NOISE IMPACT ASSESSMENT

FOR

6TH STREET PARC PROJECT

CITY OF LOS ANGELES

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INTRODUCTION

This report discusses the existing setting and identifies potential noise impacts associated with implementation of the proposed 6th Street Park, Arts, River & Connectivity Improvements (PARC) Project (proposed Project). Noise mitigation measures are recommended where the predicted noise levels would exceed applicable noise standards.

PROJECT SUMMARY

The 6th Street Viaduct Division of the City of Los Angeles (City) Department of Public Works, Bureau of Engineering, is proposing the construction of the 6th Street PARC Project. The 6th Street PARC Project includes the creation of public recreational space on approximately 13 acres in areas underneath and adjacent to the Sixth Street Viaduct in the city of Los Angeles. The 6th Street PARC Project's regional location and local project locations are depicted in Figures 1 and 2, respectively. Proposed site plans are depicted in Figures 3 and 4.

EXISTING SETTING

ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound is mechanical energy transmitted in the form of a wave because of a disturbance or vibration. Sound levels are described in terms of both amplitude and frequency.

Amplitude

Amplitude is defined as the difference between ambient air pressure and the peak pressure of the sound wave. Amplitude is measured in dB on a logarithmic scale. Amplitude is interpreted by the ear as corresponding to different degrees of loudness. Laboratory measurements correlate a 10-dB change in amplitude with a perceived doubling or halving of loudness and establish a 3-dB change in amplitude as the minimum audible difference perceptible to the average person.

Frequency

The frequency of a sound is defined as the number of fluctuations of the pressure wave per second. The unit of frequency is the Hertz (Hz). One Hz equals one cycle per second. The human ear is not equally sensitive to sound of different frequencies. For instance, the human ear is more sensitive to sound in the higher portion of this range than in the lower and sound waves below 16 Hz or above 20,000 Hz cannot be heard at all. To approximate the sensitivity of the human ear to changes in frequency, environmental sound is usually measured in what is referred to as "A-weighted decibels" (dBA). On this scale, the normal range of human hearing extends from about 10 dBA to about 140 dBA for most people. Noise generally become painful at levels above roughly 130 dBA (Caltrans 2013). Common community noise sources and associated noise levels, in dBA, are depicted in Figure 5

Addition of Decibels

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

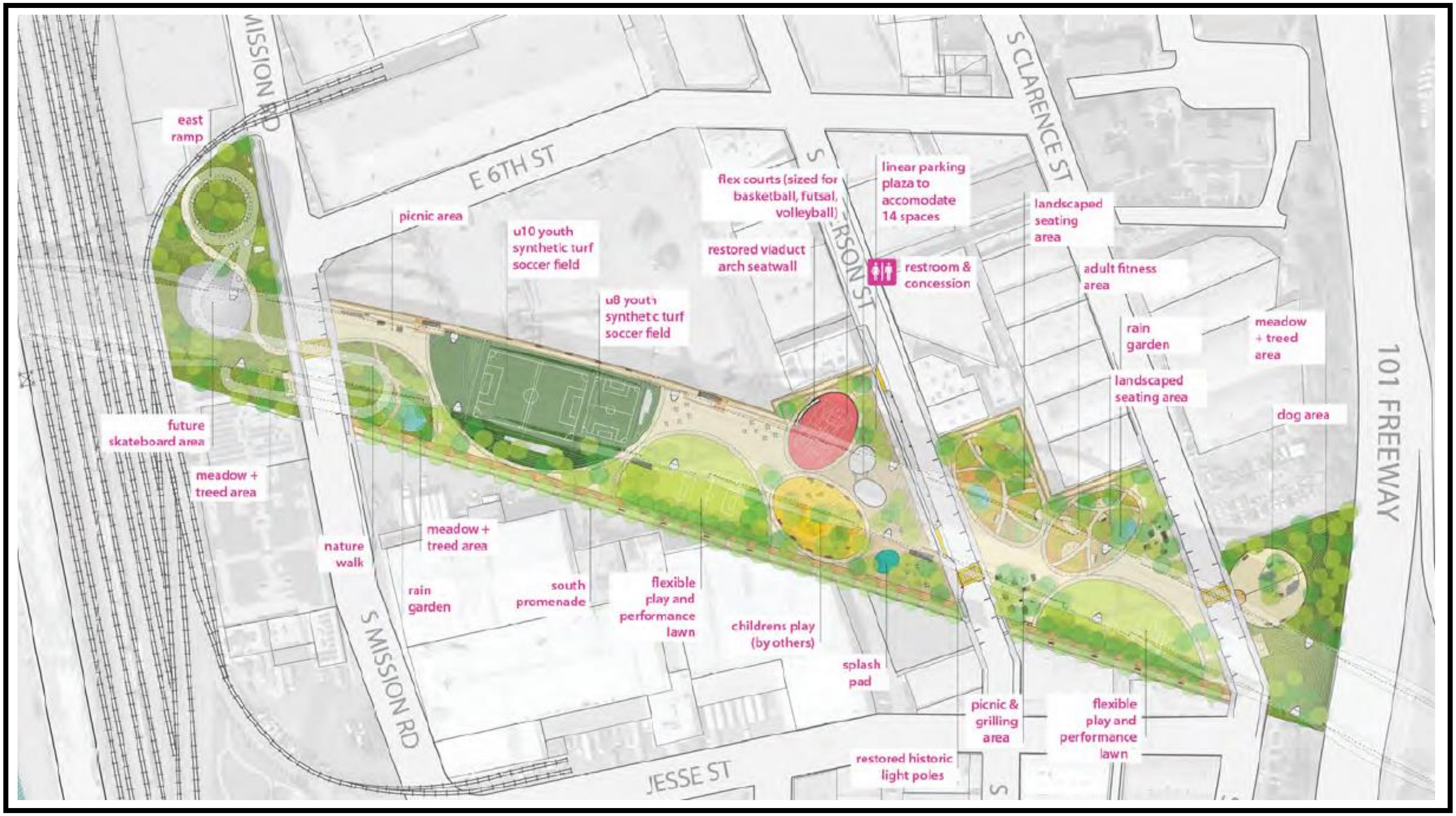
Figure 1
6th Street PARC Project Regional Location

Source: GPA Consulting 2018

Figure 2
6th Street PARC Project Area, Nearby Land Uses & Noise Monitoring Locations

