a maximum takeoff weight in excess of 75,000 pounds and, thus, applies to passenger and cargo airlines but not to operators of business jets or other general aviation aircraft.

3.7.2.1.4 Federal Railroad Administration (FRA)

On March 24, 2009, the Federal Highway Administration (FHA) and the FTA final rule that modified FRA regulations to make certain changes mandated by the Safe, Accountable, Flexible, Efficient, Transportation, Equity Act: A Legacy for Users (SAFETEA-LU). The SAFETEA-LU prescribes requirements for environmental review and project decision making. This rule became effective April 23, 2009.

3.7.2.1.5 Department of Housing and Urban Development (HUD)

The noise regulation 24 CFR Part 51 Subpart B, Noise Abatement and Control presents the HUD noise program. Within the HUD Noise Assessment Guidelines, potential noise sources are examined for projects located within 15 miles of a military or civilian airport, 1,000 feet from a road or 3,000 feet from a railroad. HUD exterior noise regulations state that 65 dBA DNL noise levels or less are acceptable for residential land uses and noise levels exceeding 75 dBA DNL are unacceptable. HUD's regulations do not contain standards for interior noise levels. A goal of 45 decibels is set forth for interior noise and the attenuation requirements are based upon this level. HUD's standards assume that internal noise levels would be met if exterior standard are met under standard construction practices.

3.7.2.1.6 Federal Vibration Policies

The FRA and FTA have published guidance relative to vibration impacts. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. 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. The decibel notation, VdB, is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration.

According to the FRA, fragile buildings can be exposed to groundborne vibration levels of 0.5 inches per second PPV without experiencing structural damage. The FTA has identified the human annoyance response to vibration levels as 80 VdB (U.S. FTA, 2006).

3.7.2.2 State Agencies and Regulations

3.7.2.2.1 California's Airport Noise Standards

The State of California's Airport Noise Standards, found in Title 21 of the California Code of Regulations, identify a noise exposure level of Community Noise Equivalent Level (CNEL) 65 dB as the noise impact boundary around airports. CNEL measurements are a weighted average of sound levels gathered throughout a 24-hour period. The noise between 7:00 p.m. and 10:00 p.m. is increased by five dB and the hours of 10:00 p.m. and 7:00 a.m. is increased by 10 dB. This takes into account the decrease in community background noise of during evening and nighttime hours.

Within the noise impact boundary, airport proprietors are required to ensure that all land uses are compatible with the aircraft noise environment or the airport proprietor must secure a variance from the California Department of Transportation.

3.7.2.2.2 California Department of Transportation (Caltrans)

The State of California establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the state pass-by standard is consistent with the federal limit of 80 dB. The state pass-by standard for light trucks and passenger cars (less than 4.5 tons gross vehicle rating) is also 80 dB at 15 meters from the centerline. For new roadway projects, Caltrans employs the Noise Abatement Criteria, discussed above in connection with the FHWA.

3.7.2.2.3 California Noise Insulation Standards

The California Noise Insulation Standards found in the California Code of Regulations, Title 24, set requirements for new multi-family residential units, hotels, and motels that may be subject to relatively high levels of transportation-related noise. For exterior noise, the noise insulation standard is DNL 45 dB in any habitable room and requires an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than DNL 60 dB. DNL is the average noise level over a 24 hour period. The noise between the hours of 10:00 p.m. and 7:00 a.m. is artificially increased by 10 dB. This takes into account the decrease in community background noise during nighttime hours.

3.7.2.2.4 State Vibration Policies

There are no adopted state policies or standards for ground-borne vibration. However, Caltrans recommends that extreme care be taken when sustained pile driving occurs within 7.5 meters (25 feet) of any building, and 15 to 30 meters (50 to 100 feet) of a historic building or a building in poor condition.

