

NOISE AND VIBRATION IMPACT ANALYSIS

**TEMESCAL CANYON SELF STORAGE PROJECT
RIVERSIDE COUNTY, CALIFORNIA**



August 2024

NOISE AND VIBRATION IMPACT ANALYSIS

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LIST OF ABBREVIATIONS AND ACRONYMS

CEQA	California Environmental Quality Act
County	County of Riverside
CNEL	Community Noise Equivalent Level
dB	decibel(s)
dBA	A-weighted decibel(s)
EPA	United States Environmental Protection Agency
ft	foot/feet
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HVAC	heating, ventilation, and air conditioning
in/sec	inches per second
L_{dn}	day-night average noise level
L_{eq}	equivalent continuous sound level
L_{max}	maximum instantaneous sound level
Noise Element	Riverside County General Plan Noise Element
PPV	peak particle velocity
project	Temescal Canyon Self Storage Project
RMS	root-mean-square
SPL	sound pressure level
sq ft	square foot/feet
VdB	vibration velocity decibels

INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and reduction measures associated with the Temescal Canyon Road Self Storage Project (project) located at 21765 Temescal Canyon Road in Riverside County, California. This report is intended to satisfy the County of Riverside (County) requirements for a project-specific noise impact analysis by examining the impacts of the project site and evaluating noise reduction measures that the project may require.

PROJECT LOCATION AND DESCRIPTION

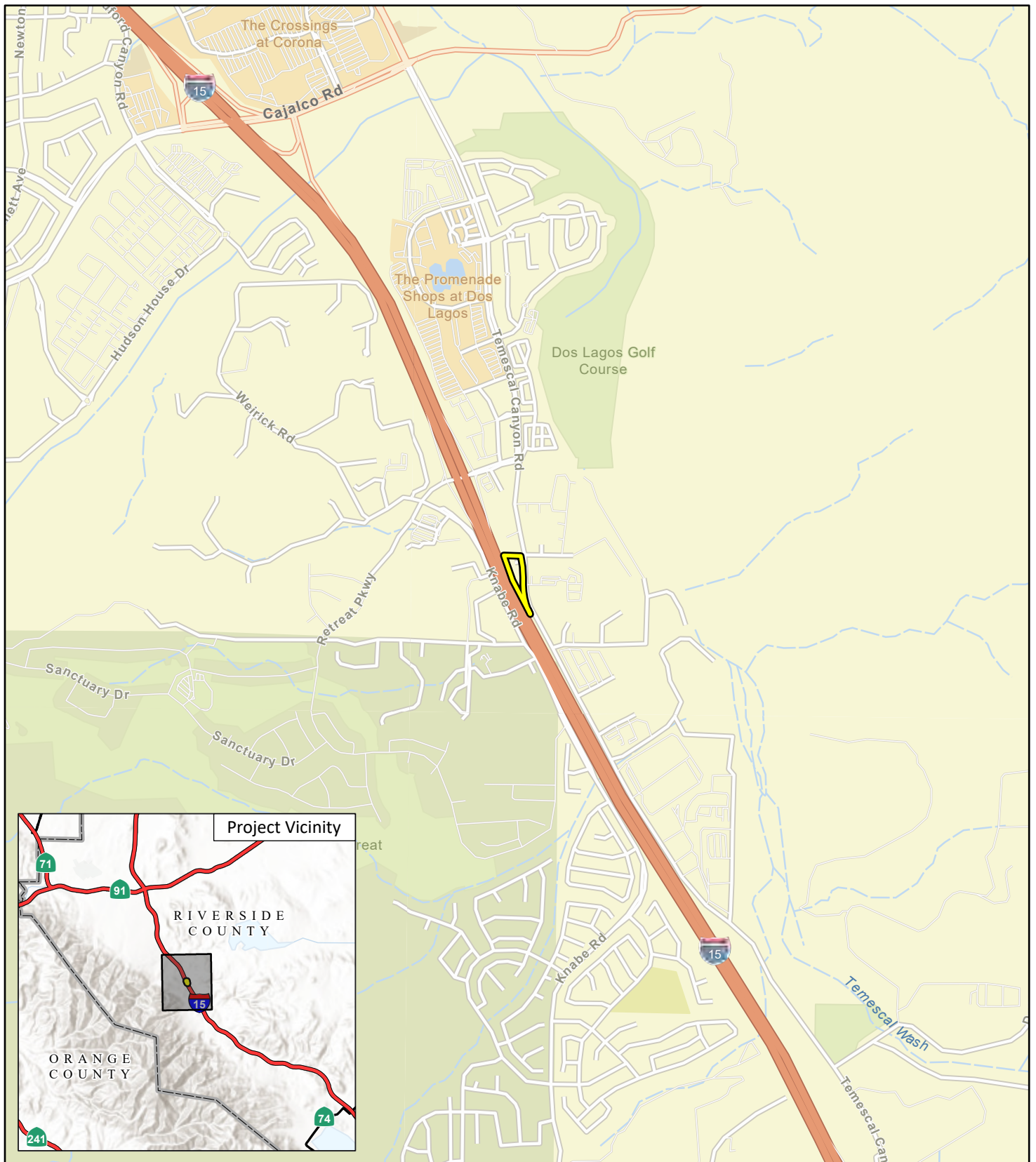
The proposed project involves demolishing the two existing buildings within the site including the 11,501 square foot (sf) Empire Recreational Rentals shop and 2,615 sf All Four-Wheel Drive auto repair shop. The existing land uses would be replaced with a 3-story 103,195 sf self-storage unit building. The proposed building would consist of 33,379 sf self-storage area and 942 sf of office space on the first floor and 34,437 sf self-storage area on the second floor as well as a 34,437 sf self-storage area on the third floor. The proposed project has the potential to operate 24 hours per day, seven (7) days a week. Figure 1, Project Location and Vicinity, and Figure 2, Project Site Plan, are presented below.

EXISTING LAND USES IN THE PROJECT AREA

The project site is surrounded by both existing industrial and residential uses. The areas adjacent to the project site include the following uses:

- **North:** Existing residential and commercial uses.
- **East:** Existing industrial uses.
- **West:** Downey Wholesale Warehouse and vacant land across Interstate 15 (I-15).

The nearest sensitive receptor is the existing residence approximately 15 feet (ft) away from the northern project boundary line.



LSA

 Project Location

FIGURE 1



0 1000 2000
FEET

SOURCE: Esri Street Map 2024

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Temescal Canyon Self Storage
Project Location

