Appendix K

Noise Impact Analysis

ORANGE PALMYRA CEMETERY NOISE IMPACT ANALYSIS

City of Orange

February 1, 2022

gandini

Traffic Engineering ● Transportation Planning ● Parking ● Noise & Vibration
Air Quality ● Global Climate Change ● Health Risk Assessment

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City of Orange

February 1, 2022

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Project No. 19358

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Project Location

The approximately 5.95-acre project site is located at 290 South Yorba Street and 2205 east Palmyra Avenue in the City of Orange, California. The Project Site was developed with a 5,262 square foot former multi-purpose activity center (YMCA) in the central portion, a parking lot in the east-central portion, a bicycle motocross (BMX) track in the northern portion, and soccer field in the southern portion; however, the building recently burned down. The Santiago Creek and bike path intersect the northwest portion of the project site.

Project Description

The Proposed Project involves building a 5,138 square foot building to support activities associated with funeral and burial practices, with associated administrative offices, a 3,513-gravesite cemetery, and accessory parking, loading, pedestrian paths of travel, and landscaping. The project also includes an approximately 800 square foot accessory shed/structure.

The majority of the Project Site would be utilized for gravesite purposes. Full buildout of the gravesite space would occur through a 20-year phased plan. A prepared grave consists of a four-sided bottomless pre-cast concrete grave liner (crypt) measuring approximately three-feet by six-feet. During the batching of crypts for each phase, the operator would dig the planned gravesites, place the crypt liner, and refill the gravesite with the soil from initial digging. Due to religious constraints that prevent excavation equipment from traversing occupied crypts, the sequence of batches would commence in the most remote areas of the cemetery and proceed towards the main building. Phased construction of the gravesites would occur in batches of approximately 100-120 crypts. Once a precast crypt houses interred remains, the gravesite would be covered by pebbles and include installation of a gravestone and concrete border to surround each gravesite.

Construction Impacts

Modeled unmitigated construction noise levels when combined with existing measured noise levels reached 81 dBA L_{eq} at the nearest school property line to the east, 71.8 dBA L_{eq} at the nearest park property line to the north, 73.6 dBA L_{eq} at the nearest residential property line to the southeast, 72.9 dBA L_{eq} at the nearest residential property line to the south, and 70.6 dBA L_{eq} at the nearest residential property line to the west of the project site.

Limiting construction hours of operation per Section 8.24.040(A) of the Municipal Code and implementation of construction mitigation measures listed under Goal 7.0 of the City of Orange General Plan Noise Element, (see Section 7 of this report), will reduce construction noise levels to below a level of significance.

Noise Impacts to Off-Site Receptors Due to Project Generated Trips

For off-site project generated noise, an increase in ambient noise levels is assumed to be a significant noise impact if a project causes ambient noise levels to exceed the following:

- Where the existing ambient noise level is less than 65 dBA, a project related permanent increase in ambient noise levels of 5 dBA CNEL or greater.
- Where the existing ambient noise level is greater than 65 dBA, a project related permanent increase in ambient noise levels of 3 dBA CNEL or greater.

The proposed project involves building a 5,138 square foot building to support activities associated with funeral and burial practices for a 3,513-gravesite cemetery. During operation, the proposed project is expected to generate approximately 36 average daily weekday trips, with 1 trip during the AM peak hour and 3 trips during the PM peak hour, and 83 average daily Sunday trips, with 16 trips during the peak hour.

Typically, a doubling of traffic volumes is required to result in an increase of 3 dBA, which is considered to be a barely audible change. At a maximum of 83 average daily trips per day, project generated trips will not result in a doubling of traffic volumes along any affected road segment. This impact would be less than significant. No mitigation is required.

Noise Impacts to Off-Site Receptors Due to On-Site Operational Noise

The City of Orange General Plan Noise Element maximum allowable noise exposures for stationary sources, as well as the City's Municipal Code Section 8.24.040(A), identify maximum allowable noise exposure standards from stationary noise sources as 55 dBA L_{eq} during the daytime (7:00 AM to 10:00 PM) and 45 dBA L_{eq} during the nighttime (10:00 PM to 7:00 AM). In addition, the standards include maximum levels of 70 dBA L_{max} during the daytime and 65 dBA L_{max} during the nighttime.

Daytime operational noise levels generated by proposed project would reach up to 54 dBA L_{eq} at the Santiago Creek Trail & bike path, immediately west of the project site and 54 dBA Leq south of the project site at the nearest residential receptor. Project operational noise at other sensitive receptors, including the single-family homes to the southeast, the park uses to the north, and the school uses to east, would range between 29-37 dBA Leq. Operational noise levels would not exceed the City's daytime standards and the project would not operate between the hours of 10:00 PM and 7:00 AM. Therefore, no significant on-site noise impacts from the on-going operations of the proposed project would occur at the closest sensitive receptors. Impacts would be less than significant. No mitigation is required.

Construction Noise Reduction Measures

In addition to adherence to the City of Orange Municipal Code which limits the construction hours of operation, the following measures are recommended to reduce construction noise and vibrations, emanating from the proposed project:

1. During all project site excavation and grading on-site, construction contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with manufacturer standards.

2. The contractor shall place all stationary construction equipment so that emitted noise is directed away from the noise sensitive receptors nearest the project site.

3. Equipment shall be shut off and not left to idle when not in use.

4. The contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise/vibration sources and sensitive receptors nearest the project site during all project construction.

5. Jackhammers, pneumatic equipment and all other portable stationary noise sources shall be shielded and noise shall be directed away from sensitive receptors.

6. The project proponent shall mandate that the construction contractor prohibit the use of music or sound amplification on the project site during construction.

7. The construction contractor shall limit haul truck deliveries to the same hours specified for construction equipment.

1. INTRODUCTION

This section describes the purpose of this noise impact analysis, project location, proposed development, and study area. Figure 1 shows the project location map and Figure 2 illustrates the project site plan.

PURPOSE AND OBJECTIVES

The purpose of this report is to provide an assessment of the noise impacts resulting from development of the Orange Palmyra Cemetery project and to identify mitigation measures that may be necessary to reduce those impacts. The noise issues related to the proposed land use and development have been evaluated in light of applicable federal, state and local policies, including those of the City of Orange.

Although this is a technical report, effort has been made to write the report clearly and concisely. A list of acronyms and glossary are provided in Appendix A and Appendix B of this report to assist the reader with technical terms related to noise analysis.

PROJECT LOCATION

The approximately 5.95-acre project site is located at 290 South Yorba Street and 2205 east Palmyra Avenue in the City of Orange, California. The Project Site was developed with a 5,262 square foot former multi-purpose activity center (YMCA) in the central portion, a parking lot in the east-central portion, a bicycle motocross (BMX) track in the northern portion, and soccer field in the southern portion; however, the building recently burned down. The Santiago Creek and bike path intersect the northwest portion of the Project Site. A vicinity map showing the project location is provided on Figure 1.

PROJECT DESCRIPTION

The Proposed Project involves building a 5,138 square foot building to support activities associated with funeral and burial practices, with associated administrative offices, a 3,513-gravesite cemetery, and accessory parking, loading, pedestrian paths of travel, and landscaping. The project also includes an approximately 800 square foot accessory shed/structure. Figure 2 illustrates the project site plan.

The majority of the Project Site would be utilized for gravesite purposes. Full buildout of the gravesite space would occur through a 20-year phased plan. A prepared grave consists of a four-sided bottomless pre-cast concrete grave liner (crypt) measuring approximately three-feet by six-feet. During the batching of crypts for each phase, the operator would dig the planned gravesites, place the crypt liner, and refill the gravesite with the soil from initial digging. Due to religious constraints that prevent excavation equipment from traversing occupied crypts, the sequence of batches would commence in the most remote areas of the cemetery and proceed towards the main building. Phased construction of the gravesites would occur in batches of approximately 100-120 crypts. Once a precast crypt houses interred remains, the gravesite would be covered by pebbles and include installation of a gravestone and concrete border to surround each gravesite.

Operational Characteristics

The Proposed Project would operate as a Muslim cemetery, open seven (7) days per week, from 8:00 AM to 5:00 PM with limited operations from 5:00 PM to 7:00 PM (by appointment only). Daily activities would vary during normal business hours and would typically consist of meetings with family members seeking to funeral arrangements (by appointment only), visitations to gravesites, scheduled funeral services, pre- and post-burial family visitations (by appointment only), gravesite preparation for burial, and delivery of the remains of the deceased.

The Proposed Project entails a Muslim cemetery, which requires the timely burial of the deceased, usually within 24-48 hours after death. Consequently, the relatively short notice of the funeral service typically results in a more limited number of visitors as compared to funeral services associated with other religions/cultures.

The Proposed Project would entail approximately 20-25 funeral services per month, which would occur one at a time between 8:00 AM to 5:00 PM; services would not overlap. A typical funeral service would take place over an approximate four-to-five-hour period. Following the burial, guests would reconvene to the Prayer Hall and socialize. Post-burial memorial gatherings would occur over approximately a two-to-three hours period, with the option to include indoor gathering in the Prayer Hall or outdoor gathering on the north outdoor patio.