3.7.2.3 Local Agencies and Regulations

To identify, appraise, and remedy noise problems in the local community, each county and city within the district has adopted a noise element as part of its General Plan. Each noise element is required to analyze and quantify current and projected noise levels associated with local noise sources, including, but not limited to, highways and freeways, primary arterials and major local streets, rail operations, air traffic associated with the airports, local industrial plants, and other ground stationary sources that contribute to the community noise environment. Beyond statutory requirements, local jurisdictions are free to adopt their own goals and policies in their noise elements, although most jurisdictions have chosen to adopt noise/land use compatibility guidelines that are similar to those recommended by the state. The overlapping DNL ranges indicate that local conditions (existing noise levels and community attitudes toward dominant noise sources) should be considered in evaluating land use compatibility at specific locations.

In addition to regulating noise through noise element policies, local jurisdictions regulate noise through enforcement of local ordinance standards. These standards generally relate to noisy activities (e.g., use of loudspeakers and construction) and stationary noise sources and facilities (e.g., air conditioning units and industrial activities). Two cities within the district, Los Angeles and Long Beach, operate port facilities. Noise from the Ports of Los Angeles and Long Beach are regulated by the noise ordinances and noise elements of the Los Angeles and Long Beach General Plans.

In terms of airport noise, some of the actions that airport proprietors have been allowed to take to address local community noise concerns include runway use and flight routing changes, aircraft operational procedure changes, and engine run-up restrictions. These actions generally are subject to approval by the FAA, which has the authority and responsibility to control aircraft noise sources, implement and enforce flight operational procedures, and manage the air traffic control system

3.7.3 Environmental Setting

3.7.3.1 Noise Descriptors

Environmental noise levels typically fluctuate across time of day; different types of noise descriptors are used to account for this variability, and different types of descriptors have been developed to differentiate between cumulative noise over a given period and single noise events. Cumulative noise descriptors include the Leq, DNL, and CNEL. The Leq is the actual time-averaged, equivalent steady-state sound level, which, in a stated period, contains the same acoustic energy as the time-varying sound level during the same period. DNL and CNEL values result from the averaging of Leq values (based on A-weighted decibels) over a 24-hour period, with weighting factors applied to different periods of the day and night to account for their perceived relative annoyance. For DNL, noise that occurs during the nighttime period (10:00 p.m. to 7:00 a.m.) is "penalized" by 10 dB. CNEL is similar to DNL, except that it also includes a "penalty" of approximately five dB for noise that occurs during the evening period (7:00 p.m. to 10:00 p.m.). Cumulative noise descriptors, DNL and CNEL, are well correlated with public annoyance due to transportation noise sources. Table 3.12-1 shows the compatibility between various land uses and CNEL.

Individual noise events, such as train pass-bys or aircraft overflights, are further described using single-event and cumulative noise descriptors. For single events, the maximum measured noise level (Lmax) is often cited, as is the Sound Exposure Level (SEL). The SEL is the energy-based sum of a noise event of given duration that has been "squeezed" into a reference duration of one second and is typically a value that is five to 10 dB higher than the Lmax.