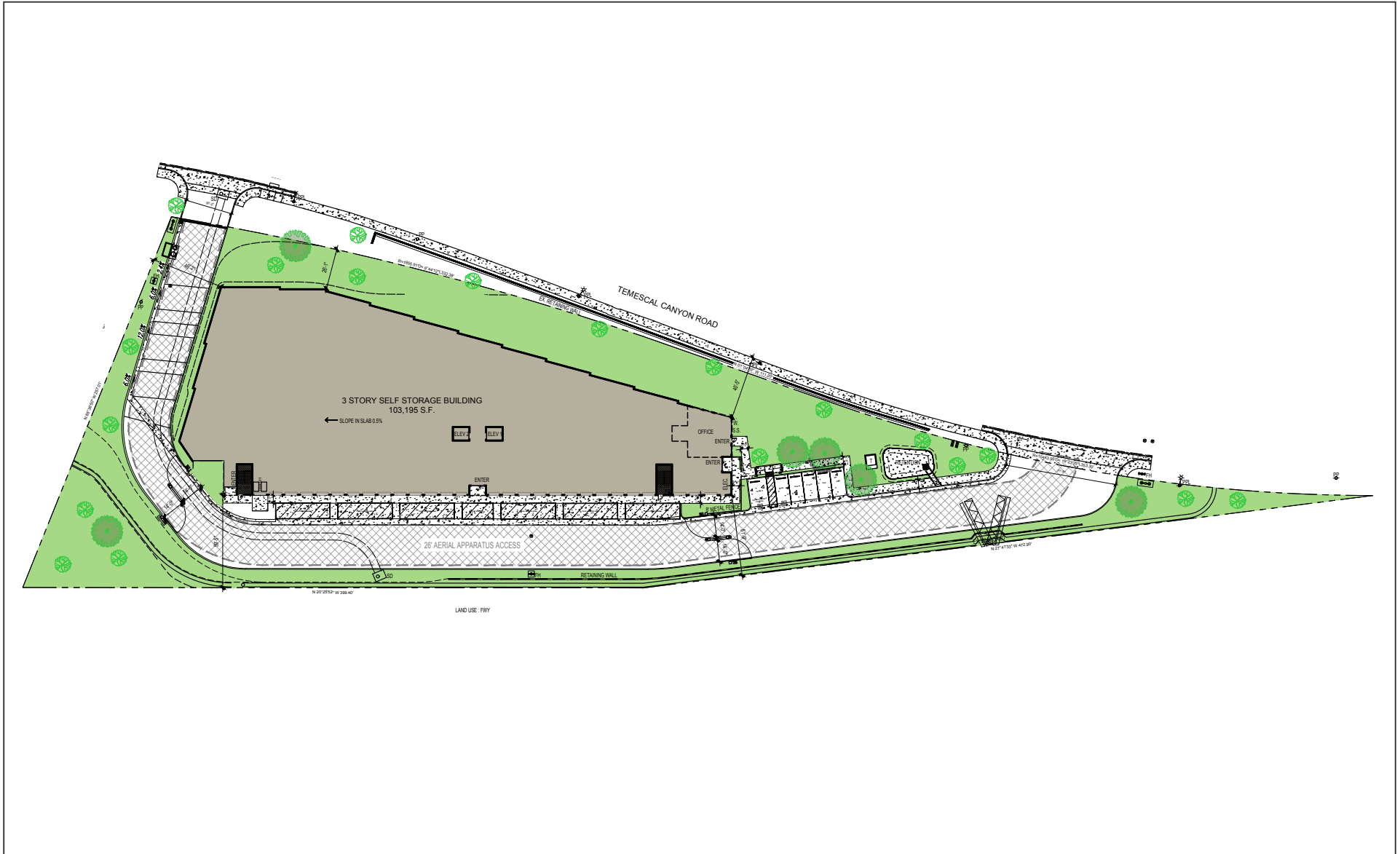


FIGURE 2

LSA

NOISE AND VIBRATION FUNDAMENTALS

CHARACTERISTICS OF SOUND

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a sound wave, which results in the tone's range from high to low. Loudness is the strength of a sound, and it describes a noisy or quiet environment; it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity is the average rate of sound energy transmitted through a unit area perpendicular to the direction in which the sound waves are traveling. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

MEASUREMENT OF SOUND

Sound intensity is measured with the A-weighted decibel (dBA) scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound, similar to the human ear's de-emphasis of these frequencies. Decibels (dB), unlike the linear scale (e.g., inches or pounds), are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 dB is 10 times more intense than 0 dB, 20 dB is 100 times more intense than 0 dB, and 30 dB is 1,000 times more intense than 0 dB. Thirty decibels (30 dB) represents 1,000 times as much acoustic energy as 0 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the sound's loudness. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound levels dissipate exponentially with distance from their noise sources. For a single point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dB for each doubling of distance in a hard site environment. Line source sound levels decrease 4.5 dB for each doubling of distance in a relatively flat environment with absorptive vegetation.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and Community Noise Equivalent Level (CNEL) or the day-night average noise level (L_{dn}) based on A-weighted decibels. CNEL is the time-weighted average noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noises occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the relaxation. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable. The County uses the CNEL noise scale for long-term traffic noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level (L_{max}), which is the highest sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by L_{max} , which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. It is often used together with another noise scale, or noise standards in terms of percentile noise levels, in noise ordinances for enforcement purposes. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first category includes audible impacts, which are increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to sound levels higher than 85 dBA. Exposure to high sound levels affects the entire system, with prolonged sound exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of sound exposure above 90 dBA would result in permanent cell damage. When the sound level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of sound is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by a feeling of pain in the ear (i.e., the threshold of pain). A sound level of 160–165 dBA will result in dizziness or a

loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed areas.

Table A lists definitions of acoustical terms, and Table B shows common sound levels and their sources.

Table A: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of sound measurement that denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in 1 second (i.e., the number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. (All sound levels in this report are A-weighted unless reported otherwise.)
L_{01} , L_{10} , L_{50} , L_{90}	The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 1%, 10%, 50%, and 90% of a stated time period, respectively.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dBA to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dBA to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dBA to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max} , L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time. Usually a composite of sound from many sources from many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, and tonal or informational content, as well as the prevailing ambient noise level.

Source 1: *Technical Noise Supplement* (Caltrans 2013)

Source 2: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

Table B: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Evaluations
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle at a Few Feet Away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/ Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	—
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	—
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	—
Near Freeway Auto Traffic	70	Moderately Loud	Reference level
Average Office	60	Quiet	One-half as loud
Suburban Street	55	Quiet	—
Light Traffic; Soft Radio Music in Apartment	50	Quiet	One-quarter as loud
Large Transformer	45	Quiet	—
Average Residence without Stereo Playing	40	Faint	One-eighth as loud
Soft Whisper	30	Faint	—
Rustling Leaves	20	Very Faint	—
Human Breathing	10	Very Faint	Threshold of Hearing
—	0	Very Faint	—

Source: Compiled by LSA (2023).

FUNDAMENTALS OF VIBRATION

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may not be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items sitting on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile-driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 ft from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft as detailed in the Federal Transit Administration's (FTA) 2018 *Transit Noise and Vibration Impact Assessment Manual* (FTA Manual). When roadways are smooth, vibration from traffic, even heavy

trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne vibration from street traffic will not exceed the impact criteria; however, construction of the project could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne noise is not likely to be a problem because noise arriving via the normal airborne path will usually be greater than ground-borne noise.

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for train-induced ground-borne vibration to cause even cosmetic building damage, it is not uncommon for construction processes such as blasting and pile-driving to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize the potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as

$$L_v = 20 \log_{10} [V/V_{ref}]$$

where “ L_v ” is the vibration velocity in decibels (VdB), “ V ” is the RMS velocity amplitude, and “ V_{ref} ” is the reference velocity amplitude, or 1×10^{-6} inches/second (in/sec) used in the United States.

REGULATORY SETTING

APPLICABLE NOISE STANDARDS

The applicable noise standards governing the project site include the criteria in the Riverside County General Plan Noise Element and the Riverside County Code of Ordinances.

Local Regulations

Riverside County

Noise Element of the General Plan. The Noise Element chapter within the Current General Plan Documents from the Riverside County General Plan includes noise and vibration goals and policies that aim to minimize the impact of noise sources found in the county. The relevant noise goals and policies are listed below:

The Riverside County's primary goal is to minimize the exposure of residents to unhealthy and excessive noise levels. The County has adopted noise and land use compatibility guidelines, shown in Table N-1 (Table C of this document), *Land Use Compatibility for Community Noise Exposure*.

N 1.1 Protect noise-sensitive land uses from high levels of noise by restricting noise-producing land uses from these areas. If the noise-producing land use cannot be relocated, then noise buffers such as setbacks, landscaping, or block walls shall be used.

N 1.2 Guide noise-tolerant land uses into areas irrevocably committed to land uses that are noise-producing, such as transportation corridors or within the projected noise contours of any adjacent airports.

