Noise Impact Analysis

FIRE STATION 1 - HEADQUARTERS PROJECT

City of Orange

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ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
City	City of Orange
cmu	Concrete masonry unit
CNEL	Community Noise Equivalent Level
dB	Decibel
dBA	A-weighted decibels
DOT	Department of Transportation
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
EPA	Environmental Protection Agency
Hz	Hertz
Ldn	Day-night average noise level
Leq	Equivalent sound level
Lmax	Maximum noise level
ONAC	Federal Office of Noise Abatement and Control
OSB	Oriented Strand Board
OSHA	Occupational Safety and Health Administration
PPV	Peak particle velocity
RMS	Root mean square
SEL	Single Event Level or Sound Exposure Level
STC	Sound Transmission Class
UMTA	Federal Urban Mass Transit Administration
VdB	Vibration velocity level in decibels

1.0 INTRODUCTION

1.1 Purpose of Analysis and Study Objectives

This Noise Impact Analysis has been prepared to determine the noise and vibration impacts associated with the proposed Fire Station No. 1 & Headquarters project (proposed project). The following is provided in this report:

- A description of the study area and the proposed project;
- Information regarding the fundamentals of noise;
- Information regarding the fundamentals of vibration;
- A description of the local noise guidelines and standards;
- An evaluation of the current noise environment;
- An analysis of the potential short-term construction-related noise impacts from the proposed project; and,
- An analysis of long-term operations-related noise impacts from the proposed project.

1.2 Site Location and Study Area

The project consist of two locations that are both in the City of Orange (City) that include: (1) The proposed Fire Station No. 1 and Headquarters (Fire Station site); and (2) The proposed Parking site for the Fire Department. The proposed Fire Station site is approximately 1.52 acres in area and is located at 105 Water Street. The Fire Station site is currently vacant and is bounded by Chapman Avenue and commercial uses to the north, Jameson Street and commercial and residential uses to the east, the City of Orange Department of Water to the south and Water Street and commercial uses to the west.

The proposed Parking site is approximately 1.23 acres in area and is currently utilized as a parking lot. The Parking site is bounded by commercial uses to the north, Water Street and the City of Orange Water Department to the east, Almond Avenue and residential uses to the south, and parking lot and residential uses to the west. The project study area is shown in Figure 1.

Sensitive Receptors in Project Vicinity

The nearest sensitive receptors to the Fire Station site are homes located on the east side of Jameson Street, which are as near as 60 feet east of the Fire Station site. The nearest sensitive receptors to the Parking site are homes located as near as 30 feet west of the Parking site. The nearest school is Palmyra Elementary School, which is located as near as 460 feet southeast of the Fire Station site and as near as 540 feet east of the Parking site.

1.3 Proposed Project Description

The proposed project is expected to break ground in January 2021 and be completed by July 2022. The proposed project would consist of development of a 16,574 square foot fire station structure with an attached 11,353 square foot headquarters structure, a 250 kilowatt (kW) backup diesel generator, and 21 staff parking spaces and 5 visitor parking spaces on the Fire Station site. In addition, an approximately 3,780 square foot reserve apparatus building that is currently located on the south side of the Fire Station

site will be retrofitted as part of the project. The proposed project would also include development of a parking lot that would include 54 staff parking spaces located behind a security gate that is located on the west side of Water Street. The proposed site plan is shown in Figure 2.

1.4 Executive Summary

Standard Noise Regulatory Conditions

The proposed project will be required to comply with the following regulatory conditions from the City of Orange and State of California.

City of Orange Noise Regulations

The following lists the noise and vibration regulations from the Municipal Code that are applicable, but not limited to the proposed project.

- Section 8.24.040 Exterior Noise
- Section 8.24.050(E) Construction Noise Exemptions

State of California Noise Regulations

The following lists the State of California noise regulations that are applicable, but not limited to the proposed project.

- California Vehicle Code Section 2700-27207 – On Road Vehicle Noise Limits
- California Vehicle Code Section 38365-38350 – Off-Road Vehicle Noise Limits

Summary of Analysis Results

The following is a summary of the proposed project's impacts with regard to the State CEQA Guidelines noise checklist questions.