3.7.3.2 Vibration Measuring and Reporting

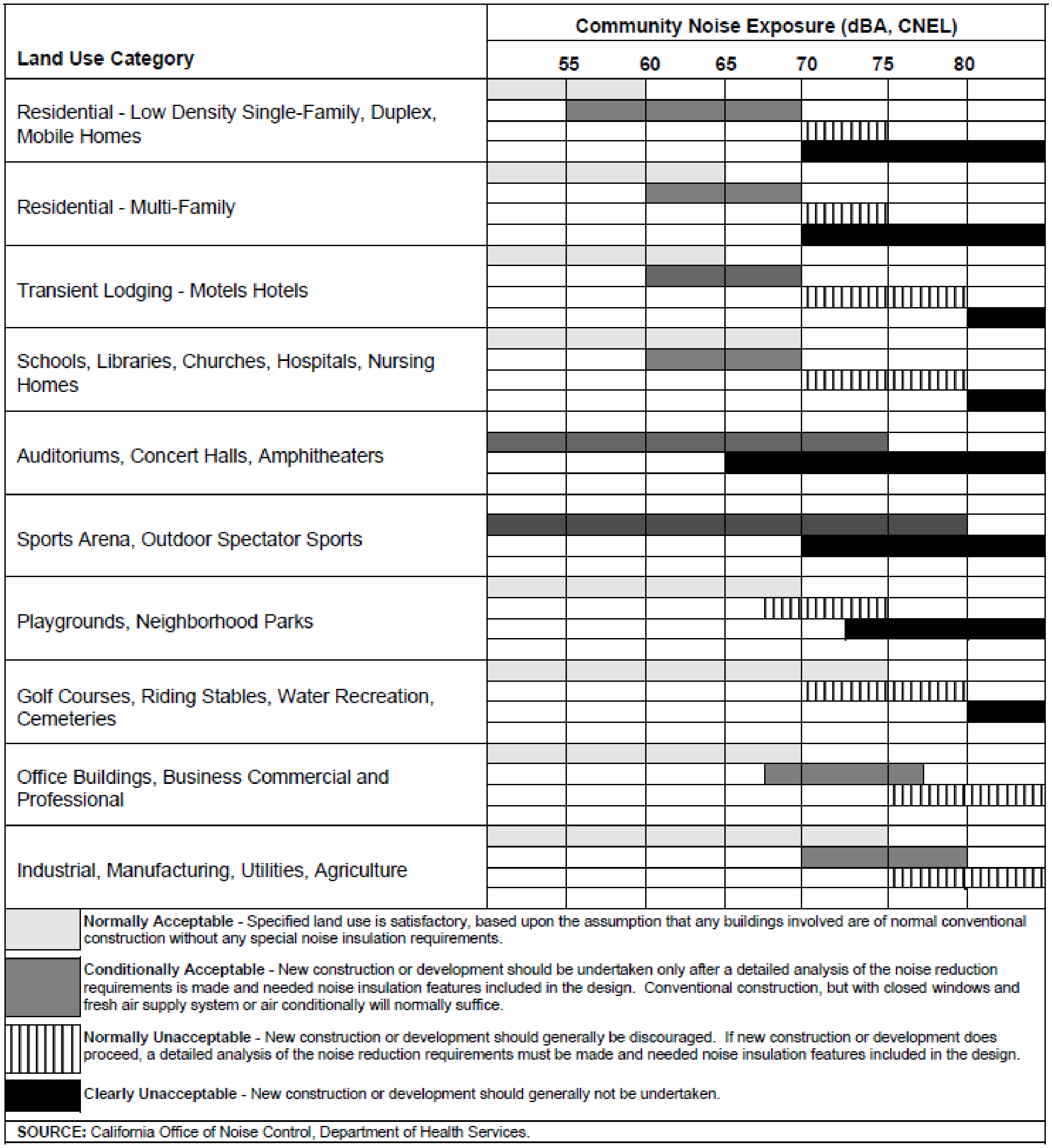
Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. The FTA Assessment states that background vibration velocity levels in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans which is around 65 VdB. The upper range for rapid transit vibration is around 80 VdB and the high range for commuter rail vibration is 85 VdB (U.S. FTA, 2006).

The FTA Assessment states that in contrast to airborne noise, ground-borne vibration is not a common environmental problem. Although the motion of the ground may be noticeable to people outside structures, without the effects associated with the shaking of a structure, the motion does not provoke the same adverse human reaction to people outside. Within structures, the effects of ground-borne vibration include noticeable movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. The maximum vibration amplitudes of the floors and walls of a building often will be at the resonance frequencies of various components of the building. However, the FTA Assessment states that noticeable vibration inside a building is typically caused by equipment or activities within the building itself, such as heating and ventilation systems, footsteps or doors closing.

FTA Assessment states that it is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. However, some common sources of vibration are trains, buses on rough roads, and construction activities, such as blasting, pile driving, and heavy earth-moving equipment.