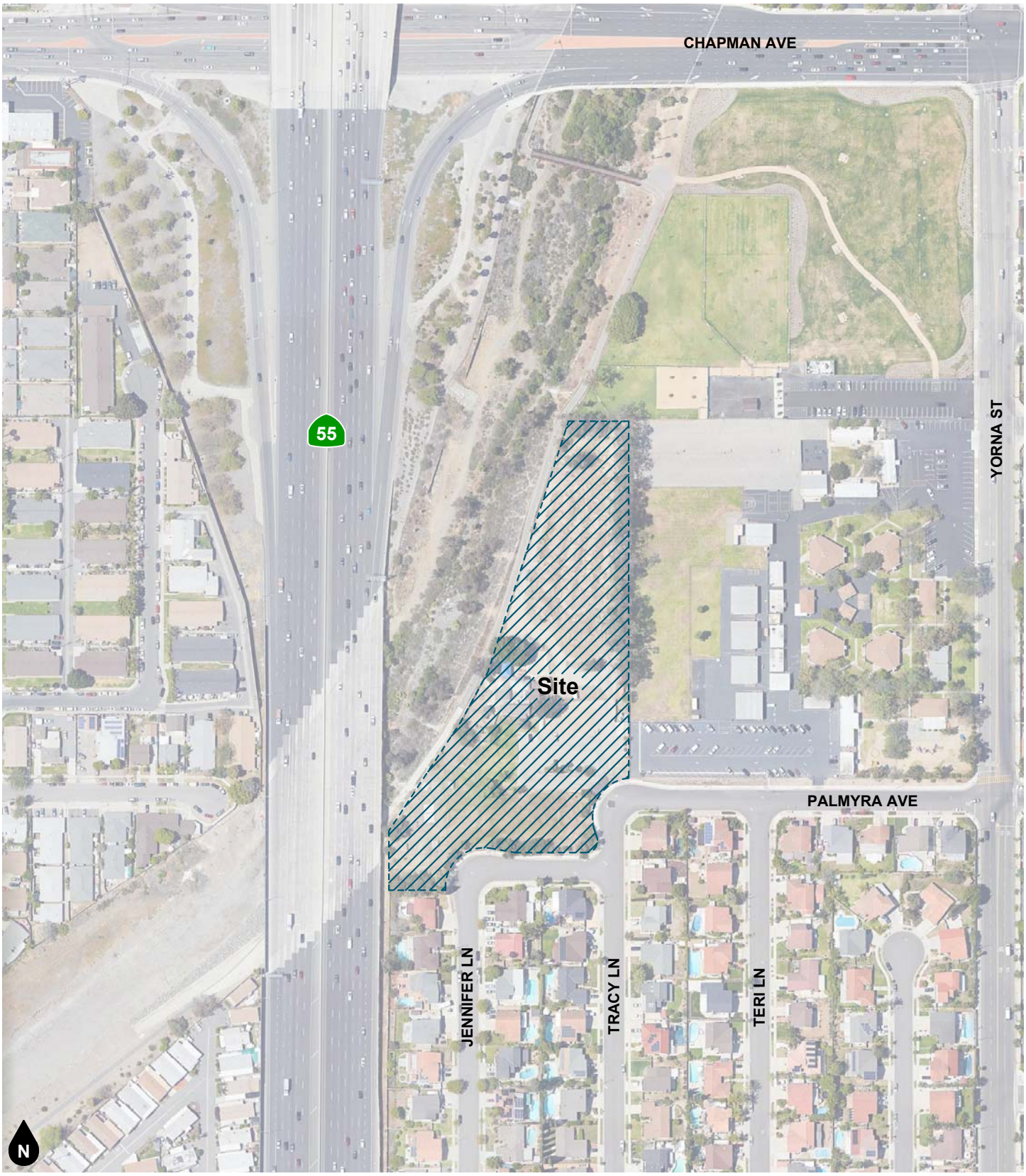


Figure 1
Project Location Map

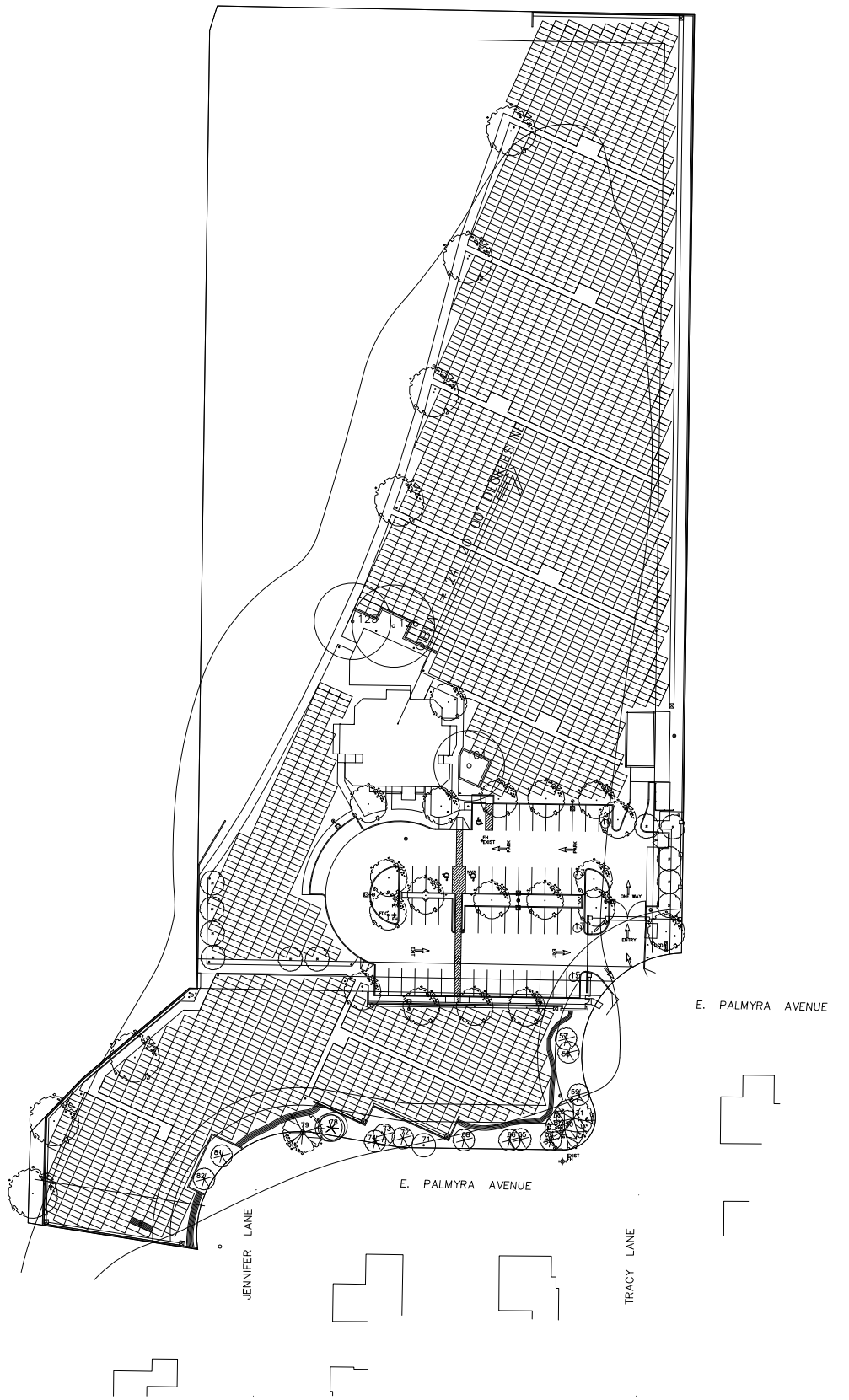


Figure 2
Site Plan

2. NOISE AND VIBRATION FUNDAMENTALS

NOISE FUNDAMENTALS

Sound is a pressure wave created by a moving or vibrating source that travels through an elastic medium such as air. Noise is defined as unwanted or objectionable sound. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and in extreme circumstances, hearing impairment.

Commonly used noise terms are presented in Appendix B. The unit of measurement used to describe a noise level is the decibel (dB). The human ear is not equally sensitive to all frequencies within the sound spectrum. Therefore, the "A-weighted" noise scale, which weights the frequencies to which humans are sensitive, is used for measurements. Noise levels using A-weighted measurements are written dB(A) or dBA.

From the noise source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on whether the source is a point or line source as well as ground absorption, atmospheric effects and refraction, and shielding by natural and manmade features. Sound from point sources, such as air conditioning condensers, radiates uniformly outward as it travels away from the source in a spherical pattern. The noise drop-off rate associated with this geometric spreading is 6 dBA per each doubling of the distance (dBA/DD). Transportation noise sources such as roadways are typically analyzed as line sources, since at any given moment the receiver may be impacted by noise from multiple vehicles at various locations along the roadway. Because of the geometry of a line source, the noise drop-off rate associated with the geometric spreading of a line source is 3 dBA/DD.

Decibels are measured on a logarithmic scale, which quantifies sound intensity in a manner similar to the Richter scale used for earthquake magnitudes. Thus, a doubling of the energy of a noise source, such as a doubled traffic volume, would increase the noise levels by 3 dBA; halving of the energy would result in a 3 dBA decrease. Figure 3 shows the relationship of various noise levels to commonly experienced noise events.

Average noise levels over a period of minutes or hours are usually expressed as dBA L_{eq}, or the equivalent noise level for that period of time. For example, $L_{eq(3)}$ would represent a 3-hour average. When no period is specified, a one-hour average is assumed.

Noise standards for land use compatibility are stated in terms of the Community Noise Equivalent Level (CNEL) and the Day-Night Average Noise Level (DNL). CNEL is a 24-hour weighted average measure of community noise. CNEL is obtained by adding five decibels to sound levels in the evening (7:00 PM to 10:00 PM), and by adding ten decibels to sound levels at night (10:00 PM to 7:00 AM). This weighting accounts for the increased human sensitivity to noise during the evening and nighttime hours. DNL is a very similar 24-hour average measure that weights only the nighttime hours.

It is widely accepted that the average healthy ear can barely perceive changes of 3 dBA; that a change of 5 dBA is readily perceptible, and that an increase (decrease) of 10 dBA sounds twice (half) as loud. This definition is recommended by the California Department of Transportation's Technical Noise Supplement to the Traffic Noise Analysis Protocol (2013).

VIBRATION FUNDAMENTALS

The way in which vibration is transmitted through the earth is called propagation. Propagation of earthborn vibrations is complicated and difficult to predict because of the endless variations in the soil through which waves travel. There are three main types of vibration propagation: surface, compression and shear waves. Surface waves, or Raleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water.

Compression waves, or P-waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. Shear waves, or S-waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse or "side-to-side and perpendicular to the direction of propagation".

As vibration waves propagate from a source, the energy is spread over an ever-increasing area such that the energy level striking a given point is reduced with the distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. Wave energy is also reduced with distance as a result of material damping in the form of internal friction, soil layering, and void spaces. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

Vibration amplitudes are usually expressed as either peak particle velocity (PPV) or the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous peak of the vibration signal in inches per second. The RMS of a signal is the average of the squared amplitude of the signal in vibration decibels (VdB), ref one micro-inch per second. The Federal Railroad Administration uses the abbreviation "VdB" for vibration decibels to reduce the potential for confusion with sound decibel.

PPV is appropriate for evaluating the potential of building damage and VdB is commonly used to evaluate human response. Decibel notation acts to compress the range of numbers required in measuring vibration. Similar to the noise descriptors, L_{eq} and L_{max} can be used to describe the average vibration and the maximum vibration level observed during a single vibration measurement interval. Figure 4 illustrates common vibration sources and the human and structural responses to ground-borne vibration. As shown in the figure, the threshold of perception for human response is approximately 65 VdB; however, human response to vibration is not usually substantial unless the vibration exceeds 70 VdB. Vibration tolerance limits for sensitive instruments such as magnetic resonance imaging (MRI) or electron microscopes could be much lower than the human vibration perception threshold.

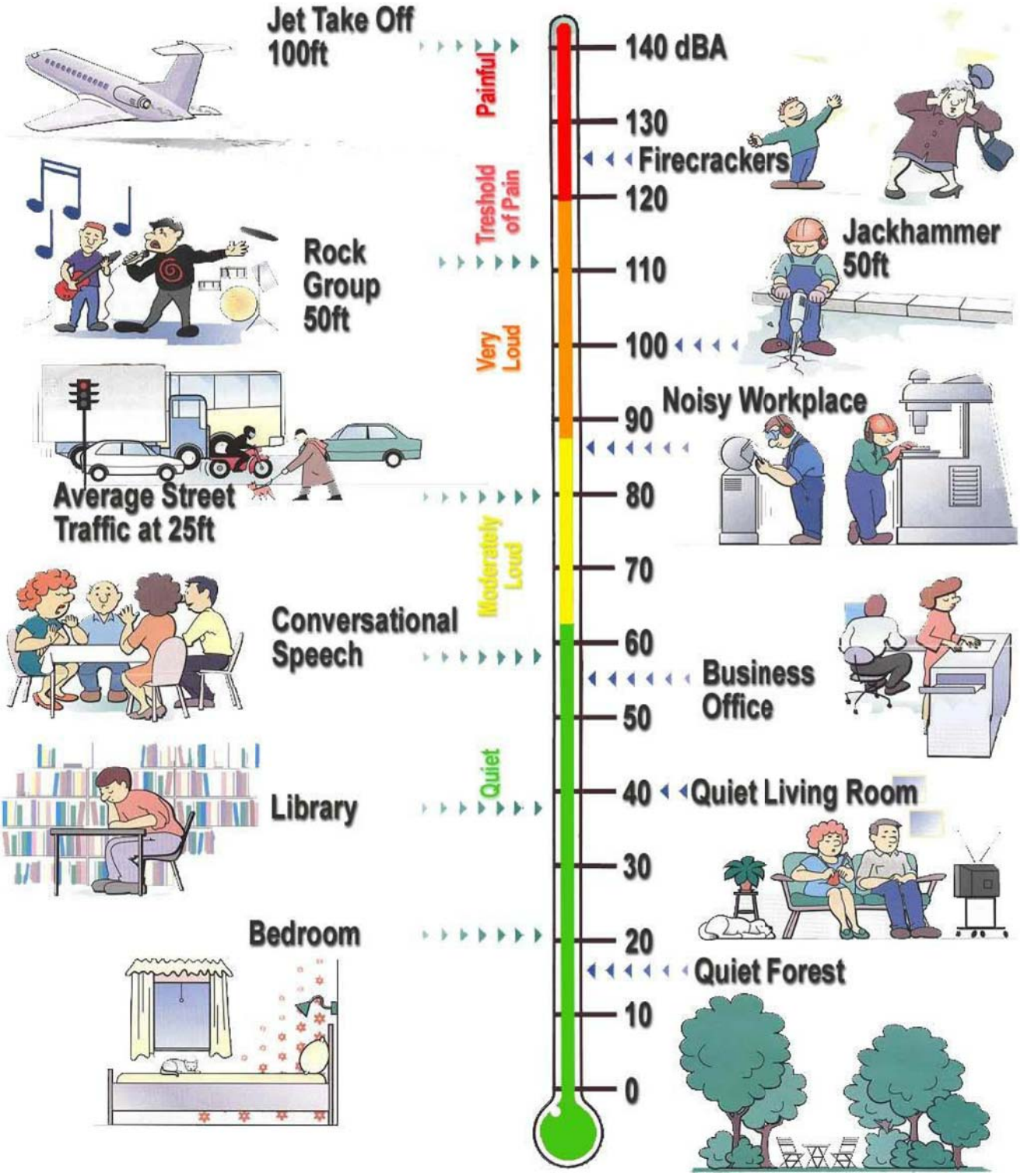
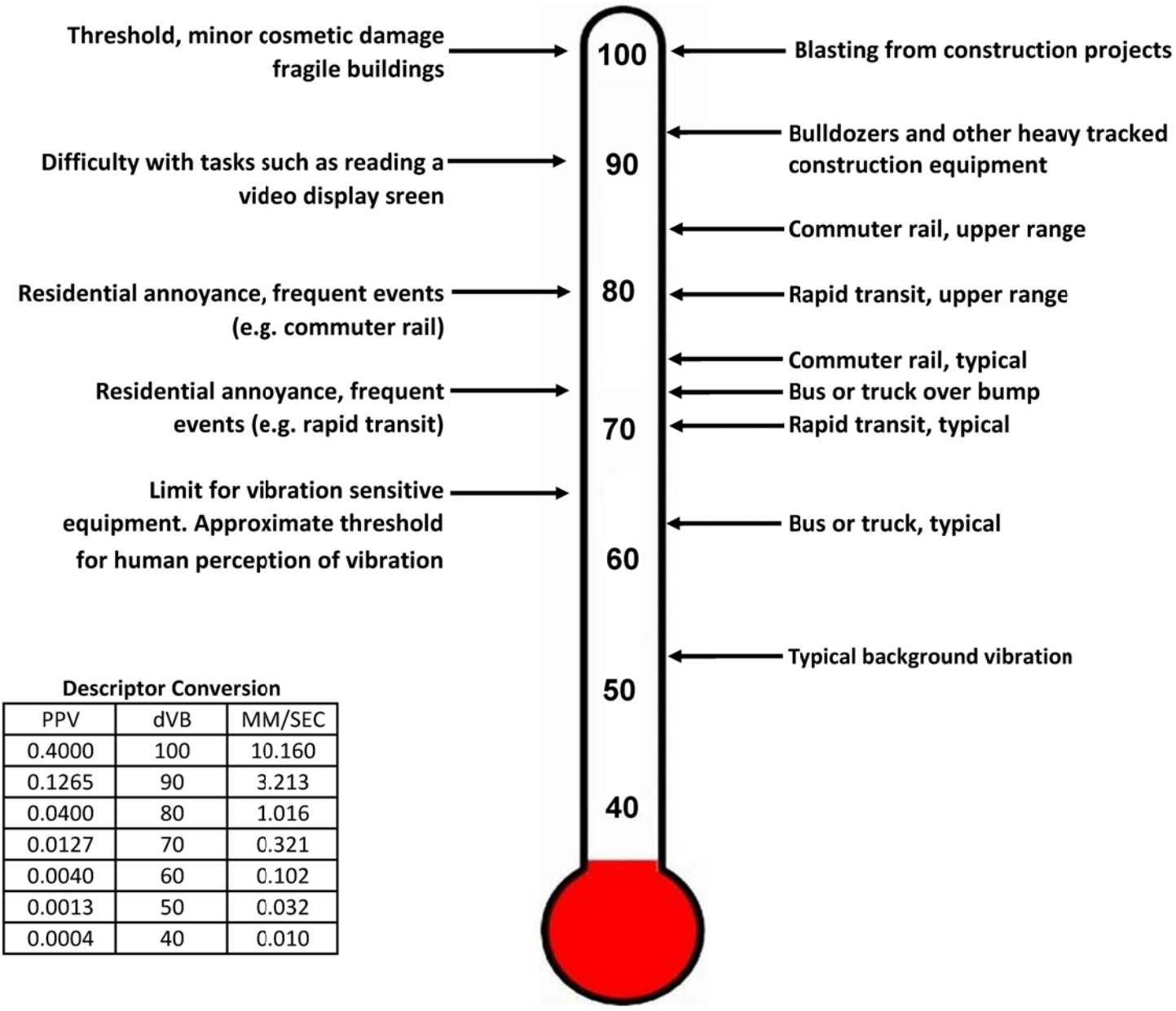