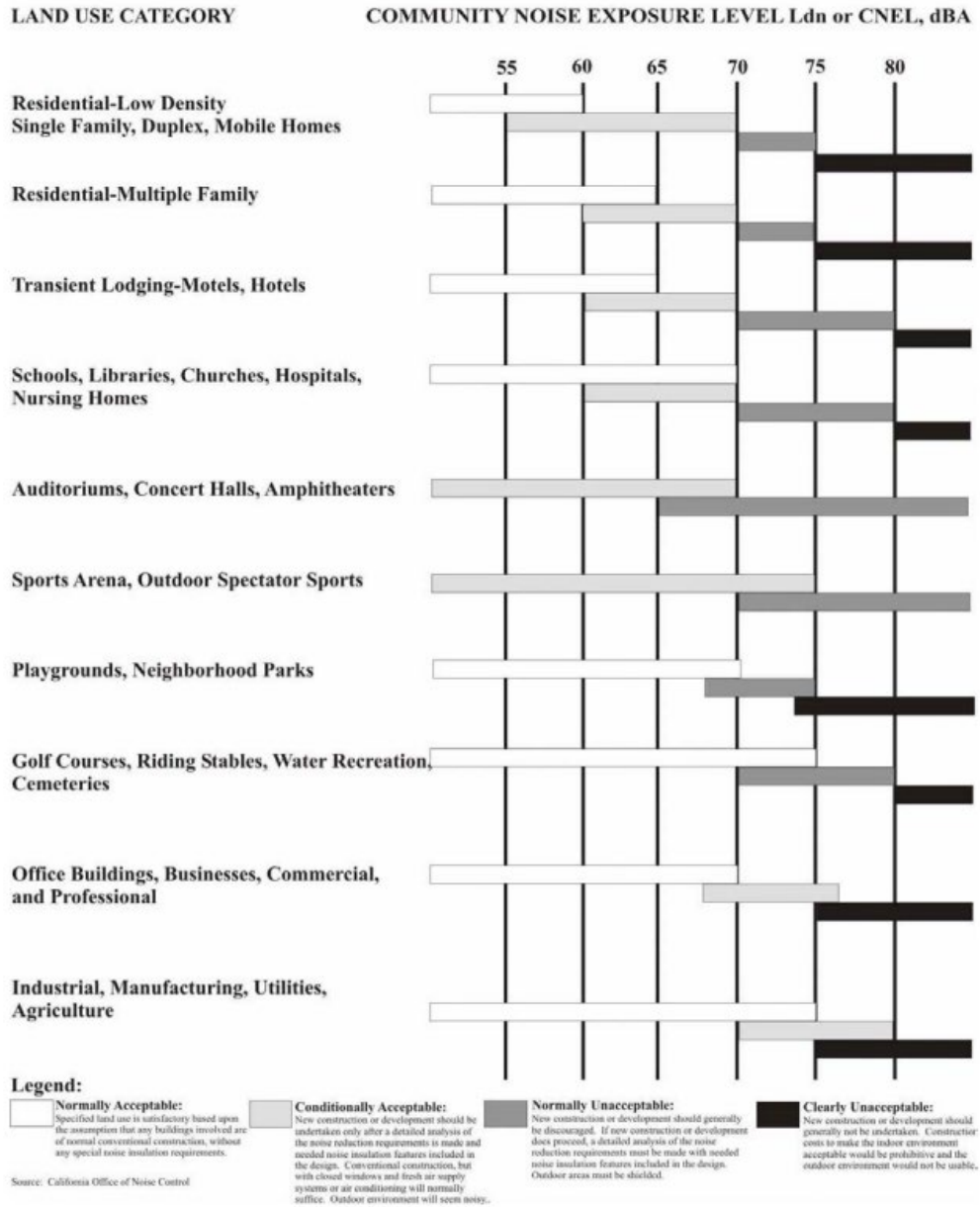
N 1.3 Consider the following uses noise-sensitive and discourage these uses in areas in excess of 65 CNEL:

- Schools.
- Hospitals.
- Rest Homes.
- Long Term Care Facilities.
- Mental Care Facilities.
- Residential Uses.
- Libraries.
- Passive Recreation Uses.
- Places of Worship.

According to the State of California Office of Planning and Research General Plan Guidelines, an acoustical study may be required in cases where these noise-sensitive land uses are located in an area of 60 CNEL or greater. Any land use that is exposed to levels higher than 65 CNEL will require noise attenuation measures.

Table C: Land Use Compatibility for Community Noise Exposure

**Table N-1
Land Use Compatibility for Community Noise Exposure**



Riverside County Code of Ordinances. Chapter 9.52, Noise Regulation, of the Riverside County Code of Ordinances states that “No person shall create any sound, or allow the creation of any sound, on any property that causes the exterior sound level on any other occupied property to exceed the sound level standards set forth in Table 1.” These sound level standards are summarized in Table D.

Table D: Sound Level Standards (dB L_{max})

General Plan Land Use Designation	Daytime	Nighttime
	7:00 a.m. – 10:00 p.m.	10:00 p.m. – 7:00 a.m.
Residential	55	45
Commercial	65	55
Industrial	75	55

Source: County of Riverside Municipal Code, Section 9.52.040 General Sound Level Standards.

The Riverside County Code of Ordinances under Section 9.52.020 specifies that sound emanating from private construction projects located within one-quarter of a mile from an inhabited dwelling is exempt from the provisions of this chapter, provided that construction does not occur between the hours of six p.m. and six a.m. during the months of June through September, and six p.m. and seven a.m. during the months of October through May.

Federal Transit Administration

Though the County does not have daytime construction noise level limits for activities that occur within the specified hours of the Riverside County Code of Ordinances, to determine potential California Environmental Quality Act (CEQA) noise impacts, construction noise was assessed using criteria from the FTA Manual (FTA 2018). Table E shows the FTA’s Detailed Assessment Construction Noise Criteria based on the composite noise levels per construction phase.

Table E: Detailed Assessment Daytime Construction Noise Criteria

Land Use	Daytime 1-hour L _{eq} (dBA)
Residential	80
Commercial	85
Industrial	90

Source: Transit Noise and Vibration Impact Assessment Manual (FTA 2018).

dBA = A-weighted decibels

FTA = Federal Transit Administration

L_{eq} = equivalent continuous sound level

APPLICABLE VIBRATION STANDARDS

Federal Transit Administration

Vibration standards included in the FTA Manual are used in this analysis for ground-borne vibration impacts on human annoyance for Industrial land uses. The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table F

provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table F: Interpretation of Vibration Criteria for Detailed Analysis

Land Use	Max L _v (VdB) ¹	Description of Use
Workshop	90	Vibration that is distinctly felt. Appropriate for workshops and similar areas not as sensitive to vibration.
Office	84	Vibration that can be felt. Appropriate for offices and similar areas not as sensitive to vibration.
Residential Day	78	Vibration that is barely felt. Adequate for computer equipment and low-power optical microscopes (up to 20×).
Residential Night and Operating Rooms	72	Vibration is not felt, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power microscopes (100×) and other equipment of low sensitivity.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

¹ As measured in 1/3-octave bands of frequency over a frequency range of 8 to 80 Hertz.

FTA = Federal Transit Administration

Max = maximum

L_v = vibration velocity

VdB = vibration velocity in decibels

Table G lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA Manual. FTA guidelines show that a vibration level of up to 0.2 in/sec in PPV is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For non-engineered timber and masonry buildings, the construction building vibration damage criterion is 0.2 in/sec in PPV.

Table G: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
Reinforced concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry buildings	0.20
Buildings extremely susceptible to vibration damage	0.12

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

FTA = Federal Transit Administration

PPV = peak particle velocity

in/sec = inch/inches per second

OVERVIEW OF THE EXISTING NOISE ENVIRONMENT

The primary existing noise sources in the project area include vehicle traffic from I-15, Temescal Canyon Road, and neighborhood and retail noises in the vicinity of the project site.

AMBIENT NOISE MEASUREMENTS

Long-Term Noise Measurements

To assess existing noise levels, LSA conducted three long-term noise measurements in the vicinity of the project site. The long-term (24-hour) noise level measurements were conducted on June 27 through June 28, 2024, using three Larson Davis Spark 706RC Dosimeters. Table G provides a summary of the measured hourly noise levels and calculated CNEL level from the long-term noise level measurements. As shown in Table H, the calculated CNEL levels reached 75.1 dBA CNEL. Hourly noise levels at surrounding uses are as low as 52.9 dBA L_{eq} during nighttime hours and 55.6 dBA L_{eq} during daytime hours. Noise measurement sheets are provided in Appendix A. Figure 3 shows the long-term monitoring locations.

Table H: Long-Term 24-Hour Ambient Noise Monitoring Results

Location		Daytime Noise Levels ¹ (dBA L_{eq})	Evening Noise Levels ² (dBA L_{eq})	Nighttime Noise Levels ³ (dBA L_{eq})	Daily Noise Levels (dBA CNEL)
LT-1	On a chain link fence running north south on the western side of the site, approximately 134 feet from the center divider of the 15 Freeway.	55.6 – 59.8	58.0 – 58.9	55.8 – 62.7	65.8
LT-2	On a telephone pole east of the site, approximately 639 feet from the center divider of the 15 Freeway.	58.7 – 64.2	55.9 – 57.5	52.9 – 62.6	65.0
LT-3	On a chain link fence running north south on the western side of the site, approximately 134 feet from the center divider of the 15 Freeway.	66.6 – 70.4	67.4 – 68.7	64.0 – 71.7	75.1

Source: Compiled by LSA (2024).

Note: Noise measurements were conducted from June 27 to June 28, 2024, starting at 2:00 p.m.

¹ Daytime Noise Levels = noise levels during the hours from 7:00 a.m. to 7:00 p.m.

² Evening Noise Levels = noise levels during the hours from 7:00 p.m. to 10:00 p.m.