TABLE 3.7-1

Noise Land Use Compatibility Matrix



Vibration can be a serious concern, causing buildings to shake and rumbling sounds to be heard. Several different methods are used to quantify vibration. High levels of vibration may cause physical personal injury or damage to buildings. However, groundborne vibration levels rarely affect human health. Instead, most people consider groundborne vibration to be an annoyance that may affect concentration or disturb sleep. In addition, high levels of groundborne vibration may damage fragile buildings or interfere with equipment that is highly sensitive to groundborne vibration (e.g., electron microscopes).

3.7.3.3 Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others due to the amount of noise exposure (in terms of both exposure time and "insulation" from noise) and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, natural areas, parks and outdoor recreation areas are generally more sensitive to noise than are commercial and industrial land uses. Consequently, the noise standards for sensitive land uses are more stringent than those for less sensitive uses, such as commercial and industrial.

To protect various human activities and sensitive land uses (e.g., residences, schools, and hospitals) lower noise levels are needed. A noise level of 55 to 60 dB DNL outdoors is the upper limit for intelligible speech communication inside a typical home. In addition, social surveys and case studies have shown that complaints and community annoyance in residential areas begin to occur at 55 dB DNL. Sporadic complaints associated with the 55 to 60 dB DNL range give way to widespread complaints and individual threats of legal action within the 60 to 70 dB DNL range. At 70 dB DNL and above, residential community reaction typically involves threats of legal action and strong appeals to local officials to stop the noise.

3.7.3.4 Noise Sources

Many principal noise generators within the district are associated with transportation (e.g., airports, freeways, arterial roadways, seaports, and railroads). Additional noise generators include stationary sources, such as industrial manufacturing plants and construction sites. Local collector streets are not considered to be a significant source of noise since traffic volume and speed are generally much lower than for freeways and arterial roadways. Generally, transportation-related noise sources characterize the ambient noise environment of an area.

3.7.3.4.1 Airports

The Southern California Association of Governments (SCAG) region contains six established airports, including Los Angeles International (LAX), Bob Hope (formerly Burbank), John Wayne, Long Beach, Ontario, and Palm Springs. There are also four new and emerging airports in the Inland Empire and North Los Angeles County. These include San Bernardino International Airport (formerly Norton Air Force Base [AFB]), March Inland Port (joint use with March Air Reserve Base), Southern California Logistics Airport (formerly George AFB), and Palmdale Airport (joint use with Air Force Plant 42).

3.7.3.4.2 Freeways and Arterial Roadways

The SCAG region has over 20,717 centerline (route) miles and over 64,771 lane-miles of roadways, including one of the most extensive High-Occupancy Vehicle (HOV) lane systems in the country (U.S. FTA, 2006). Additionally, the SCAG region has a growing network of tolled lanes and High-Occupancy Toll (HOT) lanes. Regionally significant arterials provide access to the freeway system and often serve as parallel alternate routes; in some cases, they are the only major system of transportation available to travelers.

The extent to which traffic noise levels affect sensitive land uses depends upon a number of factors. These include whether the roadway itself is elevated above grade or depressed below grade, whether there are intervening structures or terrain between the roadway and the sensitive uses, and the distance between the roadway and such uses. For example, measurements show that depressing a freeway by approximately 12 feet yields a reduction in traffic noise relative to an at-grade freeway of seven to 10 dB at all distances from the freeway. Traffic noise from an elevated freeway is typically two to 10 dB less than the noise from an equivalent at-grade facility within 300 feet of the freeway, but beyond 300 feet, the noise radiated by an elevated and at-grade freeway (assuming equal traffic volumes, fleet mix, and vehicle speed) is the same (U.S. FTA, 2006).

Additionally, the SCAG region has an enormous number of arterial roadways. Typical arterial roadways have one or two lanes of traffic in each direction, with some containing as many as four lanes in each direction. Noise from these sources can be a significant environmental concern where buffers (e.g., buildings, landscaping, etc.) are inadequate or where the distance from centerline to sensitive uses is relatively small. Given typical daily traffic volumes of 10,000 to 40,000 vehicle trips, noise levels along arterial roadways typically range from 65 to 70 dB DNL at a distance of 50 feet from the roadway centerlines.