Figure 3
Weighted Sound Levels and Human Response

Source: Bruel & Kjaer 2001



Descriptor Conversion

PPV	dVB	MM/SEC
0.4000	100	10.160
0.1265	90	3.213
0.0400	80	1.016
0.0127	70	0.321
0.0040	60	0.102
0.0013	50	0.032
0.0004	40	0.010

Source: FRA, 2012. Federal Railroad Administration High-Speed Ground Transportation Noise and Vibration Impact Assessment. Office of Railroad Policy Development, Washington, D.C. DOT/FRA/ORD-12/15. September.

Figure 4
Typical Levels of Groundborne Vibration

3. EXISTING NOISE ENVIRONMENT

EXISTING LAND USES AND SENSITIVE RECEPTORS

The project site is bordered by a recently demolished residential use and Palmyra Avenue to the south, school uses and Palmyra Avenue to the east, Santiago Creek Trail and the Costa Mesa Freeway (55 Freeway) to the west, and park uses to the north.

The State of California defines sensitive receptors as those land uses that require serenity or are otherwise adversely affected by noise events or conditions. Schools, libraries, churches, hospitals, single and multiple-family residential, including transient lodging, motels and hotel uses make up the majority of these areas.

Sensitive land uses that may be affected by project noise include the existing school use located adjacent to the east, park use located adjacent to the north, and the existing single-family residential uses located approximately 55 feet to the southeast (across Palmyra Avenue) and 60 feet to the south of the project site.[1]

AMBIENT NOISE MEASUREMENTS

An American National Standards Institute (ANSI Section SI4 1979, Type 1) Larson Davis model LxT sound level meter was used to document existing ambient noise levels. In order to document existing ambient noise levels in the project area, three (3) 15-minute daytime noise measurements were taken between 1:41 PM and 3:05 PM on April 16, 2021. Field worksheets and noise measurement output data are included in Appendix C.

As shown on Figure 5, the noise measurements were taken near the recently demolished single-family residential use adjacent to the south of the project site (along Jennifer Lane) (NM1), near the single-family residential dwelling units to the southeast of the project site (at the corner of Palmyra Avenue and Tracy Lane) (NM2), and at the Santiago Creek Trail and bike path to the northeast of the project site near the adjacent park, dog park, and school uses (NM3). Table 1 provides a summary of the short-term ambient noise data. Short-term ambient noise levels were measured between 58.9 and 65.8 dBA L_{eq}. The dominant noise sources were from vehicles traveling along the 55 Freeway and other surrounding roadways as well as the pedestrians traveling along the trail and bike path.

[1] On September 1, 2020, the City of Orange issued a building permit (No. 2008-192) for the demolition of the single-family residence and pool located immediately adjacent to the south of the Project Site, identified as 334 S. Jennifer Lane (APN 392-052-06). The applicant of record for the building permit is the County of Orange. Subsequently, on October 9, 2020, the City finalized the building permit and the Jennifer Lane property is vacant. As a result of this demolition, the nearest single-family residential sensitive receptor to the south of project site are the residential property lines located as close as approximately 60-feet south of the Project Site's southern property line.

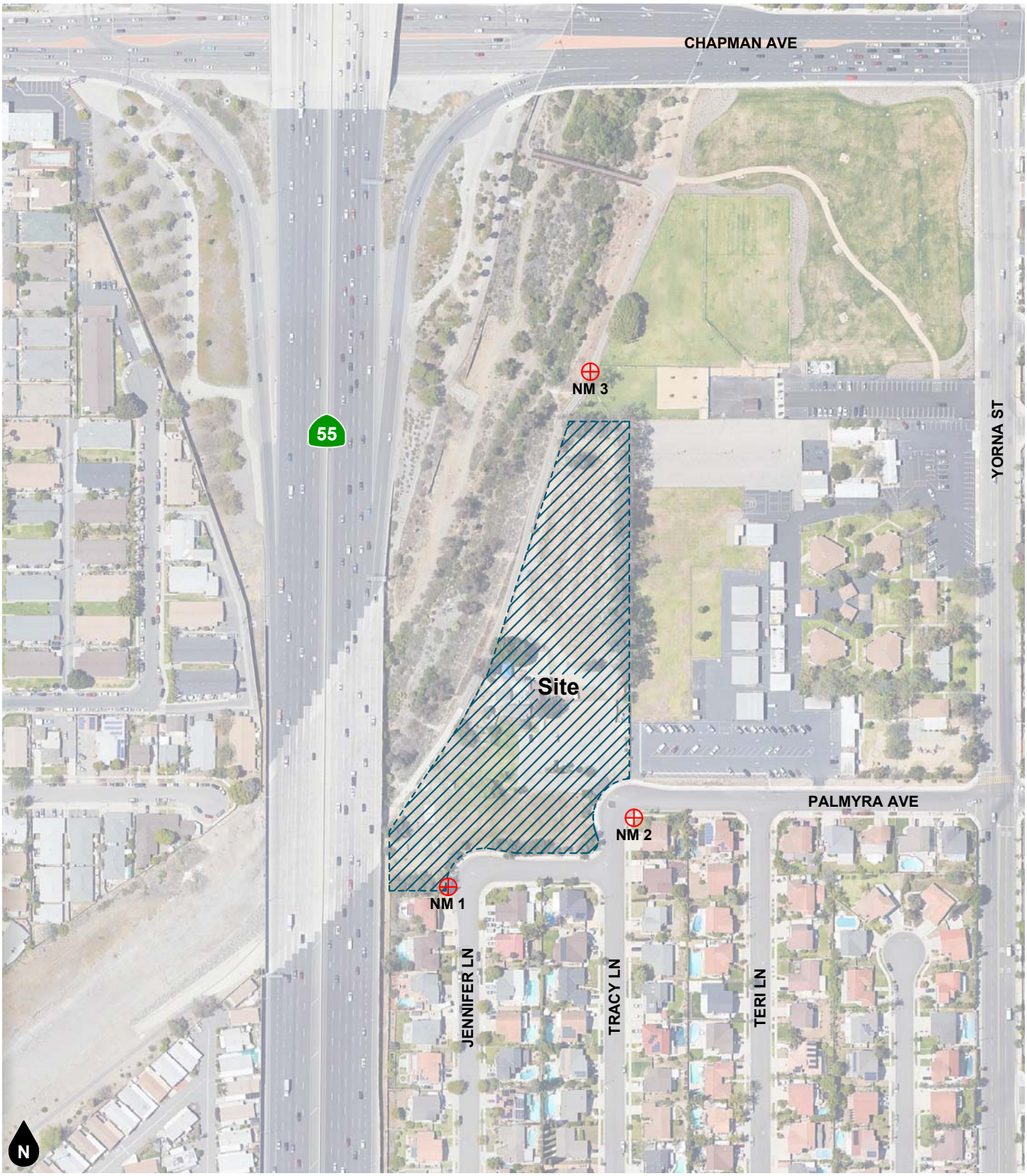
Table 1
Short-Term Noise Measurement Summary (dBA)

Daytime Measurements[1,2]								
Site Location	Time Started	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)
NM1	1:41 PM	62.8	70.8	58.4	68.0	64.4	63.1	62.1
NM2	2:19 PM	58.9	70.0	55.5	63.4	60.9	59.3	58.0
NM3	3:05 PM	65.8	73.8	62.4	68.1	67.1	66.2	65.5

Notes:

(1) See Figure 5 for noise measurement locations. Each noise measurement was performed over a 15-minute duration.

(2) Noise measurements performed on April 16, 2021.



Legend
⊕ Noise Measurement Location
NM 1

Figure 5
Noise Measurement Location Map

4. REGULATORY SETTING

FEDERAL REGULATION

Federal Noise Control Act of 1972

The U.S. Environmental Protection Agency (EPA) Office of Noise Abatement and Control was originally established to coordinate federal noise control activities. After its inception, EPA's Office of Noise Abatement and Control issued the Federal Noise Control Act of 1972, establishing programs and guidelines to identify and address the effects of noise on public health, welfare, and the environment. In response, the EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (Levels of Environmental Noise). The Levels of Environmental Noise recommended that the Ldn should not exceed 55 dBA outdoors or 45 dBA indoors to prevent significant activity interference and annoyance in noise-sensitive areas.

In addition, the Levels of Environmental Noise identified five (5) dBA as an "adequate margin of safety" for a noise level increase relative to a baseline noise exposure level of 55 dBA Ldn (i.e., there would not be a noticeable increase in adverse community reaction with an increase of five dBA or less from this baseline level). The EPA did not promote these findings as universal standards or regulatory goals with mandatory applicability to all communities, but rather as advisory exposure levels below which there would be no risk to a community from any health or welfare effect of noise.