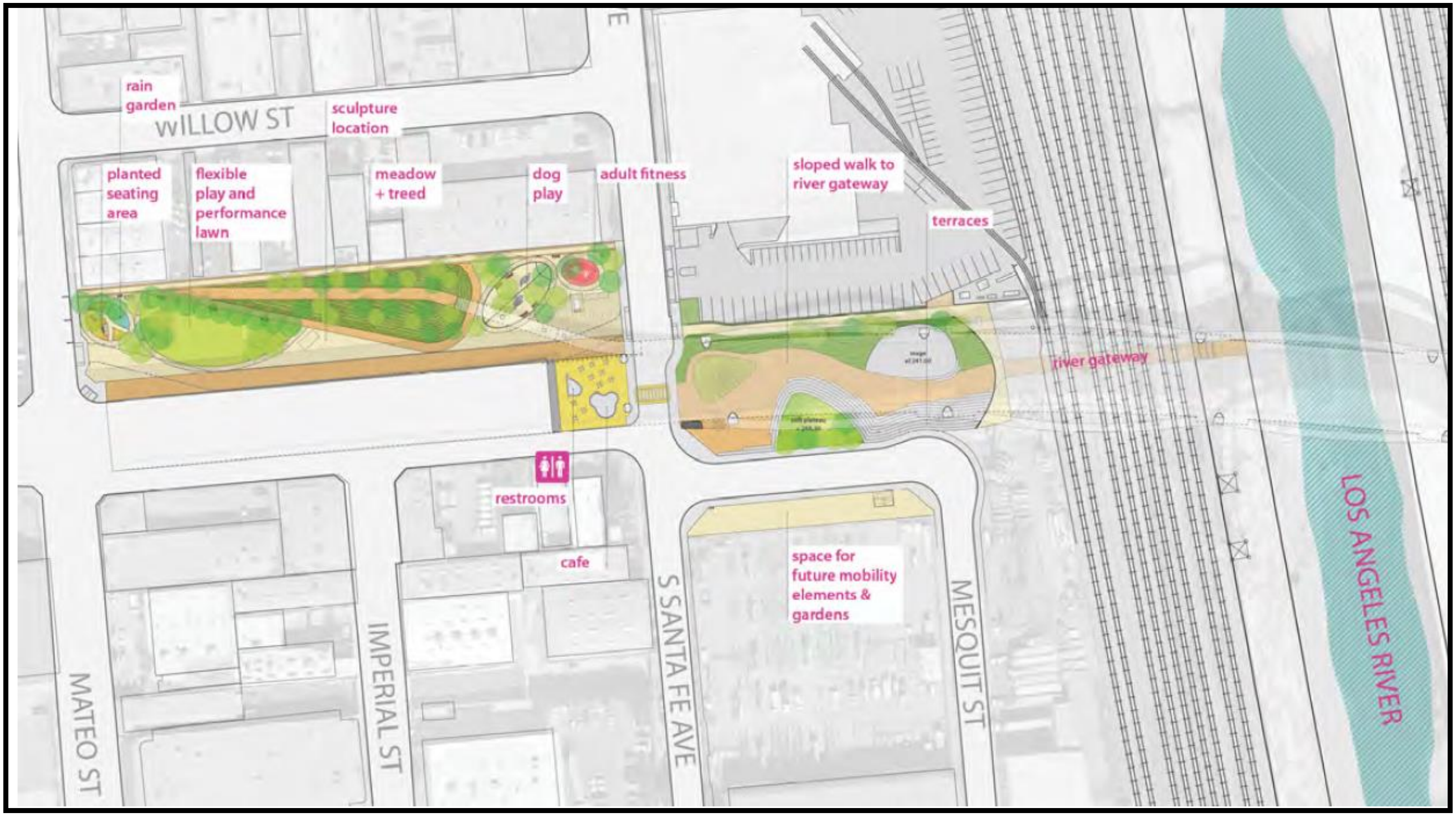
Source: ESRI 2019; GPA Consulting 2019

Figure 3
Conceptual Site Plan – East Park



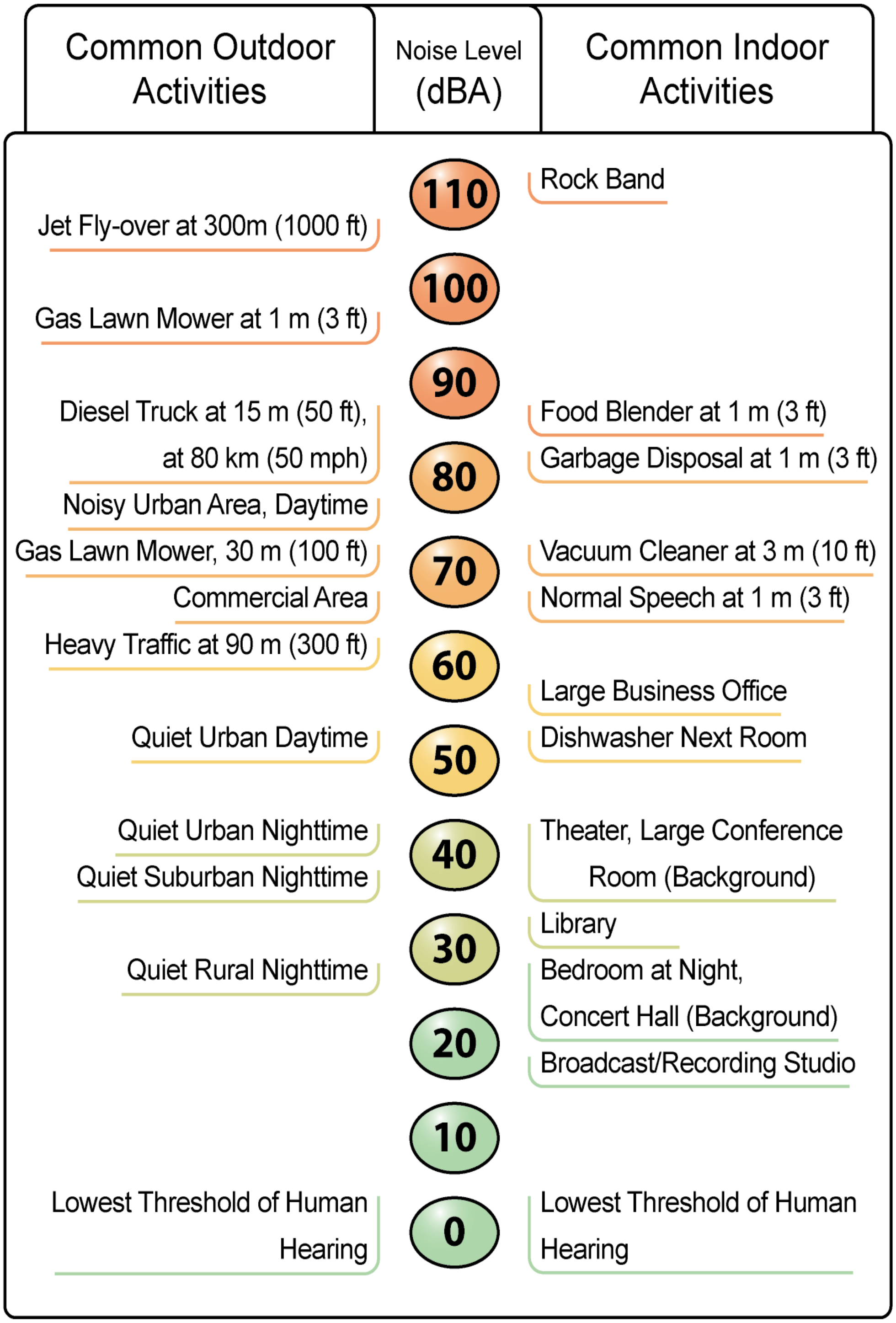
Source: Hargreaves Associates,2019

Figure 4
Conceptual Site Plan – West Park



Source: Hargreaves Associates,2019

Figure 5
Common Noise Levels



Source: Caltrans 2018

Sound Propagation & Attenuation

Geometric Spreading

Noise sources are generally characterized as either a localized source (i.e., point source) or a line source. Examples of point sources include construction equipment, vehicle horns, alarms, and amplified sound systems. Examples of a line sources include trains and on-road vehicular traffic. Sound from a point source propagates uniformly outward in a spherical pattern.

For a point source, sound levels generally decrease (attenuate) at a rate of approximately 6 dB for each doubling of distance from the source, depending on ground surface characteristics. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver), no excess ground attenuation is assumed. Parking lots and bodies of water are examples of hard surfaces which generally attenuate at this rate. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When soft surfaces are present, the excess ground attenuation for soft surfaces generally results in an overall attenuation rate of approximately 7.5 dB per doubling of distance from the point source.

On-road vehicle traffic consists of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels for line sources attenuate at a rate of approximately 3 dB for each doubling of distance for hard sites and approximately 4.5 dB per doubling of distance for soft sites.

Atmospheric Effects

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

Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in minimum 5 dB of noise reduction. Taller barriers provide increased noise reduction.

Noise reductions afforded by building construction can vary depending on construction materials and techniques. Standard construction practices typically provide approximately 15 dBA exterior-to-interior noise reductions for building facades, with windows open, and approximately 20-25 dBA, with windows closed. With compliance with current building construction and insulation requirements, exterior-to-interior noise reductions typically average approximately 25 dBA. The absorptive characteristics of interior rooms, such as carpeted floors, draperies and furniture, can result in further reductions in interior noise.

Noise Descriptors

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

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the sound-pressure level in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies, which is referred to as the "A-weighted" sound level (expressed in units of dBA). The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with environmental noise.

The intensity of environmental noise fluctuates over time, and several descriptors of time-averaged noise levels are typically used. For the evaluation of environmental noise, the most commonly used descriptors are L_{eq}, L_{dn}, CNEL and SEL. The energy-equivalent noise level, L_{eq}, is a measure of the average energy content (intensity) of noise over any given period. Many communities use 24-hour descriptors of noise levels to regulate noise. The day-night average noise level, L_{dn}, is the 24-hour average of the noise intensity, with a 10-dBA "penalty" added for nighttime noise (10 p.m. to 7 a.m.) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to L_{dn} but adds an additional 5-dBA penalty for evening noise (7 p.m. to 10 p.m.) Another descriptor that is commonly discussed is the single-event noise exposure level, also referred to as the sound-exposure level, expressed as SEL. The SEL describes a receiver's cumulative noise exposure from a single noise event, which is defined as an acoustical event of short duration (0.5 second), such as a backup beeper, the sound of an airplane traveling overhead, or a train whistle. Common noise level descriptors are summarized in Table 1.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases. The acceptability of noise and the threat to public well-being are the basis for land use planning policies preventing exposure to excessive community noise levels.

Table 1
Common Acoustical Descriptors

Descriptor	Definition
Energy Equivalent Noise Level (L_{eq})	The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value (in dBA) is calculated.
Minimum Noise Level (L_{min})	The minimum instantaneous noise level during a specific period of time.
Maximum Noise Level (L_{max})	The maximum instantaneous noise level during a specific period of time.
Day-Night Average Noise Level (L_{dn})	The L_{dn} takes into account both the frequency of occurrence and duration of all noise events during a 24-hour period with a 10 dBA "penalty" for noise events that occur between the more noise-sensitive hours of 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours to account for increases sensitivity to noise during these hours.
Community Noise Equivalent Level (CNEL)	The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA "penalty" added to noise events that occur between the hours of 7:00 p.m. to 10:00 p.m. The calculated CNEL is typically approximately 0.5 dBA higher than the calculated L_{dn}.
Single Event Level (SEL)	The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second.

Unfortunately, there is no completely satisfactory way to measure the subjective effects of noise or of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted: the so-called "ambient" environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged. Regarding increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this analysis (Kryter 1970):

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived by humans.
- Outside of the laboratory, a 3-dB change is considered a just-perceivable difference.
- A change in level of at least 5 dB is required before any noticeable change in community response would be expected.
- A 10-dB change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

NOISE-SENSITIVE LAND USES

Noise-sensitive land uses are generally considered to include those uses that would result in noise exposure that could cause health-related risks to individuals. Places where quiet is essential are also considered noise-sensitive uses. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other land uses such as libraries, places of worship, and recreation areas are also considered noise-sensitive land uses.

Existing land uses located to the north, south, and west of the project site consist predominantly of a mix of industrial and commercial uses. The nearest noise-sensitive land uses in the vicinity of the proposed East Park are residential uses located approximately 350 feet to the north of the proposed East Park, along S. Clarence Street. The nearest noise-sensitive land use in the vicinity of the proposed West Park is a residential development referred to as the "Brick Lofts", which is located approximately 700 feet south of the proposed West Park, near the intersection of Mateo Street and Jesse Street. Additional residential land uses are located approximately 700 feet to the east of the proposed East Park, across U.S. Highway 101 (U.S. 101) and Interstate 5 (I-5). These nearest noise-sensitive land uses are depicted in Figure 2. Other noise-sensitive land uses include schools, hospitals, and parks. The nearest school is Metropolitan High School, which is located south of 7th Street, approximately 1,375 feet south of the project site. The nearest hospital is Linda Vista Community Hospital, which is located approximately 1,000 feet northeast of the project site, across U.S. 101 and I-5. The nearest park is Hollenbeck Park, which is located approximately 650 feet northeast of the project site, across U.S. 101 and I-5.