³ Nighttime Noise Levels = noise levels during the hours from 10:00 p.m. to 7:00 a.m.

CNEL = Community Noise Equivalent Level

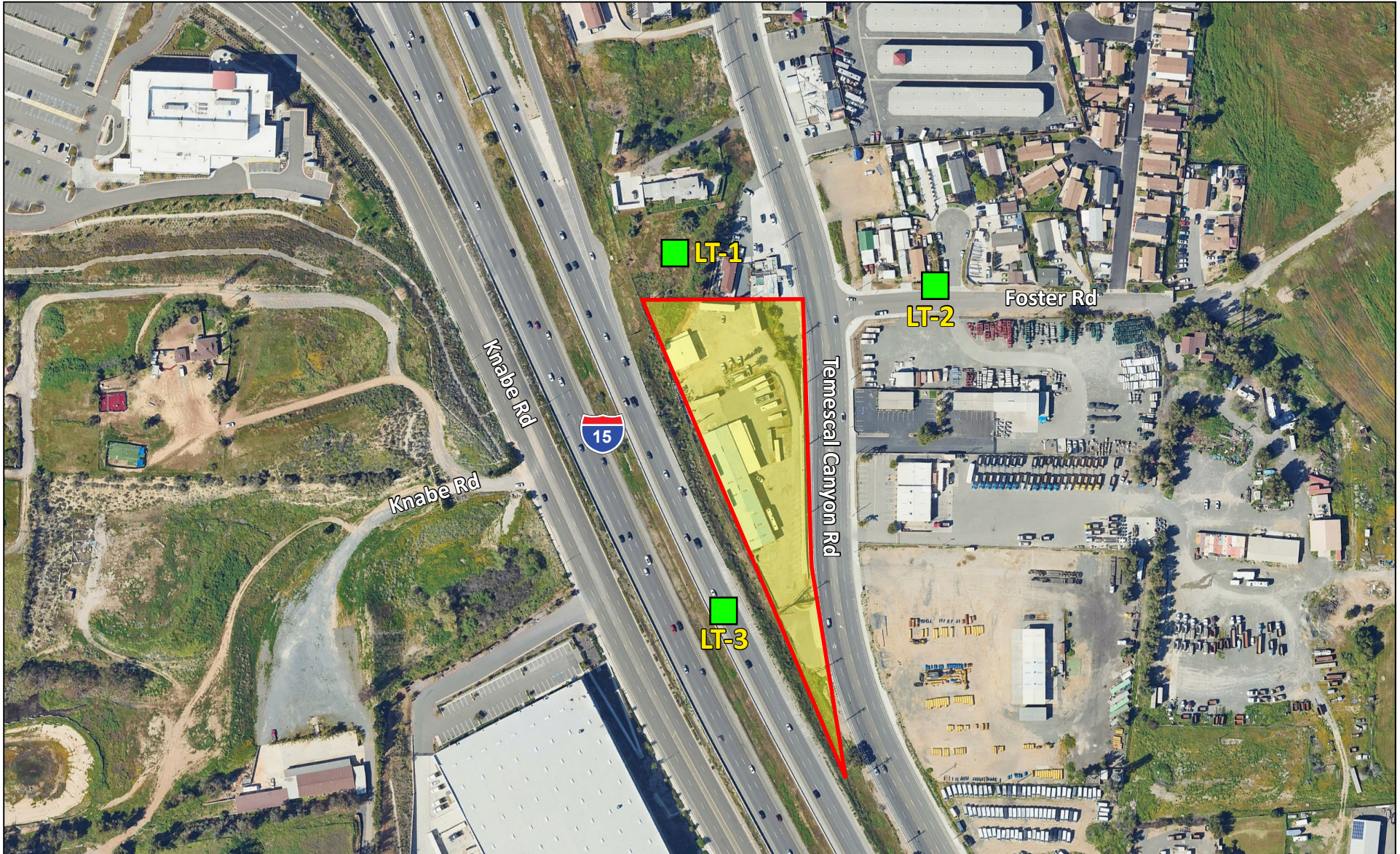
ft = foot/feet

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

EXISTING AIRCRAFT NOISE

The nearest airport to the project is the Corona Municipal Airport, a regional airport approximately 7.9 miles northwest of the project site. According to Figure N-1, Corona Municipal Airport Noise Contours, of the City of Corona's General Plan (City of Corona 2020), the project site is located well outside the 65 dBA CNEL airport noise impact zone. Therefore, the project would not be adversely affected by airport/airfield noise, nor would the project contribute to or result in adverse airport/airfield noise impacts.



PROJECT IMPACTS

SHORT-TERM CONSTRUCTION NOISE IMPACTS

Two types of short-term noise impacts could occur during the construction of the proposed project. First, construction crew commutes and the transport of construction equipment and materials to the site for the proposed project would incrementally increase noise levels on access roads leading to the site. Although there would be a relatively high single-event noise-exposure potential causing intermittent noise nuisance (passing trucks at 50 ft would generate up to 84 dBA L_{max}), the effect on longer-term ambient noise levels would be small when compared to existing daily traffic volumes on Temescal Canyon Road. During the demolition phase, approximately 370 trips would occur during an average day from worker and hauling activities. Because construction-related vehicle trips would not approach existing daily traffic volumes, traffic noise would not increase by 3 dBA CNEL. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment. Therefore, short-term, construction-related impacts associated with worker commutes and equipment transport to the project site would be less than significant.

The second type of short-term noise impact is related to noise generated during construction, which includes demolition of the existing structures and other site improvements, site preparation, grading, building construction, paving, and architectural coating on the project site. Construction is completed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the site and, therefore, the noise levels surrounding the site as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table I lists typical construction equipment noise levels recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receptor, taken from the Federal Highway Administration's *FHWA Roadway Construction Noise Model* (FHWA 2006).

In addition to the reference maximum noise level, the usage factor provided in Table I is used to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(equip) = E.L. + 10 \log(U.F.) - 20 \log\left(\frac{D}{50}\right)$$

where: $L_{eq}(equip)$ = L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period.

E.L. = noise emission level of the particular piece of equipment at a reference distance of 50 ft.

U.F. = usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time.

D = distance from the receiver to the piece of equipment.

Table I: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%) ¹	Maximum Noise Level (L _{max}) at 50 Ft ²
Auger Drill Rig	20	84
Backhoes	40	80
Compactor (ground)	20	80
Compressor	40	80
Cranes	16	85
Dozers	40	85
Dump Trucks	40	84
Excavators	40	85
Flat Bed Trucks	40	84
Forklift	20	85
Front-end Loaders	40	80
Graders	40	85
Impact Pile Drivers	20	95
Jackhammers	20	85
Paver	50	77
Pickup Truck	40	55
Pneumatic Tools	50	85
Pumps	50	77
Rock Drills	20	85
Rollers	20	85
Scrapers	40	85
Tractors	40	84
Trencher	50	80
Welder	40	73

Source: FHWA Roadway Construction Noise Model User's Guide, Table 1 (FHWA 2006).

Note: Noise levels reported in this table are rounded to the nearest whole number.

¹ Usage factor is the percentage of time during a construction noise operation that a piece of construction equipment is operating at full power.

² Maximum noise levels were developed based on Specification 721.560 from the Central Artery/Tunnel program to be consistent with the City of Boston's Noise Code for the "Big Dig" project.

FHWA = Federal Highway Administration

ft = foot/feet

L_{max} = maximum instantaneous sound level

Each piece of construction equipment operates as an individual point source. Using the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Leq (composite) = 10 * \log_{10} \left(\sum_{1}^n 10^{\frac{Ln}{10}} \right)$$

Using the equations from the methodology above, the reference information in Table I, and the construction equipment list provided, the composite noise levels of each construction phase were calculated. The project construction composite noise levels at a distance of 50 ft would range from 74 dBA L_{eq} to 88 dBA L_{eq}, with the highest noise levels occurring during the demolition phase.

Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Leq \text{ (at distance } X) = Leq \text{ (at 50 feet)} - 20 * \log_{10} \left(\frac{X}{50} \right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA.

Table J shows the nearest sensitive uses to the project site, their distance from the center of construction activities, and composite noise levels expected during construction. These noise level projections do not consider intervening topography or barriers. Construction equipment calculations are provided in Appendix B.