3.7.3.4.3 Railroad Operations

Railroad operations generate high, relatively brief, intermittent noise events. These noise events are an environmental concern for sensitive uses located along rail lines and in the vicinities of switching yards. Locomotive engines and the interaction of steel wheels and rails primarily generate rail noise. The latter source creates three types of noise: 1) rolling noise due to continuous rolling contact, 2) impact noise when a wheel encounters a rail joint, turnout or crossover, and 3) squeal generated by friction on tight curves. For very high speed rail vehicles, air turbulence can be a significant source of noise as well. In addition, use of air horns and crossing bell gates contribute to noise levels in the vicinity of grade crossings (U.S. FTA, 2006).

3.7.3.4.4 Freight Trains

Noise levels generated by freight train pass-by events reflect locomotive engine noise and rail car wheel rail interaction. The former depends upon track grade conditions (e.g., uphill versus downhill) and is largely independent of speed, whereas the latter is highly speed dependent, increasing approximately six dB for each doubling of train velocity (SCAG, 2008a). In addition to noise, freight trains also generate substantial amounts of ground-borne noise and vibration in the vicinity of the tracks. Ground-borne noise and vibration is a function of both the quality of the track and the operating speed of the vehicles.

The SCAG region has an extensive network of railroad lines belonging primarily to two major railroads: Union Pacific Railroad (Union Pacific) and Burlington Northern Santa Fe Railway (BNSF). SCAG's Inland Empire Railroad Main Line Study suggest that the number of freight trains on most BNSF and UP lines will more than double between 2000 and 2025 in response to a tripling of container volume at the San Pedro Bay Ports. A rail line supporting 40 freight trains per day generates approximately 75 dB DNL at 200 feet from the tracks. BNSF rail lines extend south from switching yards in eastern Los Angeles to the Los Angeles and Long Beach ports complex and east to Arizona and points beyond via San Bernardino County. BNSF generates approximately 75 dB DNL at a distance of 200 feet from the tracks (SCAG, 2008a).

3.7.3.4.5 Commuter and Inter-City Passenger Trains

In general, the noise generated by commuter rail facilities (powered by either diesel or electric locomotives) is from the locomotives themselves. In the district, there are two commuter and inter-city passenger train operators: AMTRAK and the Southern California Regional Rail Authority/Metrolink. AMTRAK operates trains with destinations in Seattle, Chicago, Orlando, San Diego, and San Luis Obispo. A typical AMTRAK pass-by event generates 107 dB SEL at 50 feet (SCAG, 2008a); two such events during the daytime or evening periods generate approximately 61 dB DNL at 50 feet and approximately 52 dB DNL at 200 feet. Nine such events generate approximately 67 dB DNL at 50 feet and 58 dB DNL at 200 feet.

The Southern California Regional Rail Authority operates the Metrolink commuter rail system. This system currently includes seven rail lines, with destinations in Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties. Noise levels generated by Metrolink are similar to those associated with AMTRAK.

3.7.3.4.6 Steel Wheel Urban Rail Transit

Heavy rail is generally defined as electrified rapid transit trains with dedicated guideway, and light rail as electrified transit trains that do not require dedicated guideway. In general, noise increases with speed and train length. Sensitivity to rail noise generally arises when there is less than 50 feet between the rail and sensitive receptors. A significant percentage of complaints about noise can be attributed to the proximity of switches, rough or corrugated track, or wheel flats. Within the district, the Los Angeles County Metropolitan Transit Authority (Metro) provides urban rail transit service on four lines within Los Angeles County. The Blue Line extends from Long Beach to the 7th Street Metro Center in downtown Los Angeles. The Red Line connects Union Station with North Hollywood via the Metro Center, the Gold Line connects Union Station with Pasadena, and the Green Line extends from Redondo Beach to Norwalk. Other Metro operated urban transit systems include the Orange Line which connects with the northern terminus of the Red Line in North Hollywood and serves much of the northwestern portion of Los Angeles County, and the Eastside Gold Line Extension, which provides rail transit service to East Los Angeles.