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?

Less than significant impact.

Generation of excessive groundborne vibration or groundborne noise levels?

Less than significant impact.

For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

No impact.

1.5 Project Design Features Incorporated into the Proposed Project

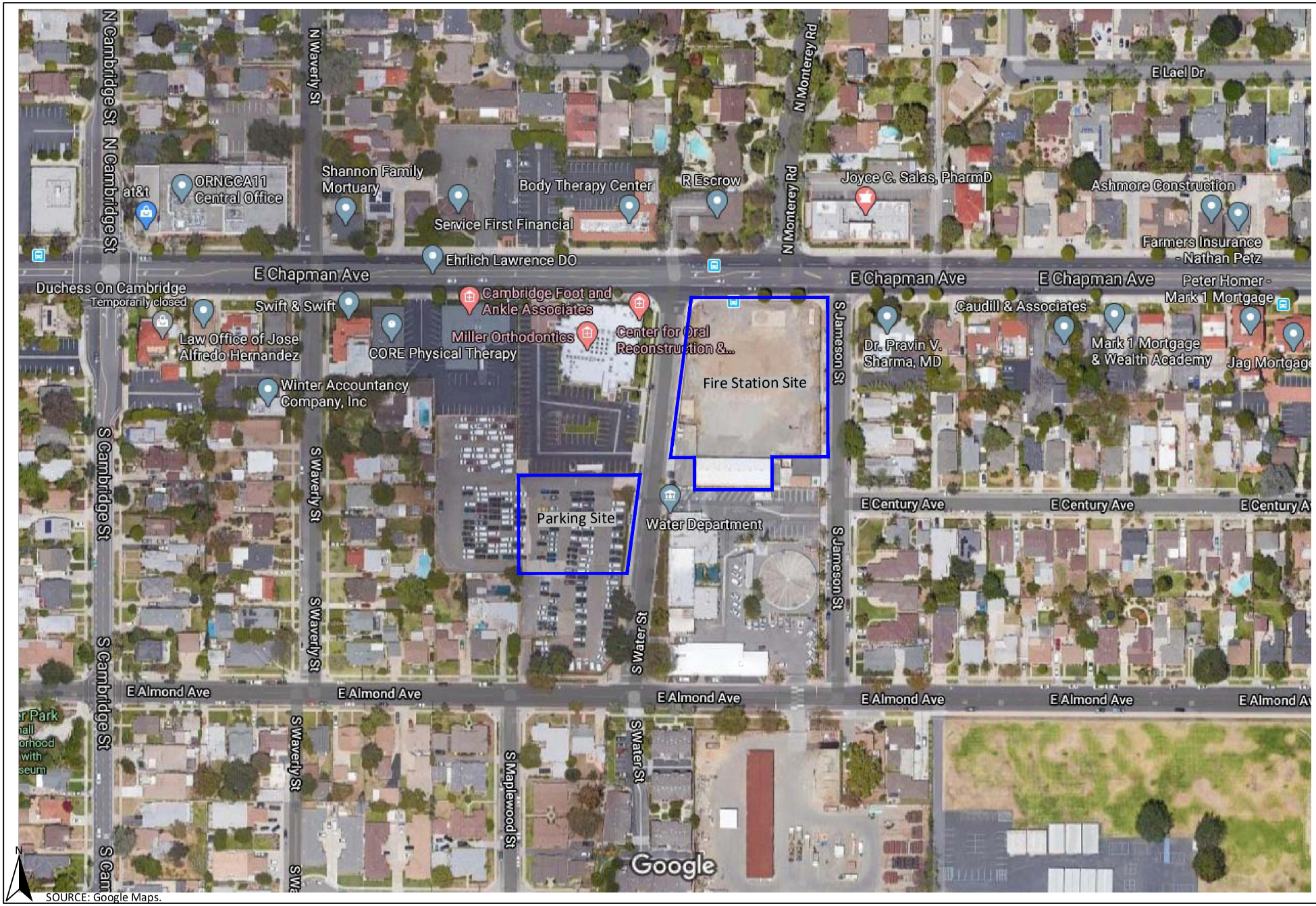
This analysis was based on implementation of the following project design features that are depicted on the plans for the project.