EXISTING NOISE ENVIRONMENT

Short-term (10-minute) noise level measurements were conducted on November 10, 2016, for the purpose of documenting and measuring the existing noise environment at various locations in the project vicinity. Ambient noise measurement locations and corresponding measured values (i.e., L_{eq} and L_{max}) are summarized in Table 2.

As indicated in Table 2, measured ambient noise levels ranged from approximately 61-65 dBA L_{eq} during the daytime hours and from approximately 52-60 dBA L_{eq} during the evening and nighttime hours. In general, nighttime noise levels are approximately 5-10 dB lower than daytime noise levels. Based on the measurements conducted, ambient noise levels in the project vicinity are largely influenced by vehicle traffic on area roadways. Additional major noise sources in the project area include trains traveling along the Union Pacific Railroad (UPRR) and Metrolink rail lines, which are generally located along the west and east banks of the Los Angeles River. Existing traffic and railroad noise levels are discussed, as follows:

Table 2
Summary of Measured Ambient Noise Levels

Location	Monitoring Period	Primary Noise Sources	Noise Levels (dBA)	
			L_{eq}	L_{max}
ST-1. Santa Fe Ave. at 6th St., Approximately 20 feet from road centerline.	11:10-11:20	Vehicle Traffic	64.9	79.6
	20:00-20:10	Vehicle Traffic	60.2	77.5
ST-2. S. Clarence St. at Inez Street at residential property line.	13:00-13:10	Vehicle Traffic	62.4	68.1
	21:10-21:20	Vehicle Traffic	56.3	69.4
ST-3. S. Clarence St. at Jesse St., Approximately 15 feet from road centerline.	11:50-12:00	Vehicle Traffic	60.5	72.3
	21:50-22:00	Vehicle Traffic	55.6	70.5
ST-4. Mateo St. at Jesse St., Approximately 30 feet from road centerline.	12:20-12:40	Vehicle Traffic	61.2	73.8
	20:30-20:40	Vehicle Traffic	52.4	75.2

Noise measurements were conducted on November 3rd, 2017 using a Larson Davis Model 820 Type I sound level meter.
Refer to Figure 1 for noise monitoring locations.

Roadway Traffic Noise

Existing roadway traffic noise levels were calculated using the Federal Highway Administration (FHWA) Roadway Noise Prediction Model (FHWA RD-77-108) based on traffic data obtained from the traffic analysis prepared for this project (Kimley-Horn and Associates, Inc., 2018). Predicted traffic noise levels and distances to projected traffic noise contours for major roadways are summarized in Table 3. It is important to note that projected traffic noise contours do not include attenuation or shielding provided by intervening structures. Based on the modeling conducted, existing traffic noise levels along area roadways range from approximately 50 to 67 dBA CNEL at 50 feet from the near-travel-lane centerline.

Table 3
Existing Roadway Traffic Noise Levels & Contour Distances

Roadway Segment	CNEL at 50 ft. from Near-travel-lane Centerline	Distance to CNEL Contour (Feet from Road Centerline)		
		70	65	60
4th Street, West of Clarence Street	67	WR	111	233
6th Street, West of Mateo Street	65	WR	67	139
6th Street, East of Mateo Street	64	WR	63	131
7th Street, West of Boyle Avenue	63	WR	64	125
7th Street, East of Alameda Street	65	WR	66	139
7th Street, West of Mateo Street	64	WR	59	121
7th Street, West of Santa Fe Avenue	64	WR	56	115
7th Street, East of Santa Fe Avenue	65	WR	63	132
Alameda Street, North of 6th Street	65	WR	85	173
Alameda Street, South of 6th Street	65	WR	85	173
Clarence Street, South of 4th Street	50	WR	WR	WR
Mateo Street, North of 7th Street	59	WR	WR	WR
Mateo Street, South of 6th Street	60	WR	WR	52
Mateo Street, North of 6th Street	59	WR	WR	WR
Santa Fe Avenue, South of 4th Street	63	WR	WR	84
Santa Fe Avenue, North of 7th Street	61	WR	WR	69
Whittier Street, West of Boyle Avenue	65	WR	67	141

Traffic noise levels for area roadways were calculated based on data obtained from the traffic analysis prepared for this project (Kimley-Horn and Associates, Inc., 2018).
Predicted noise contours do not include shielding by intervening structures.
WR=Within Roadway Right-of-Way

Railroad Noise

The UPRR and Metrolink/Amtrak rail lines run in a general north-south direction located along the west and east banks of the Los Angeles River (refer to Figure 2). Freight train volumes can vary depending on market demands. In year 2000, the UPRR operated approximately 59 through freight trains per peak day over this line. The number of average freight trains dropped to approximately 51 trains/day in 2010, but is projected to increase in future years. By year 2035, freight traffic is estimated to average approximately 111 trains/day (SCAG 2011). Existing Metrolink and Amtrak passenger train volumes currently average approximately 20 trains/day and 12 trains/day, respectively (Metrolink 2018; Amtrak 2018).

Predicted railroad noise levels were calculated using the Federal Transit Administration's *Noise and Vibration Impact Assessment* (2006) guidelines (SCAG 2011). Average-daily freight and passenger train volumes were distributed equally among the track lines running along the west and east banks of the Los Angeles River. Predicted average-daily train volumes at the nearest project site boundaries were calculated based on distance from the centerline of the east bank and west bank railroad corridors. Existing railroad noise levels are summarized in Table 4. As depicted, railroad noise levels are largely dominated by freight train traffic. In total, predicted average-daily railroad noise levels average approximately 70 dBA CNEL at approximately 100 feet from the centerline of the east and west bank rail line corridors. Combined existing noise levels at the nearest project site boundaries, taking into account contributions from both east and west bank rail corridors, would average approximately 71 dBA CNEL. Modeling assumptions and output files are included in Appendix A.

Table 4
Existing Railroad Operations & Noise Levels

Rail Line	Average Trains/Day[1]	CNEL (dBA) at 100 feet[2]	
		West Bank	East Bank
UPRR	59	70	70
Metrolink	20	56	56
Amtrak	12	54	54
Total:	91	70	70
	Combined CNEL[3]:	71	

1. *Average-daily freight train volumes based on maximum of 59 trains/day based on year 2000-2010 estimated volumes (SCAG 2011). Amtrak and Metrolink train volumes derived from the existing train schedules.*
2. *Total average-daily train volumes were distributed equally among west bank and east bank rail lines.*
3. *Combined noise levels at the project site property line were calculated taking into account existing UPRR, Metrolink, and Amtrak train volumes. Includes contributions from west bank and east bank rail lines.*

VIBRATION FUNDAMENTALS

Vibration is an oscillating motion of the earth, which can result from either natural (e.g, earthquakes, volcanic eruptions) or manmade sources (e.g., explosions). As with noise, vibration can be described by both its amplitude and frequency. Amplitude can be described in terms of displacement, velocity, or acceleration. Displacement is the distance that a point on the ground moves away from its static position. Velocity is defined as the instantaneous speed of the ground movement and acceleration is defined as the rate of change in velocity with respect to time.

Although displacement is easier to understand than velocity or acceleration, it is rarely used for describing groundborne vibration. In addition, the effects of groundborne vibration, including human reaction and effects on buildings, is commonly described in environmental assessments using either velocity (measured in inches or millimeters per second) or acceleration (measured in gravities). Frequency is defined as the number of oscillations per second that a particle makes when under the influence of seismic waves. The frequency of a vibration can also affect human perception (Caltrans 2013, FTA 2006).

The rate at which vibration travels through the earth is referred to as propagation. As with noise, the energy of a vibration wave decreases as the waves propagates with increased distance from a source. Various other factors can also influence the loss of wave energy, including soil type and condition, as well as, the frequency of the wave (Caltrans 2013, FTA 2006).

REGULATORY SETTING

Federal, state, and local governments have established noise standards and guidelines to protect citizens from potential hearing damage and various other adverse physiological and social effects associated with noise. Those regulations most applicable to the community are summarized, as follows:

Noise

City of Los Angeles General Plan Noise Element

The existing Noise Element of the *City of Los Angeles General Plan* includes noise standards intended to ensure compatibility of proposed land uses within exterior noise environments and that noise levels at adjacent land uses do not exceed acceptable levels. These standards are also designed to protect existing land uses, including transportation and industry, from encroaching urban uses. The City's exterior and interior noise standards for General Plan land use designations are summarized in Table 5.

Table 5
City of Los Angeles Land Use Noise Compatibility Guidelines

Land Use	Community Noise Exposure CNEL, dB			
	Normally Acceptable	**Conditionally Acceptable**	**Normally Unacceptable**	**Clearly Unacceptable**
Single-Family, Duplex, Mobile Homes	50–60	55–70	70–75	above 70
Multifamily Homes	50–65	60–70	70–75	above 70
Schools, Libraries, Churches, Hospitals, Nursing Homes	50–70	60–70	70–80	above 80
Transient Lodging – Motels, Hotels	50–65	60–70	70–80	above 80
Auditoriums, Concert Halls, Amphitheaters	—	50–70	—	above 65
Sports Arena, Outdoor Spectator Sports	—	50–75	—	above 70
Playgrounds, Neighborhoods Parks	50–70	—	67–75	above 72
Golf Courses, Riding Stables, Water, Recreation, Cemeteries	50–75	—	70–80	above 80

Normally Acceptable: *Specified land use is satisfactory, based on the assumption that any buildings involved are of normal conventional construction and 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 generally should 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 generally should not be undertaken.*

Source: City of Los Angeles 2006.