Table J: Potential Construction Noise Impacts at Nearest Receptor

Receptor (Location)	Composite Noise Level (dBA L_{eq}) at 50 ft ¹	Distance (ft)	Composite Noise Level (dBA L_{eq})
Industrial Use (East)	88	220	75
Commercial Use (North)		420	69
Residential Use (North)		440	69
Warehouse (West)		440	69

Source: Compiled by LSA (2024).

¹ The composite construction noise level represents the site preparation phase which is expected to result in the greatest noise level as compared to other phases.

dBA L_{eq} = average A-weighted hourly noise level

ft = foot/feet

While construction noise will vary, it is expected that composite noise levels during construction at the nearest off-site industrial uses to the east would reach 75 dBA L_{eq} while construction noise levels would approach 69 dBA L_{eq} at the nearest residential uses to the north during daytime hours. These predicted noise levels would only occur when all construction equipment is operating simultaneously and, therefore, are assumed to be rather conservative in nature. While construction-related short-term noise levels have the potential to be higher than existing ambient noise levels in the project area under existing conditions, the noise impacts would no longer occur once project construction is completed.

As it relates to off-site uses, construction-related noise impacts would remain below the 80 dBA L_{eq} and 90 dBA L_{eq} 1-hour construction noise level criteria for daytime construction noise level criteria as established by the FTA for residential and industrial land uses, respectively; therefore, the impact would be considered less than significant.

SHORT-TERM CONSTRUCTION VIBRATION IMPACTS

This construction vibration impact analysis discusses the level of human annoyance using vibration levels in RMS (VdB) and assesses the potential for building damages using vibration levels in PPV (in/sec). This is because vibration levels calculated in RMS are best for characterizing human

response to building vibration, while vibration level in PPV is best for characterizing potential for damage.

Table K shows the PPV and VdB values at 25 ft from the construction vibration source. As shown in Table K, bulldozers, and other heavy-tracked construction equipment (expected to be used for this project) generate approximately 0.089 PPV in/sec or 87 VdB of ground-borne vibration when measured at 25 ft, based on the FTA Manual. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project construction boundary (assuming the construction equipment would be used at or near the project setback line).

Table K: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L _v at 25 ft	
	PPV (in/sec)	L _v (VdB) ¹
Pile Driver (Impact), Typical	0.644	104
Pile Driver (Sonic), Typical	0.170	93
Vibratory Roller	0.210	94
Hoe Ram	0.089	87
Large Bulldozer²	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks²	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

¹ RMS vibration velocity in decibels (VdB) is 1 μin/sec.

² Equipment shown in **bold** is expected to be used on site.

μin/sec = microinches per second

ft = foot/feet

FTA = Federal Transit Administration

in/sec = inch/inches per second

L_v = velocity in decibels

PPV = peak particle velocity

RMS = root-mean-square

VdB = vibration velocity decibels

The formulae for vibration transmission are provided below and Tables L and M below provide a summary of off-site construction vibration levels.

$$L_{v\text{dB}}(D) = L_{v\text{dB}}(25 \text{ ft}) - 30 \log(D/25)$$

$$\text{PPV}_{\text{equip}} = \text{PPV}_{\text{ref}} \times (25/D)^{1.5}$$

As previously shown, the threshold at which vibration levels would result in annoyance would be 78 VdB for residential type uses and 90 VdB for workshop type uses. As shown in Table G, the FTA guidelines indicate that for a non-engineered timber and masonry building, the construction vibration damage criterion is 0.2 in/sec in PPV.

Table L: Potential Construction Vibration Annoyance Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (VdB) at 25 ft ¹	Distance (ft) ²	Vibration Level (VdB)
Industrial Use (East)	87	220	59
Commercial Use (North)		420	50
Residential Use (North)		440	50
Warehouse (West)		440	50

Source: Compiled by LSA (2024).

¹ The reference vibration level is associated with a large bulldozer, which is expected to be representative of the heavy equipment used during construction.

² The assessment distance is associated with the average condition, identified by the distance from the center of construction activities to surrounding uses.

ft = foot/feet

VdB = vibration velocity decibels

Table M: Potential Construction Vibration Damage Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (PPV) at 25 ft ¹	Distance (ft) ²	Vibration Level (PPV)
Industrial Use (East)	0.089	120	0.008
Commercial Use (North)		10	0.352
Residential Use (North)		15	0.191
Warehouse (West)		360	0.002

Source: Compiled by LSA (2024).

¹ The reference vibration level is associated with a large bulldozer, which is expected to be representative of the heavy equipment used during construction.

² The assessment distance is associated with the peak condition, identified by the distance from the perimeter of construction activities to surrounding structures.

ft = foot/feet

PPV = peak particle velocity

Based on the information provided in Table L, vibration levels are expected to approach 50 VdB at the closest residential use to the north and 59 VdB at the closest industrial use to the east and would not exceed the annoyance thresholds.

Based on the information provided in Table M, the closest structure to external construction activities is the commercial use to north, within 10 feet of the northern project construction boundary. Using the reference data from Table K and the equation above, it is expected that vibration levels generated by dump trucks and other large equipment would generate ground-borne vibration levels of 0.352 PPV (in/sec) or higher at the closest structures to the project site. This vibration level would exceed the 0.2 in/sec PPV threshold considered safe for non-engineered timber and masonry buildings, which would result in a potentially significant impact. The distance from large construction equipment with a reference vibration level of 0.089 in/sec PPV at 25 feet for which the 0.2 in/sec threshold would no longer be exceeded is 15 feet. Vibration levels at all other

buildings would be lower. Therefore, construction would not result in any vibration damage, and impacts would be less than significant with the incorporation of Mitigation Measure NOI-1 for structures located within 15 ft of heavy construction, as detailed below.

Mitigation Measure NOI-1

Construction Vibration Damage. Due to the close proximity to surrounding structures, the County of Riverside (County) Director of Community Development, or designee, shall verify prior to issuance of demolition or grading permits, that the approved plans require that the construction contractor shall implement the following reduction measures during project construction activities to ensure that damage does not occur at surrounding structures:

- Identify structures that are located within 15 feet (ft) of heavy construction activities and that have the potential to be affected by ground-borne vibration. This task shall be conducted by a qualified structural engineer as approved by the County's Director of Community Development, or designee.
- Once the construction equipment list finalized, a comparison of the proposed equipment to be used and the assumed equipment vibration levels presented in Table 7-4 of the Federal Transit Administration Noise and Vibration Impact Assessment Manual – FTA Report No. 0123 shall be completed. If it is determined that the proposed equipment would generate lower vibration levels than assumed, further vibration reduction would not be necessary. However, if levels would potentially exceed the FTA Damage Criteria presented in Table 7-5 of the Federal Transit Administration Noise and Vibration Impact Assessment Manual – FTA Report No. .0123, the applicant shall develop a vibration monitoring and construction contingency plan for approval by the County Director of Community Development, or designee, to identify structures where monitoring would be conducted; set up a vibration monitoring schedule; define structure-specific vibration limits; and address the need to conduct photo, elevation, and crack surveys to document before and after construction conditions. Construction contingencies would be identified for when vibration levels approached the limits.
- If a vibration monitoring and construction contingency plan is deemed necessary, monitor vibration during initial construction activities would be required. Monitoring results may indicate the need for more or less intensive measurements.

- When vibration levels approach limits, suspend construction and implement contingencies as identified in the approved vibration monitoring and construction contingency plan to either lower vibration levels or secure the affected structures.

LONG-TERM OFF-SITE TRAFFIC NOISE IMPACTS

As a result of the implementation of the proposed project, off-site traffic volumes on surrounding roadways have the potential to increase. According to the *21765 Temescal Canyon Road Vehicle Miles Traveled Screening Analysis* (EPD Solutions, Inc. 2024), the proposed project would result in a net increase of 49 daily trips. According to the *Corona General Plan Technical Update Volume IIb* (PlaceWorks 2019), the existing (2017) ADT on Temescal Canyon Road adjacent to the project site is 18,070 (assuming the ADT is 10 times the peak hour volumes). While the current traffic volume on Temescal Canyon Road is likely higher, using the 2017 volumes would be considered conservative. The following equation was used to determine the potential impacts of the project:

$$\text{Change in CNEL} = 10 \log_{10} [V_{(e+p)} / V_{(existing)}]$$

where: $V_{existing}$ = existing daily volumes
 V_{e+p} = existing daily volumes plus project
Change in CNEL = increase in noise level due to the project

The results of the calculations show that an increase of approximately 0.01 dBA CNEL is expected along Temescal Canyon Road. A noise level increase of less than 1 dBA would not be perceptible to the human ear; therefore, the traffic noise increase in the vicinity of the project site resulting from the proposed project would be less than significant.