In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at lower levels of government. Consequently, in 1982 responsibilities for regulating noise control policies were transferred to State and local governments. However, noise control guidelines and regulations contained in EPA rulings in prior years remain in place by designated Federal agencies, allowing more individualized control for specific issues by designated Federal, State, and local government agencies.

STATE REGULATIONS

State of California General Plan Guidelines 2017

Though not adopted by law, the State of California General Plan Guidelines 2017, published by the California Governor's Office of Planning and Research (OPR) (OPR Guidelines), provides guidance for the compatibility of projects within areas of specific noise exposure. The OPR Guidelines identify the suitability of various types of construction relative to a range of outdoor noise levels and provide each local community some flexibility in setting local noise standards that allow for the variability in community preferences. Findings presented in the Levels of Environmental Noise Document (EPA 1974) influenced the recommendations of the OPR Guidelines, most importantly in the choice of noise exposure metrics (i.e., Ldn or CNEL) and in the upper limits for the normally acceptable outdoor exposure of noise-sensitive uses.

The OPR Guidelines include a Noise and Land Use Compatibility Matrix which identifies acceptable and unacceptable community noise exposure limits for various land use categories. Where the "normally acceptable" range is used, it is defined as the highest noise level that should be considered for the construction of the buildings which do not incorporate any special acoustical treatment or noise mitigation. The "conditionally acceptable" or "normally unacceptable" ranges include conditions calling for detailed acoustical study prior to the construction or operation of the proposed project. The City of Orange has adopted their own land use/noise compatibility guidelines (Table 2).

California Environmental Quality Act

The California Environmental Quality Act Guidelines (Appendix G) establishes thresholds for noise impact analysis. This noise study includes analysis of noise and vibration impacts necessary to assess the project in light of the following Appendix G Checklist Thresholds.

Would the project result in:

a) Generation of 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?

Substantial increases in ambient noise levels are usually associated with project construction noise (temporary) and project operational noise (permanent).

Project Construction Noise: Construction noise sources are regulated within Section 8.24.050 of the City of Orange's Municipal Code which prohibits construction activities other than between the hours of 7:00 AM to 8:00 PM on any day except for Sunday or a Federal holiday, or between the hours of 9:00 AM and 8:00 PM on Sunday or a Federal holiday. Noise generated outside of the hours specified are subject to the noise standards identified in Section 8.24.040(A) (Table 3).

Project Operational Noise (permanent): The proposed project has the potential to generate on-site and off-site noise that may affect nearby sensitive receptors. For on-site generated noise, the City of Orange General Plan Noise Element maximum allowable noise exposure for stationary sources applies (Table 3) as well as the City's Municipal Code Section 8.24.040(A).

For off-site project generated noise, the City of Orange General Plan Noise Element states that, in addition to the maximum allowable noise level standards (Tables 2 and 3), an increase in ambient noise levels is assumed to be a significant noise impact if a project causes ambient noise levels to exceed the following:

- Where the existing ambient noise level is less than 65 dBA, a project related permanent increase in ambient noise levels of 5 dBA CNEL or greater.
- Where the existing ambient noise level is greater than 65 dBA, a project related permanent increase in ambient noise levels of 3 dBA CNEL or greater.

Furthermore, the proposed project is a cemetery land use and, as shown in Table 2, the City of Orange does not have interior or exterior noise standards from transportation noise sources for cemetery uses.

b) Generate excessive groundborne vibration or groundborne noise levels?

The City currently does not have any adopted standards, guidelines, or thresholds relative to ground-borne vibration. Ground-borne noise refers to the noise generated by ground-borne vibration. Ground-borne noise that accompanies the building vibration is usually perceptible only inside buildings and typically is only an issue at locations with subway or tunnel operations where there is no airborne noise path or for buildings with substantial sound insulation such as a recording studio.[2] As such, available guidelines from the California Department of Transportation (Caltrans) are utilized to assess impacts due to ground-borne vibration.

Caltrans has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. As shown in Table 4, the threshold at which there is a risk to "architectural" damage to historic and some older buildings is a peak particle velocity (PPV) of 0.25 in/sec, at older residential structures a PPV of 0.3 in/sec, and at new residential structures and modern commercial/industrial buildings a PPV of 0.5 in/sec. In addition, Caltrans has adopted standards associated with human annoyance for

[2] Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2018, pp 108, 112.

groundborne vibration impacts. As shown in Table 5, vibration is considered to be strongly perceptible at a PPV of 0.1 in/sec.

Therefore, impacts would be significant if construction activities result in groundborne vibration of 0.3 PPV or higher at residential structures and/or a PPV of 0.5 or higher at commercial structures.

LOCAL REGULATIONS

City of Orange General Plan

Applicable policies and standards governing environmental noise in the City are set forth in the General Plan Noise Element. The applicable goals and policies are presented below:

Goal 1.0: Promote a pattern of land uses compatible with current and future noise levels.

Policy 1.1: Consider potential excessive noise levels when making land use planning decisions.
Policy 1.2: Encourage new development projects to provide sufficient spatial buffers to separate excessive noise generating land uses and noise-sensitive land uses.
Policy 1.4: Ensure that acceptable noise levels are maintained near noise-sensitive uses.
Policy 1.5: Reduce impacts of high-noise activity centers located near residential areas.
Policy 1.6: Require an acoustical study for proposed developments in areas where the existing and projected noise level exceeds or would exceed the maximum allowable levels identified in Table 3. The acoustical study shall be performed in accordance with the requirements set forth within this Noise Element.

Goal 2.0: Minimize vehicular traffic noise in residential areas and near noise-sensitive land uses.

Policy 2.1: Encourage noise-compatible land uses along existing and future roadways, highways, and freeways.
Policy 2.2: Encourage coordinated site planning and traffic control measures that minimize traffic noise in noise-sensitive land use areas.

Goal 7.0: Minimize construction, maintenance vehicle, and nuisance noise in residential areas and near noise-sensitive land uses.

Policy 7.2: Require developers and contractors to employ noise minimizing techniques during construction and maintenance operations.
Policy 7.3: Limit the hours of construction and maintenance operations located adjacent to noise-sensitive land uses.
Policy 7.4: Encourage limitations on the hours of operations and deliveries for commercial, mixed-use, and industrial uses abutting residential zones.

City of Orange Municipal Ordinance

Title 8 Health and Safety, Chapter 8.24 of the City Municipal Code regulates the timing of construction activities and includes special provisions for sensitive land uses.

8.24.040 Exterior Standards.

A. The following noise standards for fixed noise sources, unless otherwise specifically indicated, shall apply to all residential property: Hourly Average (L_{eq}) 55 dBA from 7:00 AM to 10:00 PM and 50 dBA from 10:00 PM to 7:00 AM and Maximum Level of 70 dBA from 7:00 AM to 10:00 PM and 65 dBA from 10:00 PM to 7:00 AM.

B. It is unlawful for any person at any location within the City to create any noise, or to allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any other residential property to exceed the noise standards identified in Section 8.24.040(A). For multi-family residential or mixed use developments located within the City's Urban Mixed Use, Neighborhood Mixed Use, Old Towne Mixed Use or Medium Density Residential General Plan land use districts, exterior noise standards shall apply to common recreation areas only and shall not apply to private exterior space (such as a private yard, patio, or balcony).
C. In the event the ambient noise level exceeds the noise standards identified in Section8.24.040(A) of this section, the "adjusted ambient noise level" shall be applied as the noise standard. In cases where the noise standard is adjusted due to a high ambient noise level, the noise standard shall not exceed the "adjusted ambient noise level", or 70 dB (A), whichever is less. In cases where the ambient noise level is already greater than 70 dB (A), the ambient noise level shall be applied as the noise standard.
D. Each of the noise limits specified in Section 8.24.040(A) shall be reduced by 5 dB(A) for impact or simple tone noises, recurring impulsive noises, or for noises consisting of speech or music.

8.24.050 Exemptions from Chapter Provisions.

The following activities shall be exempted from the provisions of Chapter 8.24 of the City's Municipal Code:

E. Noise sources associated with construction, repair, remodeling, or grading of any real property, provided said activities take place between the hours of 7:00 AM and 8:00 PM on any day except for Sunday or a Federal holiday, or between the hours of 9:00 AM and 8:00 PM on Sunday or a Federal holiday. Noise generated outside of the hours specified are subject to the noise standards identified in Section 8.24.040(A).
I. Noise sources associated with the maintenance of real property, provided such activities take place between the hours of 7:00 AM and 8:00 PM on any day except Sunday or a Federal holiday, or between the hours of 9:00 AM and 8:00 PM on Sunday or a Federal holiday. Operation of leaf blowers are regulated under OMC Chapter 8.26.
J. Industrial or commercial noise affecting residential units, when the residential unit is associated with said industrial or commercial use (e.g. caretaker's dwellings).
K. Mobile noise sources including but not limited to operational noise from trains, or automobiles or trucks traveling on roadways. Transportation noise as related to noise/land use compatibility is subject to the City's General Plan Noise Element.

Table 2
City of Orange Maximum Noise Exposure - Transportation Sources

Land Use		CNEL (dBA)	
Designations	Uses	Interior[1,3]	Exterior[2]
Estate Low Density Residential Low Density Residential Low Medium Density Residential	Single-family, duplex, and multiple family	45	65
	Mobile home park	N/A	65
Medium Density Residential Neighborhood Mixed-use Neighborhood Office Professional Old Towne Mixed-use General Commercial Yorba Commercial Overlay Urban Mixed-use Urban Office Professional	Single-family	45	65
	Mobile home park	N/A	65
	Multiple-family, mixed-use	45	65[4,5]
	Transient lodging- motels, hotels	45	65
	Sports arenas, outdoor spectator sports	N/A	N/A
	Auditoriums, concert halls, amphitheaters	45	N/A
	Office buildings, business, commercial and professional	50	N/A
Light Industrial Industrial	Manufacturing, utilities, agriculture	N/A	N/A
Public Facilities and Institutions	Schools, nursing homes, day care facilities, hospitals, convalescent facilities, dormitories	45	65
	Government Facilities- offices, fire stations, community buildings	45	N/A
	Places of Worship, Churches	45	N/A
	Libraries	45	N/A
	Utilities	N/A	N/A
	Cemeteries	N/A	N/A
Recreation Commercial Open Space Open Space-Park Open Space-Ridgeline Resource Area	Playgrounds, neighborhood parks	N/A	70
	Golf courses, riding stables, water recreation, cemeteries	N/A	N/A

Notes:

(1) Interior habitable environment excludes bathrooms, closets and corridors.

(2) Exterior noise level standard to be applied at outdoor activity areas; such as private yards, private patio or balcony of a multi-family residence. Where the location of an outdoor activity area is unknown or not applicable, the noise standard shall be applied inside the property line of the receiving land use.

(3) Interior noise standards shall be satisfied with windows in the closed position. Mechanical ventilation shall be provided per Uniform Building Code (UBC) requirements.

(4) Within the Urban Mixed-Use, Neighborhood Mixed-Use, Old Towne Mixed-use, and Medium Density Residential land use designations, exterior space standards apply only to common outdoor recreational areas.

(5) Within Urban Mixed-Use and Medium Density Residential land use designations, exterior noise levels on private patios or balconies located within 250 feet of freeways (I-5, SR-57, SR-55, SR-22, or SR-241) and Smart Streets and Principal Arterials identified in the Circulation & Mobility Element that exceed 70 dB should provide additional common open space.

N/A = Not Applicable to specified land use category or designation.

Source: City of Orange General Plan Noise Element Table N-3, 2010.

Table 3
City of Orange Maximum Allowable Noise Exposure - Stationary Noise Sources

Noise Level Descriptor	Daytime (7 AM to 10 PM)	Nighttime (10 PM to 7 AM)
Hourly Equivalent Level (L_{eq}, dBA)	55	45
Maximum Level (L_{max}, dBA)	70	65

Notes:
(1) These standards apply to new or existing noise sensitive land uses affected by new or existing non-transportation noise sources, as determined at the outdoor activity area of the receiving land use. However, these noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

(2) Each of the noise levels specified above should be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. Such noises are generally considered by residents to be particularly annoying and are a primary source of noise complaints. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g. caretaker dwellings).

(3) No standards have been included for interior noise levels. Standard construction practices that comply with the exterior noise levels identified in this table generally result in acceptable interior noise levels.

(4) The City may impose noise level standards which are more or less restrictive than those specified above based upon determination of existing low or high ambient noise levels. If the existing ambient noise level exceeds the this table, then the noise level standards shall be increased at 3 dB increments to encompass the ambient environment. Noise level standards incorporating adjustments for existing ambient noise levels shall not exceed a maximum of 70 dB Leq.