As depicted in Table 5, areas designated for outdoor spectator sports are generally considered unacceptable in areas of noise exposure above 70 dBA CNEL. These same land uses are considered conditionally acceptable in areas up to 75 dBA CNEL provided that potential noise impacts have been evaluated and any necessary noise-reduction measures have been implemented (City of Los Angeles 1999).

City of Los Angeles Municipal Code

The City of Los Angeles Municipal Code (LAMC) provides noise guidelines and standards for significant noise disturbances in Chapter XI, Noise Regulation. This Chapter is intended to prohibit unnecessary, excessive, and annoying noises from all sources subject to its police power. Accordingly, noise-generating construction activities are generally limited to the hours of 9:00 PM and 7:00 AM which would result in noise disturbance of occupants of a nearby residence or hotel. In addition, the LAMC also specifies the maximum noise level of powered equipment or powered hand tools. Between the hours of 7:00 AM and 10:00 PM, in any residential zone of the City or within 500 feet thereof, no person shall operate or cause to be operated any powered equipment or powered hand tool that produces a maximum noise level exceeding the following noise limits at a distance of 50 feet therefrom:

(a) 75 dBA for construction, industrial, and agricultural machinery including crawler-tractors, dozers, rotary drills and augers, loaders, power shovels, cranes, derricks, motor graders, paving machines, off-highway trucks, ditchers, trenchers, compactors, scrapers, wagons, pavement breakers, compressors and pneumatic or other powered equipment;

(b) 75 dBA for powered equipment of 20 HP or less intended for infrequent use in residential areas, including chain saws, log chippers and powered hand tools;

(c) 65 dBA for powered equipment intended for repetitive use in residential areas, including lawn mowers, backpack blowers, small lawn and garden tools and riding tractors;

Said noise limitations shall not apply where compliance therewith is technically infeasible. Technical infeasibility shall mean that said noise limitations cannot be complied with despite the use of mufflers, shields, sound barriers and/or other noise reduction device or techniques during the operation of the equipment.

City of Los Angeles CEQA Thresholds

The City provides CEQA significance thresholds to be used in noise analyses. Figure 6 presents guidelines for determining acceptable and unacceptable community noise exposure limits for various land use categories. Specific significance thresholds are detailed below and include thresholds for construction and operational noise levels.

Groundborne Vibration

There are no federal, state, or local regulatory standards for ground-borne vibration. However, Caltrans has developed vibration criteria based on potential structural damage risks and human annoyance. Caltrans-recommended criteria for the evaluation of groundborne vibration levels, with regard to structural damage and human annoyance, are summarized in Table 6. The criteria apply to continuous vibration sources, which include vehicle traffic, train, and most construction vibrations, with the exception of transient or intermittent construction activities, such as pile driving. All damage criteria for buildings are in terms of ground motion at the buildings' foundations. No allowance is included for the amplifying effects of structural components (Caltrans 2013a).

As shown in Table 6, the minimum "architectural damage risk level" for continuous vibrations is a peak particle velocity (ppv) of 0.2 inches per second (in/sec) for fragile buildings or buildings with plastered walls and ceilings. This same level corresponds to the level at which vibrations typically become annoying to people in buildings (Caltrans 2013a). For newer buildings, the "architectural damage risk level" ranges from 0.3 in/sec ppv for older residential structures to 0.5 in/sec ppv for newer structures (Caltrans 2013a).

Table 6
Summary of Groundborne Vibration Levels and Potential Effects

Vibration Level (in/sec ppv)	Human Reaction	Effect on Buildings
0.006-0.019	Threshold of perception; possibility of intrusion.	Vibrations unlikely to cause damage of any type.
0.08	Vibrations readily perceptible.	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected.
0.10	Level at which continuous vibrations begin to annoy people.	Virtually no risk of “architectural” damage to normal buildings.
0.20	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relative short periods of vibrations).	Threshold at which there is a risk of “architectural” damage to fragile buildings andbuildings with plastered walls and ceilings.
0.4-0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges.	Potential risk of “architectural” damage may occur at levels above 0.3 in/sec ppv for older residential structures and above 0.5 in/sec ppv for newer structures.

The vibration levels are based on peak particle velocity in the vertical direction for continuous vibration sources, which includes most construction activities, with the exception of transient or intermittent construction activities, such as pile driving. For pile driving, the minimum criterion level is typically considered to be 0.2 in/sec ppv.
Source: Caltrans 2013a

IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE THRESHOLD CRITERIA

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would:

a. Result in a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
b. Result in the generation of excessive groundborne vibration or groundborne noise levels.
c. For a project located within the vicinity of a private airstrip or 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, expose people residing or working in the project area to excessive noise levels.

The project site is not located within an airport land use plan area or within two miles of a public use airport. Implementation of the proposed project would not expose individuals residing or working in the area to excessive aircraft noise levels. As a result, this impact is not discussed further in this report.

In the context of the above thresholds in CEQA Guidelines Appendix G, the *Los Angeles CEQA Thresholds Guide* (2006) includes thresholds for determining whether noise impacts associated with construction and operation of a project would be significant, as discussed below:

Construction Noise

A project would normally have a significant impact on noise levels from construction if:

- Construction activities lasting more than one day would exceed existing ambient exterior sound levels by 10 dBA (hourly Leq) or more at a noise-sensitive use (e.g., residences, transient lodging, schools, libraries, churches, hospitals, nursing homes);
- Construction activities lasting more than 10 days in a three-month period would exceed existing ambient exterior noise levels by 5 dBA (hourly L_{eq}) or more at a noise-sensitive use; or
- Construction activities of any duration would exceed the ambient noise level by 5 dBA (hourly L_{eq}) at a noise-sensitive use between the hours of 9:00 PM and 7:00 AM Monday through Friday, before 8:00 AM or after 6:00 PM on Saturday, or at any time on Sunday.

Operational Noise

A project would normally have a significant impact on noise levels from project operations if the project causes the ambient noise level measured at the property line of affected uses to increase by 3 dBA CNEL to or within the "normally unacceptable" or "clearly unacceptable" category, or any 5 dBA or greater noise increase reference in Figure 6. For multi-family residential land uses, noise levels up to 65 dBA CNEL are considered “normally acceptable” and noise levels up to 70 dBA CNEL are considered “conditionally acceptable” with implementation of noise-control measures (City of Los Angeles 1999).

Groundborne Vibration

The City of Los Angeles has not adopted recommended CEQA thresholds for the evaluation of groundborne vibration levels. Groundborne vibration levels were, therefore, evaluated in comparison to Caltrans’ recommended criteria

(Table 5). Construction-generated vibration levels would have a potentially significant impact if vibration levels at the nearest structures would exceed the minimum criteria of 0.2 in/sec ppv at fragile structures, 0.3 in/sec ppv at residential dwellings, or 0.5 in/sec ppv at newer buildings, including non-residential structures. This same level corresponds to the level at which vibrations typically become annoying to people in buildings (Caltrans 2013a).

METHODOLOGY

Construction Noise

Construction noise levels were evaluated based on typical equipment noise levels derived from the Federal Highway Administration's Roadway Construction Noise Model, version 1.1 (2008). Predicted construction noise levels at the nearest noise-sensitive land uses were quantified assuming that the three loudest pieces of equipment associated with onsite activities could potentially operate simultaneously at the nearest construction site boundary. A minimum 10-dB reduction for intervening structures was applied. Modeling assumptions and output files are included in Appendix A.

Operational Noise

Traffic noise levels along major area roadways were estimated using the FHWA Highway Traffic Noise Prediction model (FHWA-RD-77-108.) The FHWA modeling was based upon the California Vehicle Noise (Calveno) emission levels for automobiles and medium- and heavy-duty trucks. Input data used in the model included traffic volumes, day/night percentages of automobiles and medium and heavy trucks, vehicle speeds, ground attenuation factors, roadway widths, and ground elevation data. Traffic volumes for roadway segments in the project vicinity were derived from the traffic analysis prepared for this project (Kimley-Horn and Associates, Inc., 2018). Modeling assumptions and output files are included in Appendix A.

Noise levels associated with onsite recreational uses and events were assessed based on the estimated capacity for major onsite events assuming that fifty percent of the attendees would be male and fifty percent would be female. Where applicable, noise levels associated with the use of amplified public address/sound systems were included. Predicted operational noise levels at the nearest noise-sensitive land uses were quantified assuming an average noise-attenuation rate of 6 dB per doubling of distance from the source and shielding provided by intervening structures. Modeling assumptions and output files are included in Appendix A.

For determination of land use compatibility for the proposed Project, transportation noise levels for U.S. 101 and the adjacent rail lines were calculated for future year 2035 conditions. Traffic noise levels for U.S. 101 were quantified using the FHWA's Roadway Noise Prediction Model (FHWA RD-77-108) based on an estimated year 2035 traffic volume of 173,700 vehicles per day (Caltrans 2013b). Predicted railroad noise levels were calculated in accordance with the Federal Transit Administration's *Noise and Vibration Impact Assessment* (2006) guidelines assuming projected future year 2035 train volumes of 111 freight trains/day and 37 passenger trains/day (SCAG 2011). Projected year 2035 passenger train volumes were calculated based on existing volumes and a projected future increase of 1.6 passenger trains/5-year period for the Los Angeles region (SCAG 2012). Average-daily freight and passenger train volumes were distributed equally among the track lines running along the west and east bank of the Los Angeles River. Predicted average-daily train volumes at the nearest project site boundaries were calculated based on distance from the centerline of the east bank and west bank railroad corridors. Modeling assumptions and output files are included in Appendix A.