3.7.3.4.7 Port Operations

The Ports of Long Beach and Los Angeles are major regional economic development centers. These ports currently handle approximately 40 percent of the volume imported into the country and approximately 24 percent of the nation’s exports. Noise is generated from four sources: ships using the port facilities, equipment associated with cargo activity within the port, and truck and rail traffic moving cargo to and from the ports. All sources affect the ambient noise levels in the port areas. Residential areas in San Pedro (City of Los Angeles) and West Long Beach are affected most by truck and rail traffic related to the ports.

The Alameda Corridor provides a substantial long-term reduction in noise and vibration associated with rail operations in the vicinities of the Ports of Long Beach and Los Angeles. The Alameda Corridor consolidates the operations of UP and BNSF on 90 miles of existing branch line tracks into one 20-mile corridor along Alameda Street. This corridor provides a direct connection between the ports of Long Beach and Los Angeles and the UP and BSNF switching yards in eastern Los Angeles. The Alameda Corridor includes four overpasses and three underpasses at intersections south of State Route 91 (SR-91) that allow vehicles to pass above the trains. North of SR-91, trains pass through a 10-mile, 33-foot-deep trench. The construction of tracks in a below-grade trench, track construction on new base materials, and the use of continuous welded track reduce noise impacts on adjacent uses from freight trains associated with the ports. Also, the Alameda Corridor includes sound walls in certain locations to mitigate vehicle noise along Alameda Street in residential neighborhoods and other sensitive areas.

3.7.3.4.8 Industrial, Manufacturing, and Construction

Noise from industrial complexes, manufacturing plants, and construction sites are characterized as stationary, or point, sources of noise even though they may include mobile sources, such as forklifts and graders. Local governments typically regulate noise from industrial, manufacturing, and construction equipment and activities through enforcement of noise ordinance standards, implementation of general plan policies, and imposition of conditions of approval for building or grading permits.

Industrial complexes and manufacturing plants are generally located away from sensitive land uses, and, as such, noise generated from these sources generally has less effect on the local community. In contrast to industrial and manufacturing plants, construction sites are located throughout the region and are often located within, or adjacent to, residential districts. In general, construction activities generate high noise levels intermittently on and adjacent to the construction sites, and the related noise impacts are short-term in nature. The dominant source of noise from most construction equipment is the engine, usually a diesel engine, with inadequate muffling. However, in a few cases, such as impact pile driving or pavement breaking, noise generated that activity dominates. Construction equipment can be considered to operate in two modes, stationary and mobile. Stationary equipment operates in one location for one or more days at a time, with either a fixed-power operation (pumps, generators, compressors) or a variable noise operation (pile drivers, pavement breakers). Mobile equipment moves around the construction site with power applied in cyclic fashion (bulldozers, loaders), or movement to and from the site (trucks) (SCAG, 2008a).

Construction-related noise levels generally fluctuate depending on the construction phase, equipment type and duration of use, distance between noise source and receptor, and presence or absence of barriers between noise source and receptor. Standard convention is that noise levels decrease by approximately six dB with each doubling of distance from the construction site (e.g., noise levels from excavation might be approximately 83 dB at 100 feet from the site, and so the noise level at 200 feet from the site would be about 77 dB). Interior noise levels from construction are approximately 10 dB (open windows) to 20 dB (closed windows) less than exterior noise levels due to the attenuation provided by building facades (SCAG, 2008a).

3.7.3.5 Existing Vibration Sources

Similar to the environmental setting for noise, the vibration environment is typically dominated by traffic from nearby roadways and activity on construction sites. Heavy trucks can generate groundborne vibrations that vary depending on vehicle type, weight, and road/pavement conditions. Heavy trucks typically operate on major streets. Nonetheless, vibration levels adjacent to roadways are typically not perceptible.