Source: City of Orange General Plan Noise Element Table N-4, 2010.

Table 4
Guideline Vibration Damage Potential Threshold Criteria

Structure Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, anceint monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Notes:

Source: California Department of Transportation. *Transportation and Construction Vibration Guidance Manual* (Chapter 7 - Table 19, April 2020).

(1) Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 5
Guideline Vibration Annoyance Potential Criteria

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Notes:
(1) Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Source: California Department of Transportation. Transportation and Construction Vibration Guidance Manual, Chapter 7 Table 20, April 2020.

5. ANALYTICAL METHODOLOGY AND MODEL PARAMETERS

This section discusses the analysis methodologies used to assess noise impacts.

CONSTRUCTION NOISE MODELING

Construction noise associated with the proposed project was calculated at the sensitive receptor locations, utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Distances to receptors were based on the acoustical center of the project site. The equipment used to calculate the construction noise levels for each phase were based on the assumptions provided in the CalEEMod modeling in the Air Quality and Greenhouse Gas Analysis prepared for the proposed project (Ganddini Group 2022). For construction noise purposes, the distance measured from the project site to sensitive receptors was assumed to be the acoustical center of the project site to the property line of residential properties with existing residential buildings. Construction noise worksheets are provided in Appendix D.

SOUNDPLAN NOISE MODEL

The SoundPLAN acoustical modeling software was utilized to model project operational worst-case stationary noise impacts from the proposed project to adjacent sensitive uses (e.g., residences). SoundPLAN is capable of evaluating stationary noise sources (e.g., parking lots, drive-thru menus, carwash equipment, vacuums, etc.) and much more. The SoundPLAN software utilizes algorithms (based on the inverse square law) to calculate noise level projections. The software allows the user to input specific noise sources, spectral content, sound barriers, building placement, topography, and sensitive receptor locations. In addition to the information provided below, noise modeling input and outputs assumptions are provided in Appendix F.

Peak hour operational noise levels were modeled utilizing representative sound levels in the SoundPLAN model. Modeled noise sources include vehicular parking movements, an outdoor burial ceremony, a patio full of conversing persons, and air conditioning/heating unit. All noise sources were modeled to be in full operation for an entire hour. This is a conservative modeling effort given that, in actuality, several of the noise sources are not in operation continuously for an entire hour.

Parking Lot Noise

Parking lot noise was calculated using SoundPLAN methodology. Specifically, the traffic volume of the parking lot is entered with the number of moves per parking, the hour and the number of parking bays. The user defines whether the parking lots are for automobiles, motorcycles, or trucks, and the emission level of a parking lot is automatically adjusted accordingly. The values for the number of parking moves for each time slice is the number of parking moves per reference unit (most often per parking bay), averaged for the hour[3].

SoundPLAN utilizes parking lot noise emission levels from the 6th revised edition of the parking lot study "Recommendations for the Calculation of Sound Emissions of Parking Areas, Motorcar Centers and Bus Stations as well as of Multi-Story Car Parks and Underground Car Parks" published by the Bavarian Landesamt für Umwelt provides calculation methods to determine the emissions of parking lots.

The parking lot emission table documents the reference level (Lw, ref) from the parking lot study.

$$Lw, ref = Lw0 + KPA + KI + KD + KStrO + 10 \log(B) \text{ [dB(A)]}$$

[3] SoundPLAN Essential 4.0 Manual. SoundPLAN International, LLC. May 2016.

With the following parameters:

Lw0 = Basic sound power, sound power level of one motion / per hour on P+R areas = 63 dB(A)
KPA = Surcharge parking lot type
KI = Surcharge for impulse character
KD = Surcharge for the traffic passaging and searching for parking bays in the driving lanes 2,5 * lg (f * B - 9)
f = Parking bays per unit of the reference value
B = Reference value
KStrO = Surcharge for the road surface
B = Reference value

Mechanical Equipment (HVAC Units) Noise

A noise reference level of 67.7 dBA at 3 feet (sound power level of 78.7 dB) was utilized to represent rooftop 5 Ton Carrier HVAC units[4]. A rooftop HVAC plan is not available at the time of this analysis so the exact location and number of units per building were estimated. A total of 9 rooftop units were modeled on the proposed rooftops. The noise source height for each HVAC unit was assumed at 1 meter above the roof top. Roof top is assumed to be approximately 6 meters (~18.3 feet) above grade.

Burial Service/Outdoor Patio

A worst-case scenario was modeled which included five persons at an outdoor burial service near the southern property line, a patio crowded with persons in conversation next to the proposed building and peak hour traffic movements per the traffic trip generation letter prepared for the proposed project. A representative sound level for raised voice of 70 dB Leq was assumed for one of the five people near the southern boundary. The other four individuals were assumed to be speaking in a regular volume (65 dBA Leq). The outdoor patio was modeled using an area source that assumes a noise source of 65 dBA Leq every square meter.

[4] MD Acoustics, LLC Noise Measurement Data for RTU –Carrier 50TFQ0006 and car alarm.

6. IMPACT ANALYSIS

This impact discussion analyzes the potential for noise and/or groundborne vibration impacts to cause the exposure of a person to, or generation of, noise levels in excess of established City of Orange standards related to: construction, operation, and transportation noise related impacts to, or from, the proposed project.

IMPACTS RELATED TO CONSTRUCTION NOISE

The existing school uses located to the east, park uses located to the north, and the existing residential uses located to the south, southeast, and west of the project site may be affected by short-term noise impacts associated with construction noise. Construction noise will vary depending on the construction process, type of equipment involved, location of the construction site with respect to sensitive receptors, the schedule proposed to carry out each task (e.g., hours and days of the week) and the duration of the construction work.

The construction phases for the proposed project are anticipated to include demolition, site preparation, grading, building construction, paving and architectural coating. A summary of noise level data for a variety of construction equipment compiled by the U.S. Department of Transportation is presented in Table 6. Typical operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three to four minutes at lower power settings.

A comparison of existing noise levels and project construction noise levels at the closest receptor locations are presented in Table 7. NM1 was chosen to represent noise levels at the property lines of the single-family residential uses to the south and west, NM2 was chosen to represent noise levels at the property lines of the single-family residential uses to the southeast and school property line to the east, and NM3 was chosen to represent noise levels at the property lines of the park uses to the north of the project site.

Modeled unmitigated construction noise levels when combined with existing ambient noise levels reached up to 81 dBA L_{eq} at the nearest school property line to the east, 71.8 dBA L_{eq} at the nearest park property line to the north, 73.6 dBA L_{eq} at the nearest residential property line to the southeast, 72.9 dBA L_{eq} at the nearest residential property line to the south, and 70.6 dBA L_{eq} at the nearest residential property line to the west of the project site.

As discussed earlier, construction noise sources are regulated within Section 8.24.050 of the City of Orange's Municipal Code which prohibits construction activities other than between the hours of 7:00 AM to 8:00 PM on any day except for Sunday or a Federal holiday, or between the hours of 9:00 AM and 8:00 PM on Sunday or a Federal holiday. Noise generated outside of the hours specified are subject to the noise standards identified in Section 8.24.040(A).

Limiting construction hours of operation per Section 8.24.040(A) of the Municipal Code and implementation of construction mitigation measures listed under Goal 7.0 of the City of Orange General Plan Noise Element, (see Section 7 of this report), will reduce construction noise levels to below a level of significance.

NOISE IMPACTS TO OFF-SITE RECEPTORS DUE TO PROJECT GENERATED TRIPS

As stated previously, for purposes of this project, an increase in ambient noise levels is assumed to be a significant noise impact if a project causes ambient noise levels to exceed the following:

- Where the existing ambient noise level is less than 65 dBA, a project related permanent increase in ambient noise levels of 5 dBA CNEL or greater.
- Where the existing ambient noise level is greater than 65 dBA, a project related permanent increase in ambient noise levels of 3 dBA CNEL or greater.

The proposed project involves building a 5,138 square foot building to support activities associated with funeral and burial practices for a 3,513-gravesite cemetery. During operation, the proposed project is expected to generate approximately 36 average daily weekday trips, with 1 trip during the AM peak-hour and 3 trips during the PM peak-hour, and 83 average daily Sunday trips, with 16 trips during the peak-hour. Typically, a doubling of traffic volumes is required to result in an increase of 3 dBA, which is considered to be a barely audible change. At a maximum of 83 average daily trips per day, project generated trips will not result in a doubling of traffic volumes along any affected road segment. This impact would be less than significant. No mitigation is required.

Noise Impacts to Off-Site Receptors Due to On-Site Operational Noise

The nearest sensitive receptors to the project site are the existing school use located adjacent to the east, a park located adjacent to the north, and existing single-family residences located approximately 55-80 feet south and southwest of the project site.

The City of Orange General Plan Noise Element maximum allowable noise exposures for stationary sources (see Table 3) as well as the City's Municipal Code Section 8.24.040(A) identify maximum allowable noise exposure standards from stationary noise sources as 55 dBA L_{eq} during the daytime (7:00 AM to 10:00 PM) and 45 dBA L_{eq} during the nighttime (10:00 PM to 7:00 AM). In addition, the standards include maximum levels of 70 dBA L_{max} during the daytime and 65 dBA L_{max} during the nighttime.

As shown on Figures 6 and 7, daytime operational noise levels generated by proposed project would reach up to 54 dBA L_{eq} at the Santiago Creek Trail & bike path, immediately west of the project site, and 54 dBA L_{eq} south of the project site. Project operational noise at other sensitive receptors, including the single-family homes to the southeast, the park uses to the north, and the school uses to east, would range between 29-37 dBA L_{eq}. Operational noise levels would not exceed the City's daytime standards and the project would not operate between the hours of 10:00 PM and 7:00 AM. Therefore, no significant on-site noise impacts from the on-going operations of the proposed project would occur at the closest sensitive receptors. Impacts would be less than significant. No mitigation is required.

Table 6 (1 of 2)
CA/T Equipment Noise Emissions and Acoustical Usage Factor Database

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Spec. Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50ft (dBA, slow)	No. of Actual Data Samples (Count)
All Other Equipment > 5 HP	No	50	85	-N/A-	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	-N/A-	0
Blasting	Yes	-N/A-	94	-N/A-	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	-N/A-	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Forklift[2,3]	No	50	n/a	61	n/a
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	-N/A-	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydr. Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	-N/A-	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarafier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	50	85	77	9
Paving Equipment	No	50	85	77	9
Pneumatic Tools	No	50	85	85	90

Table 6 (2 of 2)
CA/T Equipment Noise Emissions and Acoustical Usage Factor Database

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Spec. Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50ft (dBA, slow)	No. of Actual Data Samples (Count)
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/chipping gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (Single Nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Shears (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	-N/A-	0
Tractor	No	40	84	-N/A-	0
Vacuum Excavator (Vac-truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44
Warning Horn	No	5	85	83	12
Welder/Torch	No	40	73	74	5

Notes:

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

(2) Warehouse & Forklift Noise Exposure - NoiseTesting.info Carl Stautins, November 4, 2014 http://www.noisetesting.info/blog/carl-strautins/page-3/

(3) Data provided Leq as measured at the operator. Sound Level at 50 feet is calculated using Inverse Square Law.