Groundborne Vibration

Groundborne vibration levels associated with the project were qualitatively assessed based on construction-equipment vibration levels typically associated with off-road construction equipment (Caltrans 2013a). Short-term and long-term impacts associated with transportation and non-transportation noise sources were assessed based on potential increases in ambient noise levels anticipated to occur with project implementation.

IMPACTS AND MITIGATION MEASURES

Substantial Permanent Increase in Ambient Noise Levels

Impact Noise-A: Would the project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The proposed Project would not include the installation of major stationary noise sources, such as backup power generators. Potential noise impacts are associated with project-generated vehicle traffic and onsite recreational uses and events. Noise impacts associated with vehicle traffic and recreational uses are discussed, as follows:

Increased Traffic Noise

Traffic noise levels for roadway segments primarily affected by the proposed Project were quantified using the FHWA Highway Traffic Noise Prediction model (FHWA-RD-77-108) based on traffic data derived from the traffic analysis prepared for this project (Kimley-Horn and Associates, Inc., 2018). It is important to note that project-generated traffic volumes include reductions in vehicle traffic associated with the industrial land uses that were removed. Traffic noise levels were evaluated for both existing and future cumulative conditions, with and without implementation of the proposed Project. Predicted existing and future cumulative traffic noise levels and resultant changes in traffic noise levels attributable to the proposed Project are summarized in Tables 7 and 8, respectively. As indicated, implementation of the proposed Project would not result in a significant increase in traffic noise levels under either existing or future cumulative conditions.

Recreational and Event Noise

On-site noise within the recreation and event areas would be primarily associated with human speech. Use of the recreation yard would be limited to the daytime hours. Average sustained sound levels typically associated with human speech generally range from approximately 53 to 75 dBA at one meter for males and from 50 to 71 dBA for females. Instantaneous noise levels, such as shouting, can generate noise levels ranging from approximately 82 to 88 dBA at one meter (Harris 1998).

The largest events anticipated to be conducted at the project site would range from approximately 500 to 5,000 individuals. Predicted maximum levels of crowd noise associated with these various events were calculated assuming that 50 percent of the individuals would be male and 50 percent would be female. It is anticipated that some onsite events may also include the use of portable amplified sound systems. To be conservative, this analysis included the use of amplified sound systems for the events evaluated. Noise levels associated with amplified sound systems can vary depending on various factors, including crowd size, but generally range from roughly 60 to 70 dBA L_{eq} at 100 feet. To be conservative, noise from amplified sound systems were assumed to be 70 dBA L_{eq} at 100 feet.

Existing land uses located to the north, south, and west of the project site consist predominantly of a mix of industrial and commercial uses. The nearest noise-sensitive land uses in the vicinity of the proposed East Park are multi-family residential uses located approximately 350 feet to the north of the proposed East Park, along S. Clarence Street. The nearest noise-sensitive land use in the vicinity of the proposed West Park is a residential development referred to as the "Brick Lofts", which is located approximately 700 feet south of the proposed West Park, near the intersection of Mateo Street and Jesse Street. These nearest noise-sensitive land uses are shielded from direct line-of-sight of proposed onsite recreational and event areas by intervening buildings and structures. Additional residential land uses are located approximately 700 feet to the east of the proposed East Park, across U.S. 101 (refer to Figure 2).

Table 7
Predicted Traffic Noise Levels – Existing Conditions

Scenario/Roadway Segment	Average-Daily Noise Level (dBA CNEL) at 50 ft. from Near-travel-lane Centerline[1]			Potentially Significant?[3]
	Existing Without Project	Existing With Project[2]	Change	
4th Street, West of Clarence Street	67.4	67.4	0.0	No
6th Street, West of Mateo Street	64.8	64.8	0.0	No
6th Street, East of Mateo Street	64.4	64.4	0.0	No
7th Street, West of Boyle Avenue	63.2	63.1	-0.1	No
7th Street, East of Alameda Street	64.8	64.8	0.0	No
7th Street, West of Mateo Street	63.9	63.9	0.0	No
7th Street, West of Santa Fe Avenue	63.6	63.6	0.0	No
7th Street, East of Santa Fe Avenue	64.5	64.5	0.0	No
Alameda Street, North of 6th Street	65.4	65.3	-0.1	No
Alameda Street, South of 6th Street	65.4	65.4	0.0	No
Clarence Street, South of 4th Street	49.5	49.5	0.0	No
Mateo Street, North of 7th Street	59.2	59.2	0.0	No
Mateo Street, South of 6th Street	59.5	59.5	0.0	No
Mateo Street, North of 6th Street	59.1	59.1	0.0	No
Santa Fe Avenue, South of 4th Street	62.7	62.7	0.0	No
Santa Fe Avenue, North of 7th Street	61.4	61.4	0.0	No
Whittier Street, West of Boyle Avenue	64.9	64.9	0.0	No

1. *Traffic noise levels were calculated using the FHWA roadway noise prediction model for primarily affected roadways based on traffic volumes derived from the traffic analysis prepared for this project (Kimley-Horn and Associates, Inc., 2018).*
2. *Predicted traffic noise levels with implementation of the proposed Project include reductions in traffic volumes associated with the industrial land uses that were removed (Kimley-Horn and Associates, Inc., 2018).*
3. *Potentially significant impact defined as an increase of 3 dBA, or greater.*

Predicted operational noise levels at the nearest noise-sensitive land uses were calculated based on distance from the source and taking into account intervening structures and terrain. Predicted operational noise levels for on-site uses are summarized in Table 9. As depicted, predicted operational noise levels at the nearest noise-sensitive land uses would range from approximately 30 to 58 dBA CNEL. Operational noise levels associated with events at the proposed Arts Plaza Stage in the proposed West Park area would not result in predicted increase in ambient noise levels at the nearest noise- sensitive receiver (i.e., Brick Lofts, LLC). Operational noise levels associated with events in the East Park area would result in increases of up to approximately 2 dBA CNEL at the nearest residential land uses to the north along S. Clarence Street. It is important to note that predicted operational noise levels were conservatively calculated assuming that onsite activity noise levels would occur continuously over a fifteen-hour period (7:00 a.m. to 10:00 p.m.) Actual operational times and associated noise levels would likely be less. Operational noise levels at other noise-sensitive land uses, which are generally located east of the project site, across U.S. 101 and I-5, would be largely shielded by intervening terrain and masked by existing traffic noise levels. Therefore, predicted operational noise levels at the nearest residential land uses would not exceed the "normally acceptable" noise level of 65 dBA CNEL. In addition, assuming an average exterior-to-interior noise reduction of 20 dB, which is typical for newer residential dwellings, predicted interior noise levels at these nearest residences would not exceed the commonly applied interior noise level threshold of 45 dBA CNEL.

Table 8
Predicted Traffic Noise Levels – Future Cumulative Conditions

Scenario/Roadway Segment	Average-Daily Noise Level (dBA CNEL) at 50 ft. from Near-travel-lane Centerline[1]			Potentially Significant?[3]
	Cumulative Without Project	Cumulative With Project[2]	Change	
4th Street, West of Clarence Street	69.5	69.5	0.0	No
6th Street, West of Mateo Street	64.9	64.8	-0.1	No
6th Street, East of Mateo Street	64.4	64.4	0.0	No
7th Street, West of Boyle Avenue	65.6	65.6	0.0	No
7th Street, East of Alameda Street	67.4	67.4	0.0	No
7th Street, West of Mateo Street	67.0	67.0	0.0	No
7th Street, West of Santa Fe Avenue	64.4	64.4	0.0	No
7th Street, East of Santa Fe Avenue	66.7	66.7	0.0	No
Alameda Street, North of 6th Street	68.0	68.0	0.0	No
Alameda Street, South of 6th Street	68.1	68.1	0.0	No
Clarence Street, South of 4th Street	49.8	49.8	0.0	No
Mateo Street, North of 7th Street	64.3	64.3	0.0	No
Mateo Street, South of 6th Street	65.6	65.6	0.0	No
Mateo Street, North of 6th Street	65.5	65.5	0.0	No
Santa Fe Avenue, South of 4th Street	63.8	63.7	-0.1	No
Santa Fe Avenue, North of 7th Street	65.3	65.3	0.0	No
Whittier Street, West of Boyle Avenue	64.9	64.9	0.0	No

1. *Traffic noise levels were calculated using the FHWA roadway noise prediction model for primarily affected roadways based on traffic volumes derived from the traffic analysis prepared for this project (Kimley-Horn and Associates, Inc., 2018).*
2. *Predicted traffic noise levels with implementation of the proposed Project include reductions in traffic volumes associated with the industrial land uses that were removed (Kimley-Horn and Associates, Inc., 2018).*
3. *Potentially significant impact defined as an increase of 3 dBA, or greater.*

Compatibility with General Plan Land Use Noise Standards

Major existing noise sources in the project area consist predominantly of vehicle traffic on U.S. 101 and trains traveling along the adjacent UPRR and Metrolink/Amtrak rail lines. No existing nearby stationary sources of noise were identified in the project area. For determination of land use compatibility for the proposed Project, transportation noise levels for U.S. 101 and the adjacent rail lines were calculated for future year 2035 conditions. Traffic noise levels for U.S. 101 were quantified using the FHWA roadway noise model based on an estimated year 2035 traffic volume of 173,700 vehicles per day (Caltrans 2013b). Predicted railroad noise levels were calculated in accordance with the Federal Transit Administration's *Noise and Vibration Impact Assessment* (2006) guidelines assuming projected future year 2035 train volumes of 111 freight trains/day and 37 passenger trains/day (SCAG 2011). Projected year 2035 passenger train volumes were calculated based on existing volumes and assuming an average projected future increase of 1.6 passenger trains/5-year period (SCAG 2012).