Project Design Feature 1:
The project applicant shall construct a minimum 7.7-foot high concrete masonry unit wall that is depicted on the proposed site plan and is located on the east side of the proposed staff parking lot that is located on the southeast corner of the Fire Station Site. Any doors installed in the wall shall be solid doors with self-closing hinges.

Project Design Feature 2:
The project applicant shall install a sound enclosure on the proposed emergency generator that is depicted on the proposed site plan. The sound enclosure shall be no less effective than a Level 1 Sound Enclosure provided by Generac.

1.6 Mitigation Measures for the Proposed Project

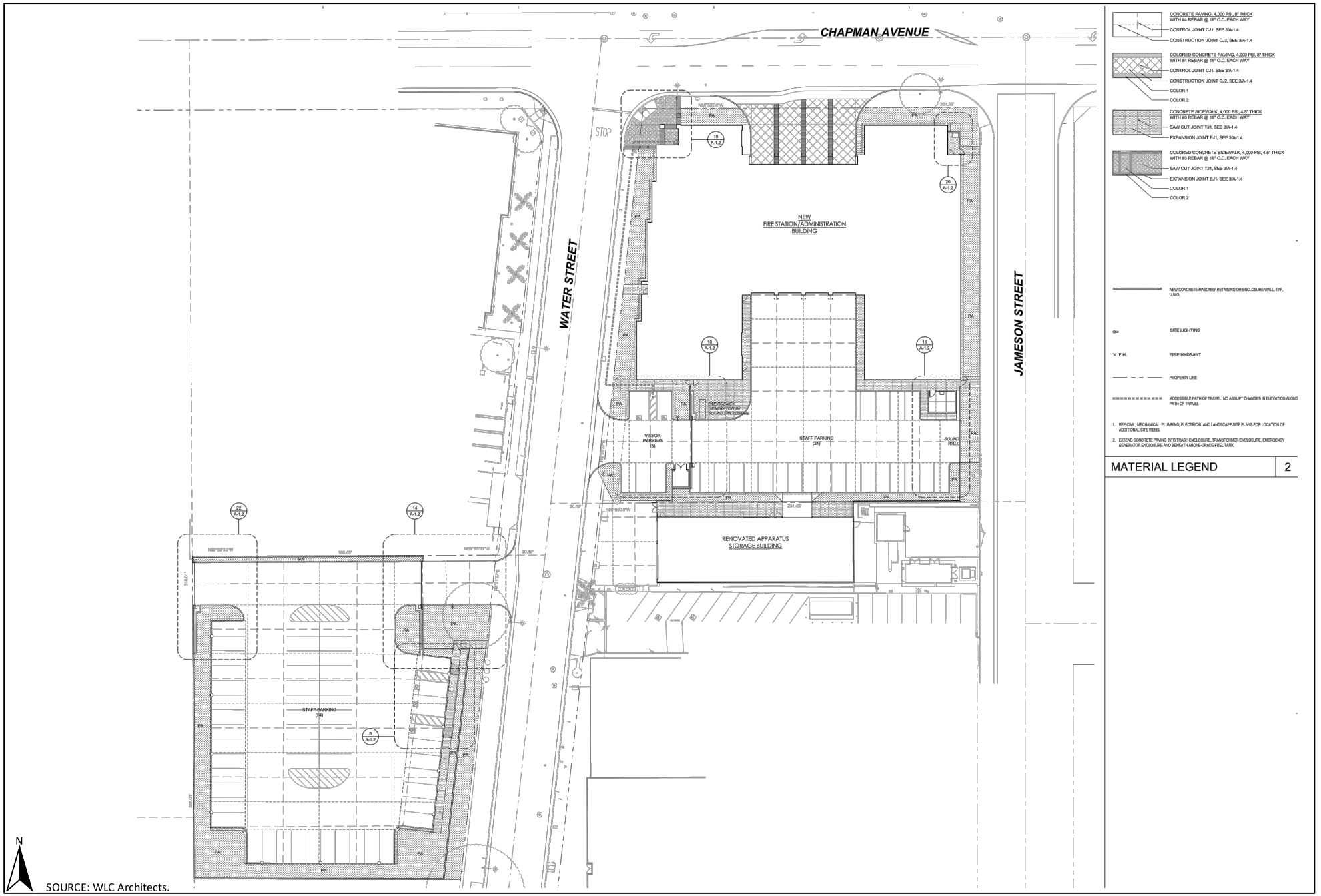
This analysis found that through adherence to the noise and vibration regulations detailed in Section 1.4 above as well as Project Design Features 1 and 2 that are detailed in Section 1.5, all noise and vibration impacts would be reduced to less than significant levels.