Table 7
Construction Noise Levels (L_{eq})

Phase	Receptor Location	Existing Ambient Noise Levels (dBA Leq)[2]	Construction Noise Levels (dBA Leq)	Combined Noise Levels (dBA Leq)	Increase (dB)
Demolition	East (School) (NM2)	58.9	77.6	77.7	18.8
	North (Park) (NM3)	65.8	69.3	70.9	5.1
	Southeast (Residential) (NM2)	58.9	73.5	73.6	14.7
	South (Residential) (NM1)	62.8	72.4	72.9	10.1
	West (Residential) (NM1)	62.8	69.8	70.6	7.8
Site Preparation	East (School) (NM2)	58.9	76.2	76.3	17.4
	North (Park) (NM3)	65.8	65.8	68.8	3.0
	Southeast (Residential) (NM2)	58.9	66.8	67.5	8.6
	South (Residential) (NM1)	62.8	64.6	66.8	4.0
	West (Residential) (NM1)	62.8	62.7	65.8	3.0
Grading	East (School) (NM2)	58.9	81.0	81.0	22.1
	North (Park) (NM3)	65.8	70.6	71.8	6.0
	Southeast (Residential) (NM2)	58.9	71.6	71.8	12.9
	South (Residential) (NM1)	62.8	69.4	70.3	7.5
	West (Residential) (NM1)	62.8	67.5	68.8	6.0
Building Construction	East (School) (NM2)	58.9	78.8	78.8	19.9
	North (Park) (NM3)	65.8	68.3	70.2	4.4
	Southeast (Residential) (NM2)	58.9	69.3	69.7	10.8
	South (Residential) (NM1)	62.8	67.2	68.5	5.7
	West (Residential) (NM1)	62.8	65.2	67.2	4.4
Paving	East (School) (NM2)	58.9	76.0	76.1	17.2
	North (Park) (NM3)	65.8	65.6	68.7	2.9
	Southeast (Residential) (NM2)	58.9	66.6	67.3	8.4
	South (Residential) (NM1)	62.8	64.4	66.7	3.9
	West (Residential) (NM1)	62.8	62.5	65.7	2.9
Architectural Coating	East (School) (NM2)	58.9	68.7	69.1	10.2
	North (Park) (NM3)	65.8	58.2	66.5	0.7
	Southeast (Residential) (NM2)	58.9	59.2	62.1	3.2
	South (Residential) (NM1)	62.8	57.1	63.8	1.0
	West (Residential) (NM1)	62.8	55.2	63.5	0.7

Notes:

(1) Construction noise worksheets are provided in Appendix D.

(2) Per measured existing ambient noise levels. NM1 was chosen to represent noise levels at the property lines of the single-family residential uses to the south and west, NM2 was chosen to represent noise levels at the property lines of the single-family residential uses to the southeast and the school property line to the east, and NM3 was chosen to represent noise levels at the property line of the park uses to the north of the project site.

Figure 6
Operational Noise Levels (dBA Leq)

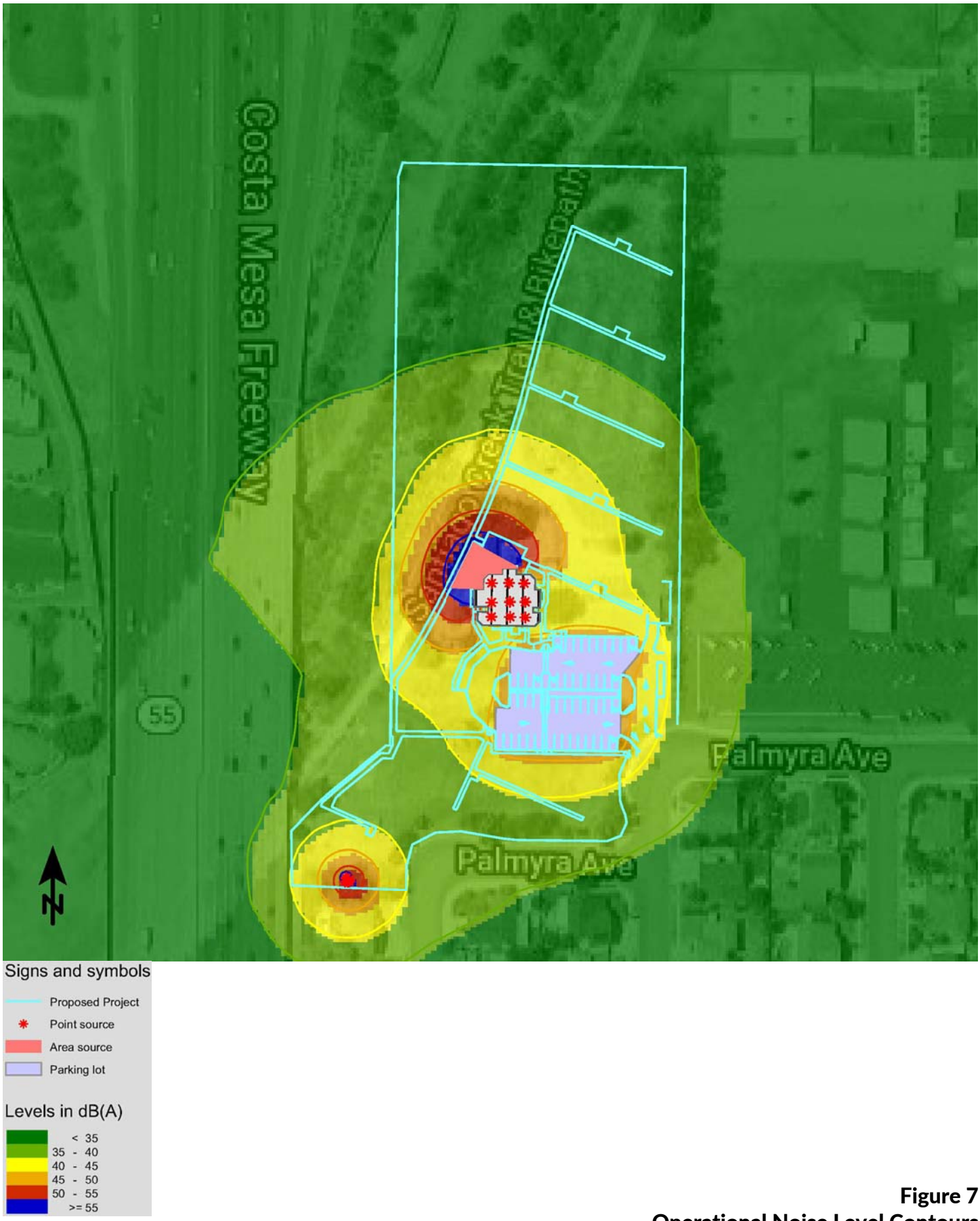


Figure 7
Operational Noise Level Contours

7. MEASURES TO REDUCE IMPACTS

CONSTRUCTION NOISE REDUCTION MEASURES

In addition to adherence to the City of Orange Municipal Code which limits the construction hours of operation, the following measures are recommended to reduce construction noise and vibrations, emanating from the proposed project:

1. During all project site excavation and grading on-site, construction contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturer standards.

2. The contractor shall place all stationary construction equipment so that emitted noise is directed away from the noise sensitive receptors nearest the project site.

3. Equipment shall be shut off and not left to idle when not in use.

4. The contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise/vibration sources and sensitive receptors nearest the project site during all project construction.

5. Jackhammers, pneumatic equipment and all other portable stationary noise sources shall be shielded and noise shall be directed away from sensitive receptors.

6. The project proponent shall mandate that the construction contractor prohibit the use of music or sound amplification on the project site during construction.

7. The construction contractor shall limit haul truck deliveries to the same hours specified for construction equipment.

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APPENDICES

Appendix A List of Acronyms
Appendix B Glossary
Appendix C Noise Measurement Field Worksheets
Appendix D Construction Noise Modeling
Appendix E SoundPLAN Inputs and Outputs

APPENDIX A

LIST OF ACRONYMS

Term	Definition
ADT	Average Daily Traffic
ANSI	American National Standard Institute
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
D/E/N	Day / Evening / Night
dB	Decibel
dBA or dB(A)	Decibel "A-Weighted"
dBA/DD	Decibel per Double Distance
dBA L_{eq}	Average Noise Level over a Period of Time
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
L_{02},L_{08},L_{50},L_{90}	A-weighted Noise Levels at 2 percent, 8 percent, 50 percent, and 90 percent, respectively, of the time period
DNL	Day-Night Average Noise Level
$L_{eq(x)}$	Equivalent Noise Level for '"x" period of time
L_{eq}	Equivalent Noise Level
L_{max}	Maximum Level of Noise (measured using a sound level meter)
L_{min}	Minimum Level of Noise (measured using a sound level meter)
LOS C	Level of Service C
OPR	California Governor's Office of Planning and Research
PPV	Peak Particle Velocities
RCNM	Road Construction Noise Model
REMEL	Reference Energy Mean Emission Level
RMS	Root Mean Square

APPENDIX B

GLOSSARY

Term	Definition
Ambient Noise Level	The all-encompassing noise environment associated with a given environment, at a specified time, usually a composite of sound from many sources, at many directions, near and far, in which usually no particular sound is dominant.
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.
CNEL	Community Noise Equivalent Level. CNEL is a weighted 24-hour noise level that is obtained by adding five decibels to sound levels in the evening (7:00 PM to 10:00 PM), and by adding ten decibels to sound levels at night (10:00 PM to 7:00 AM). This weighting accounts for the increased human sensitivity to noise during the evening and nighttime hours.
Decibel, dB	A logarithmic unit of noise level measurement that relates the energy of a noise source to that of a constant reference level; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
DNL, Ldn	Day Night Level. The DNL, or Ldn is a weighted 24-hour noise level that is obtained by adding ten decibels to sound levels at night (10:00 PM to 7:00 AM). This weighting accounts for the increased human sensitivity to noise during the nighttime hours.
Equivalent Continuous Noise Level, L_{eq}	A level of steady state sound that in a stated time period, and a stated location, has the same A-weighted sound energy as the time-varying sound.
Fast/Slow Meter Response	The fast and slow meter responses are different settings on a sound level meter. The fast response setting takes a measurement every 100 milliseconds, while a slow setting takes one every second.
Frequency, Hertz	In a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., the number of cycles per second).
L_{02}, L_{08}, L_{50}, L_{90}	The A-weighted noise levels that are equaled or exceeded by a fluctuating sound level, 2 percent, 8 percent, 50 percent, and 90 percent of a stated time period, respectively.
L_{max}, L_{min}	Lmax is the RMS (root mean squared) maximum level of a noise source or environment measured on a sound level meter, during a designated time interval, using fast meter response. Lmin is the minimum level.
Offensive/ Offending/Intrusive Noise	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of sound depends on its amplitude, duration, frequency, and time of occurrence, and tonal information content as well as the prevailing ambient noise level.
Root Mean Square (RMS)	A measure of the magnitude of a varying noise source quantity. The name derives from the calculation of the square root of the mean of the squares of the values. It can be calculated from either a series of lone values or a continuous varying function.

APPENDIX C

NOISE MEASUREMENT FIELD WORKSHEETS

Noise Measurement
Field Data

Project Name: Palmyra Cemetery, City of Orange. **Date:** April 16, 2021

Project #: 19358

Noise Measurement #: NM1 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Gallagher

Nearest Address or Cross Street: 333 South Jennifer Lane, Orange, California

Site Description (Type of Existing Land Use and any other notable features): Project site: Contains landscaping/trees, existing structures & parking area. Surrounded by Santiago Creek Trail & 55-Fwy to west, dog park to north, school to east, & Palmyra Ave & SFR to south. Noise Measurement Site: Project site to north and west with 55-Fwy further west, Palmyra Ave to east, Jennifer Ln & SFR to south and southeast.

Weather: Clear skies, sunshine. **Settings:** SLOW FAST

Temperature: 69 deg F **Wind:** 10 mph **Humidity:** 51% **Terrain:** Flat

Start Time: 1:41 PM **End Time:** 1:56 PM **Run Time:**

Leq: 62.8 dB

Lmax 70.8 dB

L2 68.0 dB

L8 64.4 dB

L25 63.1 dB

L50 62.1 dB

Primary Noise Source: Traffic noise from vehicles on the 55 Freeway & traffic ambiance from other surrounding roads.

Secondary Noise Sources: Bird song, palm leaves rustling in gentle breeze, overhead air traffic (jet airplane above, one low altitude aircraft about every 5 minutes).

NOISE METER:	SoundTrack LXT Class 2	**CALIBRATOR:**	Larson Davis CAL200
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT2	**MODEL:**	Cal 200
SERIAL NUMBER:	1152	**SERIAL NUMBER:**	15741
FACTORY CALIBRATION DATE:	10/3/2021	**FACTORY CALIBRATION DATE:**	7/23/2020
FIELD CALIBRATION DATE:	4/16/2021		

Noise Measurement
Field Data

PHOTOS:

NM1 looking south down Jennifer Lane, Orange. Residence 350 Jennifer Lane in view. Residence 334 Jennifer Lane has been removed.

NM1 looking SE across corner intersection between Jennifer Lane & Palmyra Ave. Residence 333 Jennifer Lane, Orange on other side of road.