Based on the noise modeling conducted, predicted future year 2035 U.S. 101 traffic noise levels along the eastern boundary of the proposed East Park would be approximately 70 dBA CNEL. Along the boundaries of the proposed East Park and Arts Plaza, adjacent to the UPRR and Metrolink/Amtrak railroad corridors, predicted future year 2035 onsite noise levels associated with railroad operations would be approximately 73 dBA CNEL. Predicted onsite noise levels would decrease with increased distance from the adjacent U.S. 101 and railroad corridors. Predicted onsite noise levels would not exceed the City's "normally acceptable" noise level of 75 dBA CNEL (refer to Figure 6). As a result, this impact would be considered less than significant.

Table 9
Predicted Operational Noise Levels at Nearby Residential Land Uses

Event (Capacity)	Average-daily Noise Level (dBA CNEL)[1]						
	Project Noise Levels	Existing Ambient Conditions	Ambient With Project	Noise Increase With Project	Threshold	Exceeds Threshold/ Significant Increase[4]?	Significant Impact?
Predicted Noise Levels at Brick Lofts Residential							
Arts Plaza Stage (1,000)	40	58	58	0	65	No/No	No
Soccer Field (500)	31	58	58	0	65	No/No	No
Basketball Courts (500)	30	58	58	0	65	No/No	No
Flex Area 1 (1,500)	40	58	58	0	65	No/No	No
Flex Area 2 (1,500)	40	58	58	0	65	No/No	No
Intermediate Event (2,000)[2]	42	58	58	0	65	No/No	No
Large Event (3,250)[3]	44	58	58	0	65	No/No	No
Maximum Event (5,000)[3]	45	58	58	0	65	No/No	No
Predicted Noise Levels at MFR on S. Clarence St.							
Arts Plaza Stage (1,000)	34	62	62	0	65	No/No	No
Soccer Field (500)	41	62	62	0	65	No/No	No
Basketball Courts (500)	45	62	62	0	65	No/No	No
Flex Area 1 (1,500)	51	62	62	0	65	No/No	No
Flex Area 2 (1,500)	53	62	63	1	65	No/No	No
Intermediate Event (2,000)[2]	55	62	63	1	65	No/No	No
Large Event (3,250)[3]	57	62	63	1	65	No/No	No
Maximum Event (5,000)[3]	58	62	64	2	65	No/No	No

MFR=Multi-family Residential

1. Average-daily noise levels (in dBA CNEL) were calculated assuming continuous operation for 15 hours daily (7:00 a.m. to 10:00 p.m.)

2. Intermediate event includes events in areas of the flex area and basketball court areas operating simultaneously.

3. Large and maximum events (i.e., 3,250 and 5,000 attendees, respectively) includes events in areas of the flex area, soccer fields, and basketball court areas operating simultaneously.

4. Significant increase defined as an increase of 5 dBA, or greater, in areas 65 dBA CNEL, or less, and 3 dBA, or greater, in areas above 65 dBA CNEL

Substantial Temporary or Periodic Increase in Ambient Noise Levels

Impact Noise-B: **Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?**

Construction noise typically occurs intermittently and varies depending upon the nature or phase (e.g., land clearing, grading, excavation, building construction) of construction. Noise generated by construction equipment, including earth movers, material handlers, and portable generators, can reach high levels. Temporary increases in ambient noise levels, particularly during the nighttime hours, could result in increased levels of annoyance and potential sleep disruption. Although noise ranges were found to be similar for all construction phases, the grading phase tends to involve the most equipment and resulted in slightly higher average-hourly noise levels. Typical noise levels for individual pieces of construction equipment expected to be used during project construction and distances to predicted noise contours are summarized in Table 10. As depicted, individual equipment noise levels commonly associated with residential development projects typically range from approximately 73 to 83 dBA L_{eq} at 50 feet with intermittent noise levels reaching up to approximately 90 dBA L_{max} at this same distance. Assuming that multiple pieces of construction equipment would be operating simultaneously near the construction site boundary, predicted construction noise levels during the most intensive activities (e.g., grading and excavation) could reach levels of approximately 88 dBA L_{eq} at 50 feet from the project site.

Table 10
Typical Construction Equipment Noise

Equipment	Typical Noise Level (dBA) 50 feet from Source		Distance to Noise Contours (feet, dBA L_{eq})		
	L_{max}	L_{eq}	70 dBA	65 dBA	60 dBA
Air Compressor	80	76	105	187	334
Backhoe/Front End Loader	80	76	105	187	334
Compactor (Ground)	80	73	74	133	236
Concrete Mixer Truck	85	81	187	334	594
Concrete Saw	90	83	236	420	748
Crane	85	77	118	210	374
Dozer/Grader/Excavator/Scraper	85	81	187	334	594
Drill Rig Truck	84	77	118	210	374
Generator	82	79	149	265	472
Gradall	85	81	187	334	594
Hydraulic Break Ram	90	80	167	297	529
Jack Hammer	85	78	133	236	420
Impact Hammer/Hoe Ram (Mounted)	90	83	236	420	748
Pavement Scarifier/Roller	85	78	133	236	420
Paver	85	82	210	374	667
Pneumatic Tools	85	82	210	374	667
Pumps	77	74	83	149	265
Truck (Dump/Flat Bed)	84	80	167	297	529

Based on maximum equipment noise levels. Actual noise levels are typically lower, particularly if equipment is fitted with exhaust mufflers and engine shrouds.
Sources: FTA 2006, FHWA 2008

Construction activity would comply with the allowable hours of construction in the LAMC. Accordingly, construction activities would be limited to between the hours of 7:00 a.m. to 9:00 p.m. Monday through Friday, and 8:00 a.m. to 6:00 p.m. on Saturday. Construction activities would be prohibited on Sundays and federal holidays, unless approved by the City.

The LAMC limits equipment noise levels to 75 dBA at 50 feet unless technically infeasible. Noise levels associated with onsite construction activities at nearby noise-sensitive land uses, assuming multiple pieces of equipment operating simultaneously, were quantified and are summarized in Table 11. Project construction would not result in a significant increase in daytime ambient noise levels at the nearest noise-sensitive land uses. However, as noted above, noise levels from individual pieces of equipment, which generally range from 73 to 83 dBA L_{eq} at 50 feet, could potentially exceed the allowable noise level stated in the LAMC. Therefore, the City is adopting Mitigation Measure Noise-1, which would reduce construction noise to less-than-significant levels.

Construction activities may also result in short-term increases in vehicle traffic along area roadways. Typically, a doubling of vehicle traffic would be required before a significant increases in traffic noise levels would occur. Based on the traffic analysis prepared for this project, construction activities would generate up to approximately 80 trips per day (Kimley Horn and Associates, Inc., 2018). Additional trips may also be required associated with the hauling of materials to and from the site. Traffic volumes along area roadways typically average several thousand vehicle trips per day. However, construction-generated traffic would be dispersed over multiple roadways and would not be anticipated to result in a doubling of vehicle traffic along area roadways. As a result, construction of the project would not be anticipated to result in a substantial increase in traffic noise levels along area roadways that would adversely impact noise-sensitive land uses.

Mitigation Measure

MM Noise-1: A construction-noise management plan (CNMP) shall be prepared for the proposed Project. The CNMP shall, at a minimum, include the following measures for purposes of reducing noise and vibration impacts:

a. Construction activities shall be restricted outside the hours of 7:00 a.m. to 9:00 p.m. Monday through Friday, and between the hours of 8:00 a.m. to 6:00 p.m. on Saturdays. Construction activities shall be prohibited on Sundays and federal holidays, unless approved by the City.
b. Construction equipment shall be properly maintained and equipped with mufflers.
c. Equipment shall be turned off when not in use for an excess of five minutes, except for equipment that requires idling to maintain performance.
d. A public liaison shall be appointed for project construction and shall be responsible for addressing public concerns about construction activities, including excessive noise. As needed, the liaison shall determine the cause of the concern (e.g., starting too early, bad muffler) and implement measures to address the concern.
e. The public shall be notified in advance of the location and dates of construction hours and activities. The liaison will work directly with the construction contractor to ensure implementation of the noise control plan.
f. Where necessary, temporary sound barriers shall be installed.
g. Signage and notification on where to report construction-generated noise shall be posted onsite and around the construction area, as well as the BOE website.
h. Staging and queuing areas shall not be located at the furthest distance possible from nearby residential land uses, as well as, any other noise-sensitive land uses identified in the project area at the time of construction (e.g., transient lodging, schools, libraries, churches, hospitals, nursing homes).
i. Limit noise/vibration intensive activities occurring close to existing structures and occupied land uses. Where possible and to the extent locally available, select low vibration-generating equipment when activities occur within ten feet of adjacent existing structures.
j. Implement additional measures, to the extent necessary, in response to public concerns.

Table 11
Construction Noise Levels at Nearby Noise-Sensitive Land Uses

Construction Activity	Noise Level (dBA Leq) at Nearby Noise-Sensitive Land Uses							
	Brick Lofts Residential				MFR on S. Clarence St.			
	Project Construction	Daytime Ambient	Project Plus Ambient	Change	Project Construction	Daytime Ambient	Project Plus Ambient	Change
Site Preparation/Grubbing	50	61	61	0	56	62	62	1
Grading/Excavation	51	61	61	0	57	62	62	1
Asphalt Demolition	50	61	61	0	56	62	62	1
Park Construction and Infrastructure Installation	45	61	61	0	51	62	62	0
Paving	46	61	61	0	52	62	62	0
Utilities	46	61	61	0	52	62	62	0
Building Construction	47	61	61	0	53	62	62	1
In-River Terracing	49	61	61	0	48	62	62	0

Construction noise levels were quantified assuming the three loudest pieces of equipment operating simultaneously at the nearest construction site boundary. Predicted noise levels were calculated assuming a noise-attenuation rate of 6 dB per doubling of distance from the source and shielding provided by intervening structures.