LONG-TERM TRAFFIC-RELATED VIBRATION IMPACTS

The proposed project would not generate noticeable vibration levels related to on-site operations. Trucks traveling to and from the project site as well as loading and unloading activities may generate vibration levels. However, the closest off-site uses are greater than 25 feet away and vibration levels generated from trucks would not be perceptible. In addition, vibration levels generated from project-related traffic on the adjacent roadways are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Based on a reference vibration level of 0.076 in/sec PPV, structures greater than 20 feet from the roadways that contain project trips would experience vibration levels below the most conservative standard of 0.12 in/sec PPV; therefore, vibration levels generated from project-related traffic on the adjacent roadways would be less than significant, and no mitigation measures are required.

LONG-TERM STATIONARY NOISE IMPACTS TO OFF-SITE RECEPTORS

Adjacent off-site land uses would be potentially exposed to stationary-source noise impacts from rooftop heating, ventilation, and air conditioning (HVAC) equipment and proposed truck loading and unloading activities. The potential noise impacts to off-site sensitive land uses from the proposed operations are discussed below. To provide a conservative analysis, it is assumed that within any

given peak hour, seven heavy trucks would maneuver to park near the loading zones west of the proposed building. During non-peak hours, it is assumed two trucks would operate per hour.

Heating, Ventilation, and Air Conditioning Equipment

The project would have various rooftop mechanical equipment including HVAC units on the proposed building. Based on the project site plan, the project is assumed to have two (2) rooftop HVAC units and assumed to operate 24 hours per day. The HVAC equipment would generate sound power levels (L_w) of up to 87 dBA L_w or 72 dBA L_{eq} at 5 feet, based on manufacturer data (Trane n.d.). This level is used as a reference level and is not indicative of the level at surrounding receptors. Additionally, rooftop parapet walls will further reduce HVAC noise levels.

Truck Deliveries and Truck Loading and Unloading Activities

Noise levels generated by delivery trucks would be similar to noise readings from truck loading and unloading activities, which generate a noise level of 75 dBA L_{eq} at 20 feet based on measurements taken by LSA (*Operational Noise Impact Analysis for Richmond Wholesale Meat Distribution Center* [LSA 2016]). Delivery trucks would arrive on site and maneuver their trailers so that trailers would be parked within the loading docks. During this process, noise levels are associated with the truck engine noise, air brakes, and back-up alarms while the truck is backing into the loading area. These noise levels would occur for a shorter period of time (less than 5 minutes). It is assumed that two heavy trucks would arrive on site during off-peak hour and seven heavy trucks during peak hour.

Cumulative Operations Noise Assessment

Tables N and O below show the combined hourly noise levels generated by HVAC equipment and truck delivery activities at the closest off-site land uses. The results indicated that operational noise levels would be below the daytime and nighttime hourly noise level standards of 65 dBA L_{eq} and 55 dBA L_{eq} , respectively, for commercial uses and below the daytime and nighttime hourly noise level standards of 55 dBA L_{eq} and 45 dBA L_{eq} , respectively, for residential uses. Additionally, ambient noise levels would not increase by 5 dBA or more. Therefore, operations of the proposed project would be less than significant. No mitigation is required. Appendix C presents the operational noise source calculations.

Table N: Daytime Exterior Noise Level Impacts

Receptor	Direction	Existing Quietest Daytime Noise Level (dBA L_{eq})	Project Generated Noise Levels (dBA L_{eq})	Potential Operational Noise Impact? ¹
Commercial	North	55.6	50.7	No
Residential	North	55.6	50.3	No

Source: Compiled by LSA (2024).

¹ A potential operational noise impact would occur if (1) the quietest daytime ambient hour is less than 65 dBA L_{eq} at the nearest commercial uses or 55 dBA L_{eq} at the nearest residential uses and project noise impacts are greater than 65 dBA L_{eq} at the nearest commercial uses or 55 dBA L_{eq} at the nearest residential uses, or (2) the quietest daytime ambient hour is greater than 65 dBA L_{eq} at the nearest commercial uses or 55 dBA L_{eq} at the nearest residential uses and project noise impacts are 3 dBA greater than the quietest daytime ambient hour.

dBA L_{eq} = average A-weighted hourly noise level

Table O: Nighttime Exterior Noise Level Impacts

Receptor	Direction	Existing Quietest Nighttime Noise Level (dBA Leq)	Project Generated Noise Levels (dBA Leq)	Potential Operational Noise Impact? ¹
Commercial	North	55.8	45.8	No
Residential	North	55.8	45.4	No

Source: Compiled by LSA (2024).

¹ A potential operational noise impact would occur if (1) the quietest nighttime ambient hour is less than 55 dBA Leq at the nearest commercial uses or 45 dBA Leq at the nearest residential uses and Project noise impacts are greater than 55 dBA Leq at the nearest commercial uses or 45 dBA Leq at the nearest residential uses, or (2) the quietest nighttime ambient hour is greater than 55 dBA Leq at the nearest commercial uses or 45 dBA Leq at the nearest residential uses and Project noise impacts are 3 dBA greater than the quietest nighttime ambient hour.

dBA Leq = average A-weighted hourly noise level

In conclusion, the proposed project would not generate noise levels from operations above the quietest ambient noise levels during daytime and nighttime hours. Furthermore, due to the relatively high ambient noise levels, the project would not contribute to the overall ambient noise levels. The project is also not anticipated to generate vibration levels above the FTA limits to off-site receptors with the implementation of the mitigation measure above. Therefore, the proposed project would comply with the County's noise and vibration standards.

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APPENDIX A

NOISE MONITORING DATA

Noise Measurement Survey – 24 HR

Project Number: ESL2201.87

Project Name: Temescal Canyon Road

Test Personnel: Amber Hazelrigg

Equipment: Spark 706RC (SN:17206)

Site Number: LT-1 Date: 6/27/24

Time: From 2:00 p.m. To 2:00 p.m.

Site Location: On a chain link fence on the western side of the site approximately 134 feet from the center divider of the 15 freeway.

Primary Noise Sources: Vehicle traffic from 15 freeway (primary), vehicle traffic from Temescal Canyon Rd (secondary), neighborhood and retail noises (secondary)

Comments: _____

Photo:



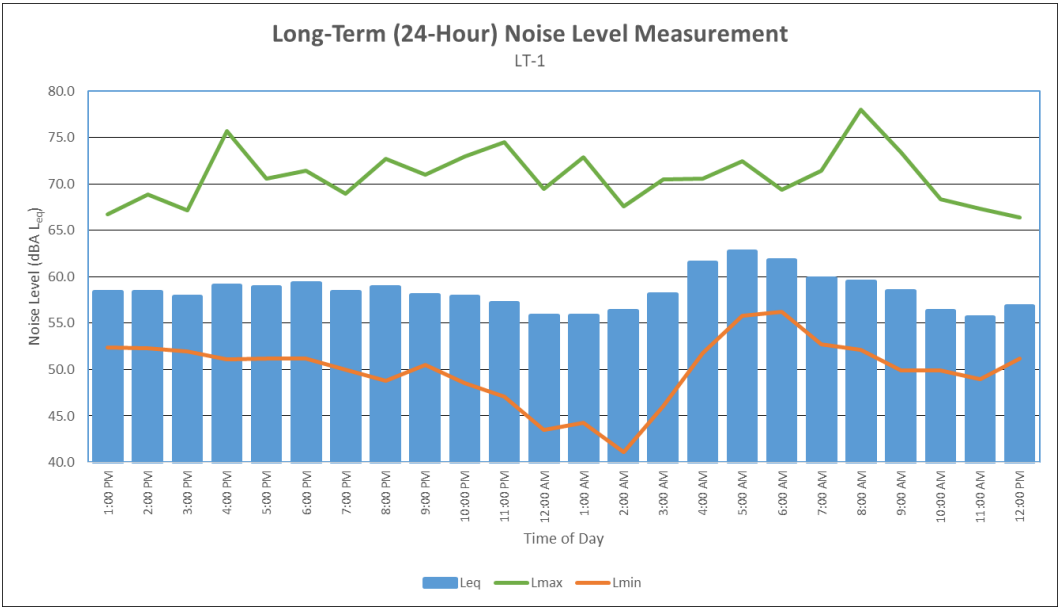
Long-Term (24-Hour) Noise Level Measurement Results at LT-1