Summary	
File Name on Meter	LxT_Data.004
File Name on PC	SLM_0001152_LxT_Data_004.00.ldbin
Serial Number	0001152
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	NM1 19358 Palmyra Cemetery 33°47'1.41"N 117°49'49.12"W
Job Description	15 minute noise measurement (1 x 15 minutes)

Measurement	
Start	2021-04-16 13:41:05
Stop	2021-04-16 13:56:05
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre Calibration	2021-04-16 13:40:29
Post Calibration	None

Overall Settings	
RMS Weight	A Weighting
Peak Weight	Z Weighting
Detector	Slow
Preamp	PRMLxT1
Microphone Correction	Off
Integration Method	Linear
OBA Range	Low
OBA Bandwidth	1/1 and 1/3
OBA Freq. Weighting	Z Weighting
OBA Max Spectrum	Bin Max
Overload	144.1 dB

Results			
L_{Aeq}	62.8		
LAE	92.3		
EA	189.066	µPa²h	
EA8	6.050	mPa²h	
EA40	30.250	mPa²h	
$LZ_{peak\ (max)}$	2021-04-16 13:41:14	98.1	dB
LAS_{max}	2021-04-16 13:53:25	70.8	dB
LAS_{min}	2021-04-16 13:42:53	58.4	dB
SEA	-99.94	dB	

LC_{eq}	72.4	dB
LA_{eq}	62.8	dB
LC_{eq} - LA_{eq}	9.7	dB
LAI_{eq}	63.6	dB
LA_{eq}	62.8	dB
LAI_{eq} - LA_{eq}	0.8	dB
# Overloads	0	

Statistics		
LAI2.00	68.0	dB
LAI8.00	64.4	dB
LAI25.00	63.1	dB
LAI50.00	62.1	dB
LAI66.60	61.6	dB

Noise Measurement
Field Data

Project Name: Palmyra Cemetery, City of Orange. **Date:** April 16, 2021

Project #: 19358

Noise Measurement #: NM2 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Gallagher

Nearest Address or Cross Street: 315 South Tracy Lane, Orange, California

Site Description (Type of Existing Land Use and any other notable features): Project site: Contains landscaping/trees, existing structures & parking area. Surrounded by Santiago Creek Trail & 55-Fwy to west, dog park to north, school to east, & Palmyra Ave & SFR to south. Noise Measurement Site: Palmyra Ave to east & south, SFR further southeast & South, school w/ parking lot to northeast, and project site to north & west.

Weather: Clear skies, sunshine. **Settings:** SLOW FAST

Temperature: 69 deg F **Wind:** 10 mph **Humidity:** 51% **Terrain:** Flat

Start Time: 2:19 PM **End Time:** 2:34 PM **Run Time:**

Leq: 58.9 dB

Lmax 70 dB

L2 63.4 dB

L8 60.9 dB

L25 59.3 dB

L50 58.0 dB

Primary Noise Source: Traffic noise from vehicles on the 55 Freeway & traffic ambiance from other surrounding roads.

Secondary Noise Sources: Bird song, palm leaves rustling in gentle breeze, overhead air traffic (one low altitude aircraft about every 5 mins). 7 vehicles passed microphone during measurement.

NOISE METER:	SoundTrack LXT Class 2	**CALIBRATOR:**	Larson Davis CAL200
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT2	**MODEL:**	Cal 200
SERIAL NUMBER:	1152	**SERIAL NUMBER:**	15741
FACTORY CALIBRATION DATE:	10/3/2021	**FACTORY CALIBRATION DATE:**	7/23/2020
FIELD CALIBRATION DATE:	4/16/2021		

Noise Measurement
Field Data

PHOTOS:

NM2 looking SE towards front yard of residence, 315 South Tracy Lane, Orange.

NM2 looking NW across Tracy Lane & Palmyra Avenue corner intersection towards project site (Palmyra Cemetery).

Summary	
File Name on Meter	LxT_Data.005
File Name on PC	SLM_0001152_LxT_Data_005.00.ldbin
Serial Number	0001152
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	NM2 19358 Palmyra Cemetery 33°47'2.51"N 117°49'45.28"W
Job Description	15 minute noise measurement (1 x 15 minutes)

Measurement	
Start	2021-04-16 14:19:15
Stop	2021-04-16 14:34:15
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre Calibration	2021-04-16 14:16:21
Post Calibration	None

Overall Settings	
RMS Weight	A Weighting
Peak Weight	Z Weighting
Detector	Slow
Preamp	PRMLxT1
Microphone Correction	Off
Integration Method	Linear
OBA Range	Low
OBA Bandwidth	1/1 and 1/3
OBA Freq. Weighting	Z Weighting
OBA Max Spectrum	Bin Max
Overload	144.1 dB

Results			
L_{Aeq}	58.9		
LAE	88.4		
EA	77.647	µPa²h	
EA8	2.485	mPa²h	
EA40	12.424	mPa²h	
$L_{Zpeak\ (max)}$	2021-04-16 14:21:11	104.0	dB
L_{ASmax}	2021-04-16 14:27:50	70.0	dB
L_{ASmin}	2021-04-16 14:31:40	55.5	dB
SEA	-99.94	dB	

		Statistics	
L_{Ceq}	71.1 dB	**LAI2.00**	63.4 dB
L_{Aeq}	58.9 dB	**LAI8.00**	60.9 dB
L_{Ceq} - L_{Aeq}	12.2 dB	**LAI25.00**	59.3 dB
L_{AIeq}	59.8 dB	**LAI50.00**	58.0 dB
L_{Aeq}	58.9 dB	**LAI66.60**	57.5 dB
L_{AIeq} - L_{Aeq}	0.9 dB	**LAI90.00**	56.6 dB

Noise Measurement
Field Data

Project Name: Palmyra Cemetery, City of Orange. **Date:** April 16, 2021

Project #: 19358

Noise Measurement #: NM3 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Gallagher

Nearest Address or Cross Street: 33°47'10.23"N , 117°49'46.39"W Orange, California. No nearby address or cross street.

Site Description (Type of Existing Land Use and any other notable features): Project site: Contains landscaping/trees, existing structures & parking area. Surrounded by Santiago Creek Trail & 55-Fwy to west, dog park to north, school to east, & Palmyra Ave & SFR to south. Noise Measurement Site: Taken along Santiago reek Trail & Bikepath with wash to west & 55-Fwy further west, bikepath to north/south, dog park and park uses to east with school use furthe east/southeast.

Weather: Clear skies, sunshine. **Settings:** SLOW FAST

Temperature: 69 deg F **Wind:** 10 mph **Humidity:** 51% **Terrain:** Flat

Start Time: 3:05 PM **End Time:** 3:20 PM **Run Time:**

Leq: 65.8 dB

Lmax 73.8 dB

L2 68.1 dB

L8 67.1 dB

L25 66.2 dB

L50 65.5 dB

Primary Noise Source: Traffic noise from vehicles on the 55 Freeway & traffic ambiance from other surrounding roads. Bike & pedestrian path near NM3.

Secondary Noise Sources: Bird song, palm leaves rustling in gentle breeze, overhead air traffic (jet airlane above one low altitude aircraft about every 5 minutes). Dog park ambiance.

NOISE METER:	SoundTrack LXT Class 2	**CALIBRATOR:**	Larson Davis CAL200
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT2	**MODEL:**	Cal 200
SERIAL NUMBER:	1152	**SERIAL NUMBER:**	15741
FACTORY CALIBRATION DATE:	10/3/2021	**FACTORY CALIBRATION DATE:**	7/23/2020
FIELD CALIBRATION DATE:	4/16/2021		

Noise Measurement
Field Data

PHOTOS:

NM3 looking west across bike/pedestrian public path, past microphone, over wash gulley, towards 55 Freeway (main noise source).

NM3 looking east across bike/pedestrian public path towards dog park.

Summary				
File Name on Meter	LxT_Data.006			
File Name on PC	SLM_0001152_LxT_Data_006.00.ldbin			
Serial Number	0001152			
Model	SoundTrack LxT®			
Firmware Version	2.404			
User	Ian Edward Gallagher			
Location	NM3 19358 Palmyra Cemetery 33°47'10.23"N 117°49'46.39"W			
Job Description	15 minute noise measurement (1 x 15 minutes)			
Measurement				
Start	2021-04-16 15:05:30			
Stop	2021-04-16 15:20:30			
Duration	00:15:00.0			
Run Time	00:15:00.0			
Pause	00:00:00.0			
Pre Calibration	2021-04-16 15:04:56			
Post Calibration	None			
Overall Settings				
RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRMLxT1			
Microphone Correction	Off			
Integration Method	Linear			
OBA Range	Low			
OBA Bandwidth	1/1 and 1/3			
OBA Freq. Weighting	Z Weighting			
OBA Max Spectrum	Bin Max			
Overload	144.2 dB			
Results				
LA_{eq}	65.8			
LAE	95.3			
EA	376.976 µPa²h			
EA8	12.063 mPa²h			
EA40	60.316 mPa²h			
$LZ_{peak\ (max)}$	2021-04-16 15:09:59	101.8 dB		
LAS_{max}	2021-04-16 15:14:33	73.8 dB		
LAS_{min}	2021-04-16 15:07:31	62.4 dB		
SEA	-99.94 dB			
			Statistics	
LC_{eq}	72.7 dB		**LAI2.00**	68.1 dB
LA_{eq}	65.8 dB		**LAI8.00**	67.1 dB
LC_{eq} - LA_{eq}	7.0 dB		**LAI25.00**	66.2 dB
LAI_{eq}	66.8 dB		**LAI50.00**	65.5 dB
LA_{eq}	65.8 dB		**LAI66.60**	65.1 dB
LAI_{eq} - LA_{eq}	1.0 dB		**LAI90.00**	64.3 dB
# Overloads	0			

APPENDIX D

CONSTRUCTION NOISE MODELING

Receptor - School to the East

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Demolition									
Concrete/Industrial Saws	1	90	190	20	0.20	-11.6	-7.0	78.4	71.4
Rubber Tired Dozers	2	85	190	40	0.80	-11.6	-1.0	73.4	72.4
Excavators	3	85	190	40	1.20	-11.6	0.8	73.4	74.2
								Log Sum	77.6
Site Preparation									
Tractors/Loaders/Backhoes	1	84	116	40	0.40	-7.3	-4.0	76.7	72.7
Rubber Tired Dozers	1	85	116	40	0.40	-7.3	-4.0	77.7	73.7
								Log Sum	76.2
Grading									
Grader	1	85	116	40	0.40	-7.3	-4.0	77.7	73.7
Excavators	1	85	116	40	0.40	-7.3	-4.0	77.7	73.7
Rubber Tired Dozers	1	85	116	40	0.40	-7.3	-4.0	77.7	73.7
Tractors/Loaders/Backhoes	3	84	116	40	1.20	-7.3	0.8	76.7	77.5
								Log Sum	81.0
Building Construction									
Cranes	1	83	116	16	0.16	-7.3	-8.0	75.7	67.7
Forklifts [2]	3	48	116	40	1.20	-7.3	0.8	40.7	41.5
Generator Set	1	81	116	50	0.50	-7.3	-3.0	73.7	70.7
Welders	1	74	116	40	0.40	-7.3	-4.0	66.7	62.7
Tractors/Loaders/Backhoes	3	84	116	40	1.20	-7.3	0.8	76.7	77.5
								Log Sum	78.8
Paving									
Pavers	2	77	116	50	1.00	-7.3	0.0	69.7	69.7
Paving Equipment	2	85	116	20	0.40	-7.3	-4.0	77.7	73.7
Rollers	2	80	116	20	0.40	-7.3	-4.0	72.7	68.7
								Log Sum	76.0
Architectural Coating									
Air Compressors	1	80	116	40	0.40	-7.3	-4.0	72.7	68.7
								Log Sum	68.7

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (structure).

Receptor - Park to North

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Demolition									
Concrete/Industrial Saws	1	90	494	20	0.20	-19.9	-7.0	70.1	63.1
Rubber Tired Dozers	2	85	494	40	0.80	-19.9	-1.0	65.1	64.1
Excavators	3	85	494	40	1.20	-19.9	0.8	65.1	65.9
								Log Sum	69.3
Site Preparation									
Tractors/Loaders/Backhoes	1	84	387	40	0.40	-17.8	-4.0	66.2	62.2
Rubber Tired Dozers	1	85	387	40	0.40	-17.8	-4.0	67.2	63.2
								Log Sum	65.8
Grading									
Grader	1	85	387	40	0.40	-17.8	-4.0	67.2	63.2
Excavators	1	85	387	40	0.40	-17.8	-4.0	67.2	63.2
Rubber Tired Dozers	1	85	387	40	0.40	-17.8	-4.0	67.2	63.2
Tractors/Loaders/Backhoes	3	84	387	40	1.20	-17.8	0.8	66.2	67.0
								Log Sum	70.6
Building Construction									
Cranes	1	83	387	16	0.16	-17.8	-8.0	65.2	57.3
Forklifts [2]	3	48	387	40	1.20	-17.8	0.8	30.2	31.0
Generator Set	1	81	387	50	0.50	-17.8	-3.0	63.2	60.2
Welders	1	74	387	40	0.40	-17.8	-4.0	56.2	52.2
Tractors/Loaders/Backhoes	3	84	387	40	1.20	-17.8	0.8	66.2	67.0
								Log Sum	68.3
Paving									
Pavers	2	77	387	50	1.00	-17.8	0.0	59.2	59.2
Paving Equipment	2	85	387	20	0.40	-17.8	-4.0	67.2	63.2
Rollers	2	80	387	20	0.40	-17.8	-4.0	62.2	58.2
								Log Sum	65.6
Architectural Coating									
Air Compressors	1	80	387	40	0.40	-17.8	-4.0	62.2	58.2
								Log Sum	58.2

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (structure).