Significance after Mitigation

The proposed mitigation measures would limit construction activities to the less noise-sensitive periods of the day, which would minimize potential disturbance to nearby residential land uses. The use of mufflers on off-road equipment would reduce equipment noise levels by approximately 10 dB. Additional measures have also been included to further minimize potential disturbance to nearby land uses, including limitation on equipment idling and locations for equipment staging and queuing areas. Additional measures may also be implemented on an "as-needed" basis to address public concerns. With mitigation, this impact would be considered less than significant.

Exposure to Groundborne Vibration

Impact Noise-C: Would the project result in exposure of persons to or generation of groundborne vibration or groundborne noise levels?

The effects of groundborne vibration can vary from no perceptible effects at the lowest levels, low rumbling sounds and detectable vibrations at moderate levels, and slight damage to nearby structures at the highest levels. At the highest levels of vibration, damage to structures is primarily architectural (e.g., loosening and cracking of plaster or stucco coatings) and rarely results in structural damage. The effects of ground vibration are influenced by the duration of the vibration and the distance from the vibration source.

Vibration levels associated with construction equipment likely to be required during project construction are summarized in Table 12. The use of impact pile drivers are not anticipated to be required for this project.

Table 12
Representative Construction Equipment Vibration Levels

Equipment	Vibration Level at 25 ft.	
	Peak Particle Velocity (ppv, in/sec)	VdB (micro-inch/second)
Caisson Drilling	0.089	87
Hoe Ram/Pavement Breaker	0.089	87
Large Bulldozers	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small Bulldozers	0.003	58
Source: FTA 2006, Caltrans 2013a		

As noted earlier in this report, there are no federal, state, or local regulatory standards for groundborne vibration. However, Caltrans has developed vibration criteria based on potential structural damage risks and human annoyance. Caltrans' minimum recommended criteria for the evaluation of groundborne vibration levels, with regard to structural damage and human annoyance is 0.2 in/sec ppv.

The nearest existing structures include non-residential structures located adjacent to the project site. The nearest residential uses located approximately 350 feet to the north of the proposed East Park, along S. Clarence Street. The nearest noise-sensitive land use in the vicinity of the proposed West Park is a residential development referred to as the "Brick Lofts", which is located approximately 700 feet south of the proposed West Park, near the intersection of Mateo Street and Jesse Street.

As depicted in Table 12, off-road equipment and haul trucks would generate groundborne vibration levels of 0.003 to 0.089 in/sec ppv (58 to 87 VdB) at 25 feet. Assuming a distance of 350 feet and a maximum vibration level of

0.089 in/sec ppv, predicted vibration levels would be approximately 0.01 in/sec ppv, or less, at the nearest residential structures. Based on this same vibration level, predicted vibration levels at non-residential land uses located adjacent to the project site could exceed 0.05 in/sec ppv when heavy equipment (e.g., dozers) are operated within five feet of existing structures. In addition, haul trucks traveling along area roadways may result in perceptible increases in vibration levels. However, these vibration levels would be transient and instantaneous events, which would be typical of existing vibrations along the roadway network. Based on measurements conducted by Caltrans, on-road heavy-duty trucks would not generate substantial increases in groundborne vibration that would be expected to exceed commonly applied criteria for structural damage or annoyance (Caltrans 2013).

Groundborne vibration levels associated with off-road equipment and haul trucks would not exceed the minimum commonly applied standards of 0.3 in/sec at the nearest residential structures. However, construction activities occurring within five feet of nearby existing non-residential structures could potentially exceed the threshold of 0.5 in/sec ppv. Therefore, increases in groundborne vibration levels associated with the project would be considered potentially significant.

Mitigation Measure

Implement MM Noise-1.

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APPENDIX A
Noise Modeling

REFERENCE LEVEL (DBA LEQ)

CROWD		PA	BOTH
36	DB AT 100 FEET FOR 2 INDIVIDUALS		
60	DB AT 100 FEET FOR 500 INDIVIDUALS	70	71
63	DB AT 100 FEET FOR 1000 INDIVIDUALS	73	73
64	DB AT 100 FEET FOR 1500 INDIVIDUALS	79	79
66	DB AT 100 FEET FOR 2000 INDIVIDUALS	81	81
68	DB AT 100 FEET FOR 3250 INDIVIDUALS	83	83
69	DB AT 100 FEET FOR 5000 INDIVIDUALS	84	84

CROWD NOISE BASED ON 50% MALE AND 50% FEMALE. AMPLIFIED PA SOUND SYSTEMS ASSUMED FOR ALL RECREATIONAL USES/EVENTS. ASSUMES A MINIMUM OF 70 DB AT 100 FEET OR 10 DB ABOVE CROWD NOISE FOR SMALLER LOCALIZED EVENTS (BALL FIELDS, STAGE). ASSUMES 15 DB ABOVE CROWD NOISE FOR LARGER SPECIAL EVENTS WITH DISPERSED CROWDS. CONSERVATIVELY ASSUMES CNEL IS 2 DB LOWER THAN LEQ.

Event (Capacity)	Noise Level (dBA Leq) at 100 ft.	Noise Level (dBA CNEL) at 100 ft.	Shielding (Intervening Bldgs.	Distance (feet) From Source Center		Average-daily Noise Level (dBA CNEL)							
						Project Noise Levels		Existing Ambient		Ambient With Project		Noise Increase With	
				Brick Lofts, LLC	MFR on S. Clarence St.	Brick Lofts, LLC	MFR on S. Clarence St.	Brick Lofts, LLC	MFR on S. Clarence St.	Brick Lofts, LLC	MFR on S. Clarence St.	Brick Lofts, LLC	MFR on S. Clarence St.
Arts Plaza Stage (1,000)	72	70	10	980	2,000	40	34	58	62	58	62	0	0
Soccer Field (500)	70	68	10	2,150	700	31	41	58	62	58	62	0	0
Basketball Courts (500)	70	68	10	2,485	430	30	45	58	62	58	62	0	0
Flex Area 1 (1,500)	79	77	10	2,280	610	40	51	58	62	58	62	0	0
Flex Area 2 (1,500)	79	77	10	2,210	510	40	53	58	62	58	62	0	0
Intermediate Event (2,000)	81	79	10			42	55	58	62	58	62	0	0
Special Event (3,250)	83	81	10			44	57	58	62	58	62	0	0
Special Event (5,000)	84	82	10			45	58	58	62	58	65	0	0

TRAFFIC NOISE MODELING

VEHICLE DISTRIBUTION	DAY	EVE	NIGHT
LDV	75.5	12.6	9.3
MDV	1.5	0.1	0.2
HDT	0.6	0.1	0.1

ROADWAY SEGMENT	# LANES	AVG. MEDIAN WIDTH (FEET)	AVG. SPEED (MPH)	EXISTING CONDITIONS WITHOUT PROJECT					EXISTING CONDITIONS WITH PROJECT				
				DAILY VOLUME	CNEL AT 50FT FROM NTLCL	DISTANCE TO CNEL CONTOURS (FEET)			DAILY VOLUME	CNEL AT 50FT FROM NTLCL	DISTANCE TO CNEL CONTOURS (FEET)		
						70	65	60			70	65	60
4TH STREET, WEST OF CLARENCE STREET	4	12	35	32,300	67.4	0	111	233	32,090	67.4	0	111	232
6TH STREET, WEST OF MATEO STREET	4	0	35	14,880	64.8	0	67	139	14,840	64.8	0	66	139
6TH STREET, EAST OF MATEO STREET	4	0	35	13,530	64.4	0	63	131	13,530	64.4	0	63	131
7TH STREET, WEST OF BOYLE AVE	4	12	35	12,360	63.2	0	64	125	12,060	63.1	0	63	123
7TH STREET, EAST OF ALAMEDA STREET	4	0	35	14,810	64.8	0	66	139	14,730	64.8	0	66	138
7TH STREET, WEST OF MATEO STREET	4	0	35	12,090	63.9	0	59	121	12,010	63.9	0	58	121
7TH STREET, WEST OF SANTA FE AVE	4	0	35	11,180	63.6	0	56	115	11,100	63.6	0	56	115
7TH STREET, EAST OF SANTA FE AVE	4	0	35	13,740	64.5	0	63.3	132	13,620	64.5	0	63	131
ALAMEDA STREET, NORTH OF 6TH STREET	4	12	35	20,500	65.4	0	85	173	19,730	65.3	0	83	169
ALAMEDA STREET, SOUTH OF 6TH STREET	4	12	35	20,460	65.4	0	85	173	20,460	65.4	0	85	173
CLARENCE STREET, SOUTH OF 4TH STREET	2	0	25	750	49.5	0	0	0	750	49.5	0	0	0
MATEO STREET, NORTH OF 7TH STREET	2	0	30	4,580	59.2	0	0	0	4,580	59.2	0	0	0
MATEO STREET, SOUTH OF 6TH STREET	2	0	30	4,960	59.5	0	0	52	4,920	59.5	0	0	52
MATEO STREET, NORTH OF 6TH STREET	2	0	30	4,530	59.1	0	0	0	4,530	59.1	0	0	0
SANTA FE AVE, SOUTH OF E 4TH STREET	2	0	30	10,190	62.7	0	0	84	10,150	62.7	0	0	84
SANTA FE AVE, NORTH OF 7TH STREET	2	0	30	7,620	61.4	0	0	69	7,620	61.4	0	0	69
WHITTIER STREET, WEST OF BOYLE AVE	4	0	35	15,110	64.9	0	67	141	15,110	64.9	0	67	141