SOURCE: Google Maps.

VISTA ENVIRONMENTAL

Figure 1
Project Location Map



SOURCE: WLC Architects.

VISTA ENVIRONMENTAL

Figure 2
Proposed Site Plan

2.0 NOISE FUNDAMENTALS

Noise is defined as unwanted sound. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm or when it has adverse effects on health. Sound is produced by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit which expresses the ratio of the sound pressure level being measured to a standard reference level. A-weighted decibels (dBA) approximate the subjective response of the human ear to a broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies which are audible to the human ear.

2.1 Noise Descriptors

Noise Equivalent sound levels are not measured directly, but are calculated from sound pressure levels typically measured in A-weighted decibels (dBA). The equivalent sound level (Leq) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period. The peak traffic hour Leq is the noise metric used by California Department of Transportation (Caltrans) for all traffic noise impact analyses.

The Day-Night Average Level (Ldn) is the weighted average of the intensity of a sound, with corrections for time of day, and averaged over 24 hours. The time of day corrections require the addition of ten decibels to sound levels at night between 10 p.m. and 7 a.m. While the Community Noise Equivalent Level (CNEL) is similar to the Ldn, except that it has another addition of 4.77 decibels to sound levels during the evening hours between 7 p.m. and 10 p.m. These additions are made to the sound levels at these time periods because during the evening and nighttime hours, when compared to daytime hours, there is a decrease in the ambient noise levels, which creates an increased sensitivity to sounds. For this reason the sound appears louder in the evening and nighttime hours and is weighted accordingly. The City of Orange relies on the CNEL noise standard to assess transportation-related impacts on noise sensitive land uses.

2.2 Tone Noise

A pure tone noise is a noise produced at a single frequency and laboratory tests have shown that humans are more perceptible to changes in noise levels of a pure tone. For a noise source to contain a “pure tone,” there must be a significantly higher A-weighted sound energy in a given frequency band than in the neighboring bands, thereby causing the noise source to “stand out” against other noise sources. A pure tone occurs if the sound pressure level in the one-third octave band with the tone exceeds the average of the sound pressure levels of the two contiguous one-third octave bands by:

- 5 dB for center frequencies of 500 hertz (Hz) and above
- 8 dB for center frequencies between 160 and 400 Hz
- 15 dB for center frequencies of 125 Hz or less

2.3 Noise Propagation

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, radiate 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.

2.4 Ground Absorption

The sound drop-off rate is highly dependent on the conditions of the land between the noise source and receiver. To account for this ground-effect attenuation (absorption), two types of site conditions are commonly used in traffic noise models, soft-site and hard-site conditions. Soft-site conditions account for the sound propagation loss over natural surfaces such as normal earth and ground vegetation. For point sources, a drop-off rate of 7.5 dBA/DD is typically observed over soft ground with landscaping, as compared with a 6.0 dBA/DD drop-off rate over hard ground such as asphalt, concrete, stone and very hard packed earth. For line sources a 4.5 dBA/DD is typically observed for soft-site conditions compared to the 3.0 dBA/DD drop-off rate for hard-site conditions. Caltrans research has shown that the use of soft-site conditions is more appropriate for the application of the Federal Highway Administration (FHWA) traffic noise prediction model used in this analysis.