Start Time	Date	Noise Level (dBA)		
		L _{eq}	L _{max}	L _{min}
1:00 PM	6/13/24	58.4	66.7	52.4
2:00 PM	6/13/24	58.4	68.9	52.3
3:00 PM	6/13/24	57.9	67.2	52.0
4:00 PM	6/13/24	59.0	75.7	51.1
5:00 PM	6/13/24	58.8	70.6	51.2
6:00 PM	6/13/24	59.3	71.4	51.2
7:00 PM	6/13/24	58.4	69.0	50.0
8:00 PM	6/13/24	58.9	72.7	48.8
9:00 PM	6/14/24	58.0	71.0	50.5
10:00 PM	6/14/24	57.9	73.0	48.5
11:00 PM	6/14/24	57.2	74.5	47.1
12:00 AM	6/14/24	55.8	69.5	43.5
1:00 AM	6/14/24	55.8	72.9	44.3
2:00 AM	6/14/24	56.4	67.6	41.1
3:00 AM	6/14/24	58.1	70.5	46.1
4:00 AM	6/14/24	61.5	70.6	51.8
5:00 AM	6/14/24	62.7	72.5	55.8
6:00 AM	6/14/24	61.8	69.4	56.2
7:00 AM	6/14/24	59.8	71.4	52.7
8:00 AM	6/14/24	59.4	78.0	52.1
9:00 AM	6/14/24	58.4	73.4	49.9
10:00 AM	6/14/24	56.3	68.4	49.9
11:00 AM	6/14/24	55.6	67.3	49.0
12:00 PM	6/14/24	56.8	66.4	51.2

Source: Compiled by LSA Associates, Inc. (2024).

dBA = A-weighted decibel
 L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level
 L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: ESL2201.87

Project Name: Temescal Canyon Road

Test Personnel: Amber Hazelrigg

Equipment: Spark 706RC (SN:17815)

Site Number: LT-1 Date: 6/27/24

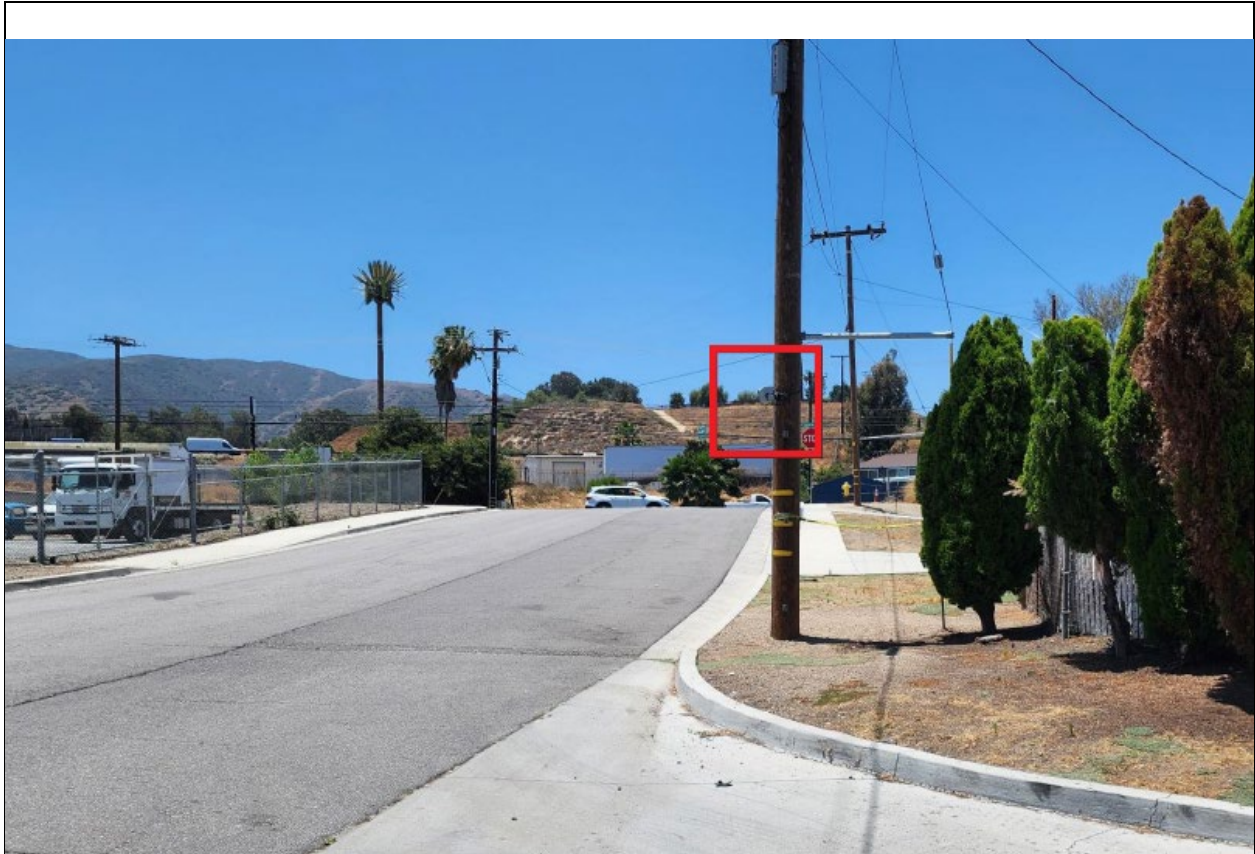
Time: From 2:00 p.m. To 2:00 p.m.

Site Location: On a telephone pole east of the site, approximately 639 feet from the center divider of the 15 freeway.

Primary Noise Sources: Vehicle traffic from Temescal Canyon Road (primary), traffic from 15 freeway (secondary), vehicle neighborhood noises (secondary)

Comments: _____

Photo:



Long-Term (24-Hour) Noise Level Measurement Results at LT-2

Start Time	Date	Noise Level (dBA)		
		L _{eq}	L _{max}	L _{min}
2:00 PM	6/27/24	59.7	75.3	50.4
3:00 PM	6/27/24	60.1	76.6	53.2
4:00 PM	6/27/24	59.8	77.2	52.4
5:00 PM	6/27/24	64.2	86.6	51.1
6:00 PM	6/27/24	59.6	81.7	51.1
7:00 PM	6/27/24	57.5	71.9	50.9
8:00 PM	6/27/24	57.2	71.6	48.6
9:00 PM	6/27/24	55.9	78.8	45.0
10:00 PM	6/27/24	57.1	84.5	46.6
11:00 PM	6/27/24	54.9	71.7	44.0
12:00 AM	6/28/24	53.5	69.4	42.1
1:00 AM	6/28/24	52.9	65.5	41.1
2:00 AM	6/28/24	54.8	79.1	40.1
3:00 AM	6/28/24	56.0	72.7	45.7
4:00 AM	6/28/24	59.0	72.8	48.9
5:00 AM	6/28/24	62.6	87.0	53.2
6:00 AM	6/28/24	61.1	76.8	53.1
7:00 AM	6/28/24	59.1	79.4	49.1
8:00 AM	6/28/24	59.6	78.8	49.5
9:00 AM	6/28/24	59.3	79.5	48.8
10:00 AM	6/28/24	59.1	77.0	48.6
11:00 AM	6/28/24	59.4	76.8	48.3
12:00 PM	6/28/24	58.7	76.7	49.6
1:00 PM	6/28/24	60.7	82.7	51.4