Receptor - Residential to Southeast

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Demolition									
Concrete/Industrial Saws	1	90	305	20	0.20	-15.7	-7.0	74.3	67.3
Rubber Tired Dozers	2	85	305	40	0.80	-15.7	-1.0	69.3	68.3
Excavators	3	85	305	40	1.20	-15.7	0.8	69.3	70.1
								Log Sum	73.5
Site Preparation									
Tractors/Loaders/Backhoes	1	84	345	40	0.40	-16.8	-4.0	67.2	63.2
Rubber Tired Dozers	1	85	345	40	0.40	-16.8	-4.0	68.2	64.2
								Log Sum	66.8
Grading									
Grader	1	85	345	40	0.40	-16.8	-4.0	68.2	64.2
Excavators	1	85	345	40	0.40	-16.8	-4.0	68.2	64.2
Rubber Tired Dozers	1	85	345	40	0.40	-16.8	-4.0	68.2	64.2
Tractors/Loaders/Backhoes	3	84	345	40	1.20	-16.8	0.8	67.2	68.0
								Log Sum	71.6
Building Construction									
Cranes	1	83	345	16	0.16	-16.8	-8.0	66.2	58.3
Forklifts [2]	3	48	345	40	1.20	-16.8	0.8	31.2	32.0
Generator Set	1	81	345	50	0.50	-16.8	-3.0	64.2	61.2
Welders	1	74	345	40	0.40	-16.8	-4.0	57.2	53.2
Tractors/Loaders/Backhoes	3	84	345	40	1.20	-16.8	0.8	67.2	68.0
								Log Sum	69.3
Paving									
Pavers	2	77	345	50	1.00	-16.8	0.0	60.2	60.2
Paving Equipment	2	85	345	20	0.40	-16.8	-4.0	68.2	64.2
Rollers	2	80	345	20	0.40	-16.8	-4.0	63.2	59.2
								Log Sum	66.6
Architectural Coating									
Air Compressors	1	80	345	40	0.40	-16.8	-4.0	63.2	59.2
								Log Sum	59.2

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (structure).

Receptor - Residential to South

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Demolition									
Concrete/Industrial Saws	1	90	345	20	0.20	-16.8	-7.0	73.2	66.2
Rubber Tired Dozers	2	85	345	40	0.80	-16.8	-1.0	68.2	67.3
Excavators	3	85	345	40	1.20	-16.8	0.8	68.2	69.0
								Log Sum	72.4
Site Preparation									
Tractors/Loaders/Backhoes	1	84	442	40	0.40	-18.9	-4.0	65.1	61.1
Rubber Tired Dozers	1	85	442	40	0.40	-18.9	-4.0	66.1	62.1
								Log Sum	64.6
Grading									
Grader	1	85	442	40	0.40	-18.9	-4.0	66.1	62.1
Excavators	1	85	442	40	0.40	-18.9	-4.0	66.1	62.1
Rubber Tired Dozers	1	85	442	40	0.40	-18.9	-4.0	66.1	62.1
Tractors/Loaders/Backhoes	3	84	442	40	1.20	-18.9	0.8	65.1	65.9
								Log Sum	69.4
Building Construction									
Cranes	1	83	442	16	0.16	-18.9	-8.0	64.1	56.1
Forklifts [2]	3	48	442	40	1.20	-18.9	0.8	29.1	29.9
Generator Set	1	81	442	50	0.50	-18.9	-3.0	62.1	59.1
Welders	1	74	442	40	0.40	-18.9	-4.0	55.1	51.1
Tractors/Loaders/Backhoes	3	84	442	40	1.20	-18.9	0.8	65.1	65.9
								Log Sum	67.2
Paving									
Pavers	2	77	442	50	1.00	-18.9	0.0	58.1	58.1
Paving Equipment	2	85	442	20	0.40	-18.9	-4.0	66.1	62.1
Rollers	2	80	442	20	0.40	-18.9	-4.0	61.1	57.1
								Log Sum	64.4
Architectural Coating									
Air Compressors	1	80	442	40	0.40	-18.9	-4.0	61.1	57.1
								Log Sum	57.1

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (structure).

Receptor - Residential to West (across 55-Fwy)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Demolition									
Concrete/Industrial Saws	1	90	468	20	0.20	-19.4	-7.0	70.6	63.6
Rubber Tired Dozers	2	85	468	40	0.80	-19.4	-1.0	65.6	64.6
Excavators	3	85	468	40	1.20	-19.4	0.8	65.6	66.4
								Log Sum	69.8
Site Preparation									
Tractors/Loaders/Backhoes	1	84	552	40	0.40	-20.9	-4.0	63.1	59.2
Rubber Tired Dozers	1	85	552	40	0.40	-20.9	-4.0	64.1	60.2
								Log Sum	62.7
Grading									
Grader	1	85	552	40	0.40	-20.9	-4.0	64.1	60.2
Excavators	1	85	552	40	0.40	-20.9	-4.0	64.1	60.2
Rubber Tired Dozers	1	85	552	40	0.40	-20.9	-4.0	64.1	60.2
Tractors/Loaders/Backhoes	3	84	552	40	1.20	-20.9	0.8	63.1	63.9
								Log Sum	67.5
Building Construction									
Cranes	1	83	552	16	0.16	-20.9	-8.0	62.1	54.2
Forklifts [2]	3	48	552	40	1.20	-20.9	0.8	27.1	27.9
Generator Set	1	81	552	50	0.50	-20.9	-3.0	60.1	57.1
Welders	1	74	552	40	0.40	-20.9	-4.0	53.1	49.2
Tractors/Loaders/Backhoes	3	84	552	40	1.20	-20.9	0.8	63.1	63.9
								Log Sum	65.2
Paving									
Pavers	2	77	552	50	1.00	-20.9	0.0	56.1	56.1
Paving Equipment	2	85	552	20	0.40	-20.9	-4.0	64.1	60.2
Rollers	2	80	552	20	0.40	-20.9	-4.0	59.1	55.2
								Log Sum	62.5
Architectural Coating									
Air Compressors	1	80	552	40	0.40	-20.9	-4.0	59.1	55.2
								Log Sum	55.2

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (structure).

APPENDIX E

SOUNDPLAN INPUTS AND OUTPUTS

Noise emissions of industry sources

Source n	Referer	Leve Day dB(A	31 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.3 kHz	1.6 kHz	2 kHz	2.5 kHz	3.2 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	Correctio Cwa dB	CI dB	CT dB
Patio	Lw/m²	-	-	-	-	-	-	-	-	-	-	-	-	-	61.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Voice 1	Lw/unit	-	-	-	-	-	-	-	-	-	-	-	-	-	70.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Voice 2	Lw/unit	-	-	-	-	-	-	-	-	-	-	-	-	-	65.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Voice 3	Lw/unit	-	-	-	-	-	-	-	-	-	-	-	-	-	65.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Voice 4	Lw/unit	-	-	-	-	-	-	-	-	-	-	-	-	-	65.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Voice 5	Lw/unit	-	-	-	-	-	-	-	-	-	-	-	-	-	65.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-
HVAC	Lw/unit	-	20.0	24.	20.	24.	27.	34.	37.	39.	39.	42.	44.	34.	36.	37.	46.	47.	47.	48.	49.	49.	48.	48.	47.	51.	50.	48.	52.	50.	-	-	-

GANDDINI GROUP, INC. 550 Parkcenter Drive, Suite 202 Santa Ana CA 92705 USA

Noise emissions of parking lot traffic

Name	Parking lot type	Size	Movements per hour Day	Road surface	Separated method	Lw,ref dB(A)
Parking Movements	Visitors and staff	51 Parking bays	0.100	Asphaltic driving lanes	no	84.1

Receiver list

No.	Receiver name	Building side	Floor	Limit Day dB(A)	Level Day dB(A)	Conflict Day dB
1	1	-	GF	-	53.9	-
2	2	-	GF	-	35.8	-
3	3	-	GF	-	36.7	-
4	4	-	GF	-	36.7	-
5	5	-	GF	-	32.4	-
6	6	-	GF	-	28.6	-
7	7	-	GF	-	53.7	-

Contribution levels of the receivers

Source name		Traffic lane	Level Day dB(A)
1	GF		53.9
HVAC		-	3.4
HVAC		-	3.6
HVAC		-	1.0
HVAC		-	-1.6
HVAC		-	4.0
HVAC		-	2.6
HVAC		-	1.4
HVAC		-	1.2
HVAC		-	-1.8
Parking Movements		-	31.2
Patio		-	28.5
Voice 1		-	49.7
Voice 2		-	44.0
Voice 3		-	46.1
Voice 4		-	46.4
Voice 5		-	46.1
2	GF		35.8
HVAC		-	4.8
HVAC		-	4.9
HVAC		-	-0.7
HVAC		-	-0.8
HVAC		-	5.0
HVAC		-	2.8
HVAC		-	2.4
HVAC		-	2.3
HVAC		-	-0.9
Parking Movements		-	32.9
Patio		-	27.4
Voice 1		-	27.5
Voice 2		-	22.3
Voice 3		-	22.2
Voice 4		-	22.4
Voice 5		-	22.6
3	GF		36.7
HVAC		-	7.2
HVAC		-	6.7
HVAC		-	0.4
HVAC		-	1.1
HVAC		-	6.1
HVAC		-	1.3
HVAC		-	1.8
HVAC		-	4.1
HVAC		-	3.4
Parking Movements		-	36.5
Patio		-	16.2
Voice 1		-	16.0
Voice 2		-	10.9
Voice 3		-	10.9
Voice 4		-	10.9
Voice 5		-	11.0
4	GF		36.7
HVAC		-	9.5
HVAC		-	7.3
HVAC		-	3.8
HVAC		-	6.7
HVAC		-	3.4
HVAC		-	3.5
HVAC		-	4.7
HVAC		-	9.6
HVAC		-	10.1
Parking Movements		-	34.5

Contribution levels of the receivers

Source name		Traffic lane	Level Day dB(A)
Patio		-	32.6
Voice 1		-	13.1
Voice 2		-	8.1
Voice 3		-	8.0
Voice 4		-	8.1
Voice 5		-	8.1
5	GF		32.4
HVAC		-	3.8
HVAC		-	2.6
HVAC		-	-0.1
HVAC		-	2.8
HVAC		-	-0.1
HVAC		-	-1.2
HVAC		-	1.6
HVAC		-	3.8
HVAC		-	3.9
Parking Movements		-	30.6
Patio		-	27.5
Voice 1		-	11.0
Voice 2		-	6.0
Voice 3		-	6.0
Voice 4		-	6.0
Voice 5		-	6.0
6	GF		28.6
HVAC		-	-2.6
HVAC		-	-2.8
HVAC		-	-0.2
HVAC		-	-0.3
HVAC		-	-2.9
HVAC		-	-1.5
HVAC		-	-1.9
HVAC		-	-1.3
HVAC		-	-0.1
Parking Movements		-	19.7
Patio		-	27.9
Voice 1		-	7.9
Voice 2		-	2.9
Voice 3		-	2.9
Voice 4		-	2.9
Voice 5		-	2.9
7	GF		53.7
HVAC		-	3.3
HVAC		-	5.7
HVAC		-	19.0
HVAC		-	12.3
HVAC		-	8.9
HVAC		-	12.0
HVAC		-	6.7
HVAC		-	4.1
HVAC		-	9.9
Parking Movements		-	26.9
Patio		-	53.7
Voice 1		-	16.1
Voice 2		-	11.1
Voice 3		-	11.0
Voice 4		-	11.0
Voice 5		-	11.1

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