3.0 GROUND-BORNE VIBRATION FUNDAMENTALS

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room and may also consist of the rattling of windows or dishes on shelves.

3.1 Vibration Descriptors

There are several different methods that are used to quantify vibration amplitude such as the maximum instantaneous peak in the vibrations velocity, which is known as the peak particle velocity (PPV) or the root mean square (rms) amplitude of the vibration velocity. Due to the typically small amplitudes of vibrations, vibration velocity is often expressed in decibels and is denoted as (L_v) and is based on the rms velocity amplitude. A commonly used abbreviation is "VdB", which in this text, is when L_v is based on the reference quantity of 1 micro inch per second.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Off-site sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration.

3.3 Vibration Propagation

The propagation of ground-borne vibration is not as simple to model as airborne noise. This is due to the fact that noise in the air travels through a relatively uniform median, while ground-borne vibrations travel through the earth which may contain significant geological differences. There are three main types of vibration propagation; surface, compression, and shear waves. Surface waves, or Rayleigh 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. P-waves, or compression 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. S-waves, or shear 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 vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil but has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.

4.0 REGULATORY SETTING

The project site is located in the City of Orange. Noise regulations are addressed through the efforts of various federal, state, and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Promulgating noise emission standards for interstate commerce
- Assisting state and local abatement efforts
- Promoting noise education and research

The Federal Office of Noise Abatement and Control (ONAC) was initially tasked with implementing the Noise Control Act. However, the ONAC has since been eliminated, leaving the development of federal noise policies and programs to other federal agencies and interagency committees. For example, the Occupational Safety and Health Administration (OSHA) agency prohibits exposure of workers to excessive sound levels. The Department of Transportation (DOT) assumed a significant role in noise control through its various operating agencies. The Federal Aviation Administration (FAA) regulates noise of aircraft and airports. Surface transportation system noise is regulated by a host of agencies, including the Federal Transit Administration (FTA). Transit noise is regulated by the federal Urban Mass Transit Administration (UMTA), while freeways that are part of the interstate highway system are regulated by the Federal Highway Administration (FHWA). Finally, the federal government actively advocates that local jurisdictions use their land use regulatory authority to arrange new development in such a way that "noise sensitive" uses are either prohibited from being sited adjacent to a highway or, alternately that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

Although the proposed project is not under the jurisdiction of the FTA, the FTA is the only agency that provides specific guidance for construction noise. The FTA recommends developing construction noise criteria on a project-specific basis that utilizes local noise ordinances if possible. However, local noise ordinances usually relates to nuisance and hours of allowed activity and sometimes specify limits in terms of maximum levels, but are generally not practical for assessing the noise impacts of a construction project. Project construction noise criteria should take into account the existing noise environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land uses. The FTA standards are based on extensive studies by the FTA and other governmental agencies on the human effects and reaction to noise and a summary of the FTA findings for a general construction noise assessment are provided below in Table A.

Table A – FTA General Assessment Construction Noise Criteria

Land Use	Day (dBA $Leq_{(1\text{-hour})}$)	Night (dBA $Leq_{(1\text{-hour})}$)
Residential	90	80
Commercial	100	100
Industrial	100	100

Source: Federal Transit Administration, 2018.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation sources, the City is restricted to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

4.2 State Regulations

Noise Standards

California Department of Health Services Office of Noise Control

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the "Land Use Compatibility for Community Noise Environments Matrix," which allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise.

California Noise Insulation Standards

Title 24, Chapter 1, Article 4 of the California Administrative Code (California Noise Insulation Standards) requires noise insulation in new hotels, motels, apartment houses, and dwellings (other than single-family detached housing) that provides an annual average noise level of no more than 45 dBA CNEL. When such structures are located within a 60-dBA CNEL (or greater) noise contour, an acoustical analysis is required to ensure that interior levels do not exceed the 45-dBA CNEL annual threshold. In addition, Title 21, Chapter 6, Article 1 of the California Administrative Code requires that all habitable rooms, hospitals, convalescent homes, and places of worship shall have an interior CNEL of 45 dB or less due to aircraft noise.