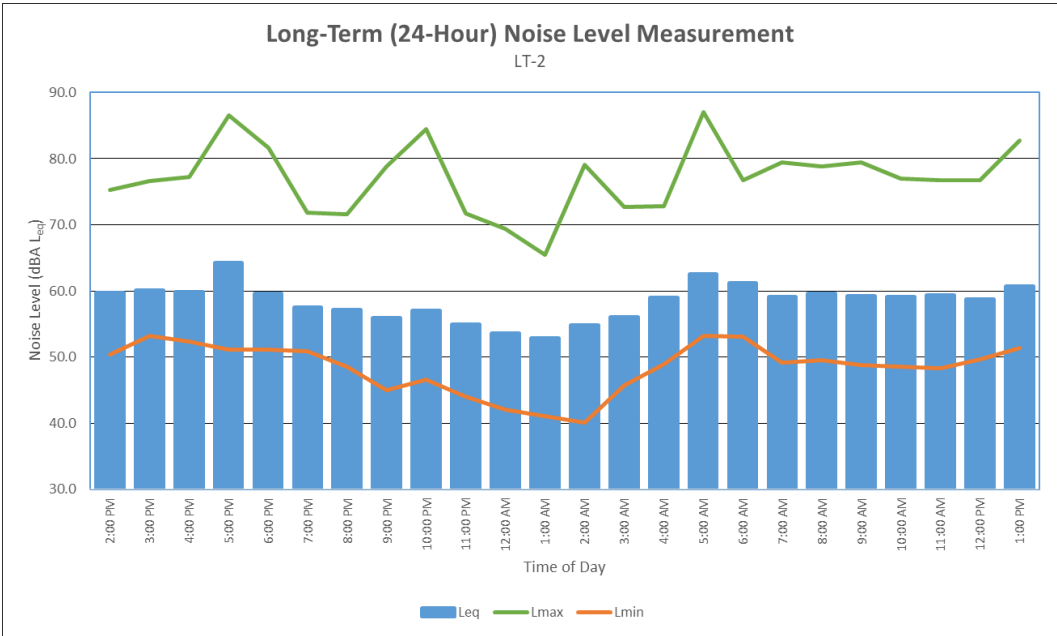
Source: Compiled by LSA Associates, Inc. (2024).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: ESL2201.87

Project Name: Temescal Canyon Road

Test Personnel: Amber Hazelrigg

Equipment: Spark 706RC (SN:18571)

Site Number: LT-3 Date: 6/27/24

Time: From 2:00 p.m. To 2:00 p.m.

Site Location: On a chain link fence on the western side of the site, approximately 134 feet from the center divider of the 15 freeway.

Primary Noise Sources: Vehicle traffic from 15 freeway (primary), vehicle traffic from Temescal Canyon Road (secondary), neighborhood noises (secondary)

Comments: _____

Photo:



Long-Term (24-Hour) Noise Level Measurement Results at LT-3

Start Time	Date	Noise Level (dBA)		
		L _{eq}	L _{max}	L _{min}
1:00 PM	6/27/24	69.3	80.7	60.4
2:00 PM	6/27/24	69.6	86.3	61.4
3:00 PM	6/27/24	69.4	87.2	59.9
4:00 PM	6/27/24	70.1	84.1	58.7
5:00 PM	6/27/24	69.9	78.9	60.2
6:00 PM	6/27/24	70.4	90.9	58.6
7:00 PM	6/27/24	68.5	80.9	55.2
8:00 PM	6/27/24	68.7	81.7	54.4
9:00 PM	6/27/24	67.4	82.4	55.5
10:00 PM	6/27/24	67.0	79.7	50.9
11:00 PM	6/27/24	66.2	85.9	51.1
12:00 AM	6/28/24	65.1	81.5	47.8
1:00 AM	6/28/24	64.0	81.2	46.6
2:00 AM	6/28/24	64.8	77.7	44.4
3:00 AM	6/28/24	67.2	80.4	50.2
4:00 AM	6/28/24	70.4	80.5	59.1
5:00 AM	6/28/24	71.7	81.8	62.7
6:00 AM	6/28/24	71.0	82.9	62.5
7:00 AM	6/28/24	69.9	82.0	61.1
8:00 AM	6/28/24	69.3	83.4	59.4
9:00 AM	6/28/24	69.2	84.4	57.8
10:00 AM	6/28/24	67.3	77.8	57.3
11:00 AM	6/28/24	66.6	78.3	57.8
12:00 PM	6/28/24	68.3	79.5	58.7

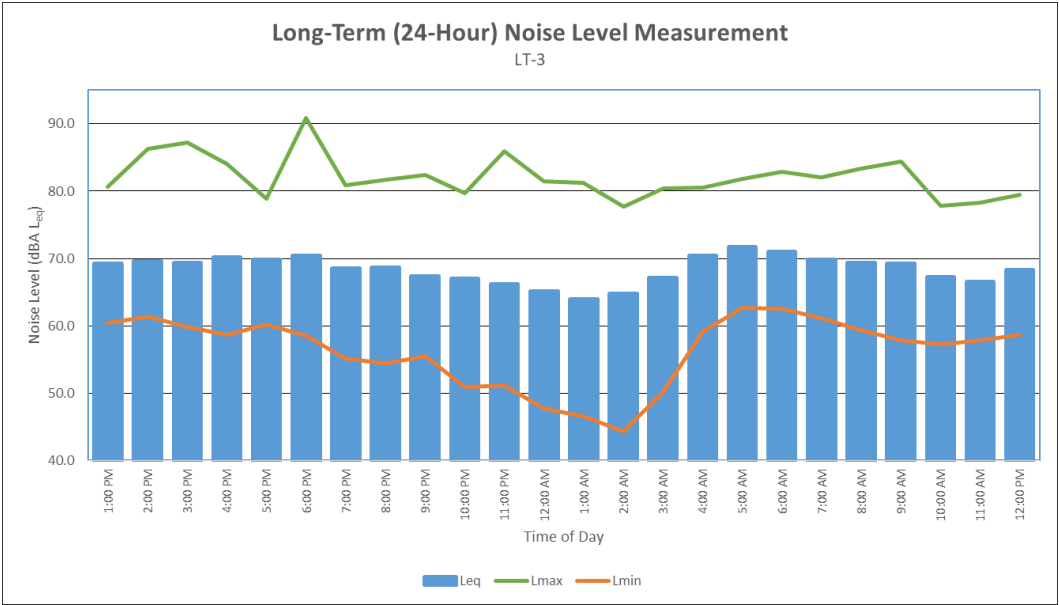
Source: Compiled by LSA Associates, Inc. (2024).

dba = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level



APPENDIX B

CONSTRUCTION NOISE LEVEL CALCULATIONS

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Concrete Saw	1	90	20	50	0.5	90	83
Dozer	1	82	40	50	0.5	82	78
Tractor	3	84	40	50	0.5	84	85
Combined at 50 feet						91	88
Combined at Receptor 220 feet						79	75
Combined at Receptor 420 feet						73	69
Combined at Receptor 440 feet						73	69

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Scraper	1	84	40	50	0.5	84	80
Tractor	1	84	40	50	0.5	84	80
Combined at 50 feet						89	85
Combined at Receptor 220 feet						76	72

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Tractor	2	84	40	50	0.5	84	83
Combined at 50 feet						89	86
Combined at Receptor 220 feet						76	73

Phase: Building Construction

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Crane	1	81	16	50	0.5	81	73
Man Lift	2	75	20	50	0.5	75	71
Tractor	1	84	40	50	0.5	84	80
Generator	1	81	50	50	0.5	81	78
Welder / Torch	3	74	40	50	0.5	74	75
Combined at 50 feet						87	84
Combined at Receptor 220 feet						75	71

Phase: Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Drum Mixer	1	80	50	50	0.5	80	77
Paver	1	77	50	50	0.5	77	74
Tractor	1	84	40	50	0.5	84	80
Roller	2	80	20	50	0.5	80	76
All Other Equipment > 5 hp	1	85	50	50	0.5	85	82
Combined at 50 feet						89	86
Combined at Receptor 220 feet						76	73

Phase: Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Compressor (air)	1	78	40	50	0.5	78	74
Combined at 50 feet						78	74
Combined at Receptor 220 feet						65	61

Sources: RCNM

¹ - Percentage of time that a piece of equipment is operating at full power.

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level

APPENDIX C

OPERATIONAL NOISE LEVEL CALCULATIONS

Stationary Noise

				Peak Hour Daytime Reference Noise Level at 50 ft (dBA Leq)	Off-Peak Nighttime Reference Noise Level at 50 ft (dBA Leq)	Reference Distance (ft)	Distance (ft)	Distance Attenuation (dBA)	Peak Hour Daytime Reference Noise Level at Receptor (dBA Leq)	Off-Peak Nighttime Reference Noise Level at Receptor (dBA Leq)
1	Land Use	Direction	Noise Source							
1	Commercial	North	Truck Load/Unload Activity	72.7	67.2	20	255	22.1	50.5	45.1
			HVAC 1	72.0	72.0	5	370	37.4	34.6	34.6
			HVAC 2	72.0	72.0	5	370	37.4	34.6	34.6
								Combined	50.7	45.8
1	Residential	North	Truck Load/Unload Activity	72.7	67.2	20	270	22.6	50.1	44.6
			HVAC 1	72.0	72.0	5	370	37.4	34.6	34.6
			HVAC 2	72.0	72.0	5	370	37.4	34.6	34.6
								Combined	50.3	45.4