CHANGES IN TRAFFIC NOISE LEVELS WITH PROJECT IMPLEMENTATION

ROADWAY SEGMENT	CNEL AT 50 FT FROM NTLCL		
	EX NP	EX PP	CHANGE
4TH STREET, WEST OF CLARENCE STREET	67.4	67.4	0.0
6TH STREET, WEST OF MATEO STREET	64.8	64.8	0.0
6TH STREET, EAST OF MATEO STREET	64.4	64.4	0.0
7TH STREET, WEST OF BOYLE AVE	63.2	63.1	-0.1
7TH STREET, EAST OF ALAMEDA STREET	64.8	64.8	0.0
7TH STREET, WEST OF MATEO STREET	63.9	63.9	0.0
7TH STREET, WEST OF SANTA FE AVE	63.6	63.6	0.0
7TH STREET, EAST OF SANTA FE AVE	64.5	64.5	0.0
ALAMEDA STREET, NORTH OF 6TH STREET	65.4	65.3	-0.1
ALAMEDA STREET, SOUTH OF 6TH STREET	65.4	65.4	0.0
CLARENCE STREET, SOUTH OF 4TH STREET	49.5	49.5	0.0
MATEO STREET, NORTH OF 7TH STREET	59.2	59.2	0.0
MATEO STREET, SOUTH OF 6TH STREET	59.5	59.5	0.0
MATEO STREET, NORTH OF 6TH STREET	59.1	59.1	0.0
SANTA FE AVE, SOUTH OF E 4TH STREET	62.7	62.7	0.0
SANTA FE AVE, NORTH OF 7TH STREET	61.4	61.4	0.0
WHITTIER STREET, WEST OF BOYLE AVE	64.9	64.9	0.0

TRAFFIC NOISE MODELING

VEHICLE DISTRIBUTION	EVE	NIGHT	NIGHT
LDV	12.6	9.3	9.3
MDV	0.1	0.2	0.2
HDT	0.1	0.1	0.1

ROADWAY SEGMENT	CUMULATIVE CONDITIONS WITHOUT PROJECT					CUMULATIVE CONDITIONS WITH PROJECT				
	DAILY VOLUME	CNEL AT 50FT FROM NTLCL	DISTANCE TO CNEL CONTOURS (FEET)			DAILY VOLUME	CNEL AT 50FT FROM NTLCL	DISTANCE TO CNEL CONTOURS (FEET)		
			70	65	60			70	65	60
4TH STREET, WEST OF CLARENCE STREET	52,520	69.5	75	151	321	52,310	69.5	75	151	320
6TH STREET, WEST OF MATEO STREET	14,920	64.9	0	67	139	14,880	64.8	0	67	139
6TH STREET, EAST OF MATEO STREET	13,570	64.4	0	63	131	13,570	64.4	0	63	131
7TH STREET, WEST OF BOYLE AVE	21,440	65.6	0	87	178	21,140	65.6	0	86	177
7TH STREET, EAST OF ALAMEDA STREET	26,950	67.4	0	97	206	26,870	67.4	0	97	205
7TH STREET, WEST OF MATEO STREET	24,220	67.0	0	90	192	24,140	67.0	0	90	191
7TH STREET, WEST OF SANTA FE AVE	13,550	64.4	0	63	131	13,470	64.4	0	63	131
7TH STREET, EAST OF SANTA FE AVE	22,830	66.7	0	87	184	22,710	66.7	0	87	184
ALAMEDA STREET, NORTH OF 6TH STREET	37,320	68.0	63	122	256	37,320	68.0	63	122	256
ALAMEDA STREET, SOUTH OF 6TH STREET	38,300	68.1	63	124	260	38,300	68.1	63	124	260
CLARENCE STREET, SOUTH OF 4TH STREET	810	49.8	0	0	0	810	49.8	0	0	0
MATEO STREET, NORTH OF 7TH STREET	14,760	64.3	0	0	108	14,760	64.3	0	0	108
MATEO STREET, SOUTH OF 6TH STREET	19,840	65.6	0	61	131	19,800	65.6	0	61	131
MATEO STREET, NORTH OF 6TH STREET	19,410	65.5	0	60	129	19,410	65.5	0	60	129
SANTA FE AVE, SOUTH OF E 4TH STREET	13,100	63.8	0	0	99	13,010	63.7	0	0	99
SANTA FE AVE, NORTH OF 7TH STREET	18,660	65.3	0	59	126	18,660	65.3	0	59	126
WHITTIER STREET, WEST OF BOYLE AVE	15,160	64.9	0	67	141	15,160	64.9	0	67	141

CHANGES IN TRAFFIC NOISE LEVELS WITH PROJECT IMPLEMENTATION

ROADWAY SEGMENT	CNEL AT 50 FT FROM NTLCL		
	CU NP	CU PP	CHANGE
4TH STREET, WEST OF CLARENCE STREET	69.5	69.5	0.0
6TH STREET, WEST OF MATEO STREET	64.9	64.8	-0.1
6TH STREET, EAST OF MATEO STREET	64.4	64.4	0.0
7TH STREET, WEST OF BOYLE AVE	65.6	65.6	0.0
7TH STREET, EAST OF ALAMEDA STREET	67.4	67.4	0.0
7TH STREET, WEST OF MATEO STREET	67.0	67.0	0.0
7TH STREET, WEST OF SANTA FE AVE	64.4	64.4	0.0
7TH STREET, EAST OF SANTA FE AVE	66.7	66.7	0.0
ALAMEDA STREET, NORTH OF 6TH STREET	68.0	68.0	0.0
ALAMEDA STREET, SOUTH OF 6TH STREET	68.1	68.1	0.0
CLARENCE STREET, SOUTH OF 4TH STREET	49.8	49.8	0.0
MATEO STREET, NORTH OF 7TH STREET	64.3	64.3	0.0
MATEO STREET, SOUTH OF 6TH STREET	65.6	65.6	0.0
MATEO STREET, NORTH OF 6TH STREET	65.5	65.5	0.0
SANTA FE AVE, SOUTH OF E 4TH STREET	63.8	63.7	-0.1
SANTA FE AVE, NORTH OF 7TH STREET	65.3	65.3	0.0
WHITTIER STREET, WEST OF BOYLE AVE	64.9	64.9	0.0

PREDICTED ONSITE NOISE LEVELS

VEHICLE DISTRIBUTION	DAY	EVE	NIGHT	TOTAL %
LDV	75	12.4	9.2	96.60%
MDV	1.7	0.3	0.4	2.40%
HDT	0.7	0.2	0.1	1.00%

ROADWAY SEGMENT	# LANES	AVG. SPEED (MPH)	YR 2035 AVERAGE DAILY VOLUME	BARRIER HEIGHT (FT.)	BARRIER ADJUSTMENT	DISTANCE FROM ROAD C.L. TO NEAREST ONSITE REC. AREA (FT)	CNEL AT NEAREST ONSITE REC. AREA
U.S. 101	6	65	173700	10	-9	200	67.6
U.S. 101	6	65	173700	10	-9	100	70.3

Year 2035 traffic volumes and vehicle distribution derived from Caltrans' Transportation Concept Report U.S. 101, District 7 (July 2013)

UNION PACIFIC & METRO RAIL LINES	EXISTING	YR 2035
AVERAGE NUMBER OF FREIGHT TRAINS-TOTAL YR 2035:	59	111
AVERAGE NUMBER OF FREIGHT TRAINS/HR - EAST BANK:	1.3	2.3
AVERAGE NUMBER OF FREIGHT TRAINS/HR - WEST BANK:	1.3	2.3
HOURS OF OPERATION DAILY:	24	24
AVERAGE NUMBER OF ENGINES/TRAIN:	4	4
AVERAGE NUMBER OF CARS/TRAIN:	100	100
AVERAGE SPEED:	35	35
AVERAGE NUMBER OF AMTRAK TRAINS-TOTAL:	12	13
AVERAGE NUMBER OF AMTRAK TRAINS/HR/BANK-DAYTIME:	0.4	0.5
AVERAGE NUMBER OF AMTRAK TRAINS/HR/BANK-NIGHTTIME:	0.1	0.1
AVERAGE NUMBER OF ENGINES/TRAIN:	2	2
AVERAGE NUMBER OF CARS/TRAIN:	8	8
AVERAGE SPEED:	45	45
AVERAGE NUMBER OF METRO TRAINS-TOTAL:	20	24
AVERAGE NUMBER OF METRO TRAINS/HR/BANK-DAYTIME:	0.7	0.8
AVERAGE NUMBER OF METRO TRAINS/HR/BANK-NIGHTTIME:	0.1	0.1
AVERAGE NUMBER OF ENGINES/TRAIN:	2	2
AVERAGE NUMBER OF CARS/TRAIN:	8	8
AVERAGE SPEED:	45	45
COMBINED CNEL AT 100 FT. FROM NEAR CORRIDOR TRACK C.L. :	**70**	**72**
COMBINED CNEL AT 400 FT. FROM FAR CORRIDOR TRACK C.L. :	**61**	**63**
COMBINED CNEL AT NEAR SITE BOUNDARY:	**71**	**73**

**Based on predicted future year 2035 freight train volumes derived from Southern California Association of Government's Regional Rail Simulation Update Summary Report (November 2011). Metrolink and Amtrak volumes based on existing schedules for year 2020. Passenger train volumes for future year 2035 assumes in average projected increase of 1.6 passenger trains/5-year period (SCAG. 2012. 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy. http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx). Train volumes distributed equally among east and west bank track lines.*