Government Code Section 65302

Government Code Section 65302 mandates that the legislative body of each county and city in California adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable.

California Vehicle Code Section 27200-27207 – On-Road Vehicle Noise

California Vehicle Code Section 27200-27207 provides noise limits for vehicles operated in California. For vehicles over 10,000 pounds noise is limited to 88 dB for vehicles manufactured before 1973, 86 dB for vehicles manufactured before 1975, 83 dB for vehicles manufactured before 1988, and 80 dB for vehicles manufactured after 1987. All measurements are based at 50 feet from the vehicle.

California Vehicle Section 38365-38380 – Off-Road Vehicle Noise

California Vehicle Code Section 38365-38380 provides noise limits for off-highway motor vehicles operated in California. 92 dBA for vehicles manufactured before 1973, 88 dBA for vehicles manufactured before 1975, 86 dBA for vehicles manufactured before 1986, and 82 dBA for vehicles manufactured after December 31, 1985. All measurements are based at 50 feet from the vehicle.

Vibration Standards

Title 14 of the California Administrative Code Section 15000 requires that all state and local agencies implement the California Environmental Quality Act (CEQA) Guidelines, which requires the analysis of exposure of persons to excessive groundborne vibration. However, no statute has been adopted by the state that quantifies the level at which excessive groundborne vibration occurs.

Caltrans issued the *Transportation- and Construction-Induced Vibration Guidance Manual* in 2004. The manual provides practical guidance to Caltrans engineers, planners, and consultants who must address vibration issues associated with the construction, operation, and maintenance of Caltrans projects. However, this manual is also used as a reference point by many lead agencies and CEQA practitioners throughout California, as it provides numeric thresholds for vibration impacts. Thresholds are established for continuous (construction-related) and transient (transportation-related) sources of vibration, which found that the human response becomes distinctly perceptible at 0.25 inch per second PPV for transient sources and 0.04 inch per second PPV for continuous sources.

4.3 Local Regulations

The City of Orange General Plan and Municipal Code establishes the following applicable policies related to noise and vibration.

City of Orange General Plan

The City of Orange has developed its own land use compatibility standards based on recommended parameters from the California Governor's Office of Planning and Research that rate compatibility. Using the State's land use compatibility guidelines, the City has established interior and exterior noise standards. The City's compatibility standards provide only for normally acceptable conditions based on State recommendations and City land use designations. The City's Land Use Compatibility standards are presented in Table B.

Table B – City of Orange Maximum Allowable Noise Exposure – Transportation Sources

Land Use		CNEL (dBA)	
Land Use 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

Table B – City of Orange Maximum Allowable Noise Exposure – Transportation Sources

Land Use		CNEL (dBA)	
Land Use Designations	**Uses**	**Interior[1,3]**	**Exterior[2]**
	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 Arterial 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 Table N-3.

The City's maximum allowable noise exposure levels from stationary sources are defined in Table N-4 of the General Plan and reprinted below in Table C.

Table C – City of Orange Maximum Allowable Noise Exposure – Stationary Sources

Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly Equivalent Level (Leq), dBA	55	45
Maximum Level (Lmax), 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. Standards construction practices that comply with 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 standards listed in Table N-4, then the noise level standards shall be increased at 3 dB increments to encompass the ambient noise 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 Table N-4.

For City analysis of noise impacts and determining appropriate mitigation under the California Environmental Quality Act (CEQA), in addition to the maximum allowable noise level standards outlined in Tables N-3 (Table B above) and N-4 (Table C above) from the General Plan, 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 60 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.

In addition to the standards provided above, the City of Orange General Plan includes the following goals and policies that are applicable to the proposed project

Goals and Policies

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

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 Code

The City of Orange Municipal Code establishes the following applicable standards related to noise.

Section 8.24.020 Definitions.

The following words, phrases and terms as used in this chapter shall have the meaning as indicated below:

A. “Ambient noise level” means the all-encompassing noise level associated with a given environment, being a composite of sounds from all sources, excluding the alleged offensive noise at the location and approximate time at which a comparison with the alleged offensive noise is to be made.

B. “Adjusted ambient noise level” means the measured ambient noise level plus 3 dB (A). Three (3) dB (A) is the industry-accepted threshold of human perceptibility for a change in noise environment.

Section 8.24.040 Exterior Noise Standards.

A. The following noise standards [Table D] for fixed noise sources, unless otherwise specifically indicated, shall apply to all residential property:

Table D – City of Orange Municipal Code Exterior Noise Standards

Standard	Noise Level	Time Period
Hourly Average (L_{eq})	55 dB (A)	7:00 a.m. – 10:00 p.m.
	50 dB (A)	10:00 p.m. – 7:00 a.m.
Maximum Level	70 dB (A)	7:00 a.m. – 10:00 p.m.
	65 dB (A)	10:00 p.m. – 7:00 a.m.

Source: City of Orange Municipal Code Section 8.24.040.

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 Table 8.24.040. 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 Table 8.24.040 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 Table 8.240.040 shall be reduced by five dB(A) for impact or simple tone noises, recurring impulsive noises, or for noises consisting of speech or music. (Ord. No. 1-4 § I, 8-12-14)

8.24.050 Exemptions from Chapter Provisions.

The following activities shall be exempted from the provisions of this chapter:

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 a.m. and 8:00 p.m. on any day except for Sunday or a Federal holiday, or between the hours of 9:00 a.m. and 8:00 p.m. on Sunday or a Federal holiday. Noise generated outside of the hours specified are subject to the noise standards identified in Table 8.24.040;

I. Noise sources associated with the maintenance of real property, provided such activities take place between the hours of 7:00 A.M. and 8:00 P.M. on any day except Sunday or a Federal holiday, or between the hours of 9:00 A.M. and 8:00 P.M. on Sunday or a Federal holiday;

L. 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;

M. Any activity to the extent regulation thereof has been preempted by State or Federal Law. (Ord. No. 1-4 § I, 8-12-14)

8.24.060 Special Provisions for Schools, Hospitals and Churches.

It is unlawful for any person to create any noise which causes the noise level at any school, hospital, or church, while the same is in use, to exceed the noise limits as specified in Section 8.24.040, or which noise level unreasonably interferes with the use of such institutions. (Ord. No. 1-4 § I, 8-12-14)

5.0 EXISTING NOISE CONDITIONS

To determine the existing noise levels, noise measurements have been taken in the vicinity of the project site. The field survey noted that noise within the proposed project area is generally characterized by vehicle traffic on Chapman Avenue, which is located adjacent to the north side of the Fire Station site. The following describes the measurement procedures, measurement locations, noise measurement results, and the modeling of the existing noise environment.

5.1 Noise Measurement Equipment

The noise measurements were taken using three Larson Davis Model LXT1 Type 1 sound level meters programmed in "slow" mode to record the sound pressure level at 1-second intervals for 24 hours in "A" weighted form. In addition, the Leq averaged over the entire measuring time and Lmax were recorded with both sound level meters. The sound level meters and microphones were mounted on trees and fences, approximately five to six feet above the ground and were equipped with windscreens during all measurements. The noise meters were calibrated before and after the monitoring using a Larson Davis Cal200 calibrator. All noise level measurement equipment meets American National Standards Institute specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA).

Noise Measurement Location

The noise monitoring locations were selected in order to obtain noise measurements of the current noise levels in the vicinity of the nearby homes. The noise measurement sites were selected to provide a representative sampling of the existing noise levels in the project vicinity. Descriptions of the noise monitoring sites are provided below in Table E and are shown in Figure 3. Appendix A includes a photo index of the study area and noise level measurement locations.

Noise Measurement Timing and Climate

The noise measurements were recorded between 12:18 p.m. on Wednesday, April 1, 2020 and 12:35 p.m. on Thursday, April 2, 2020. When the noise measurements were started the sky was clear, the temperature was 72 degrees Fahrenheit, the humidity was 49 percent, barometric pressure was 29.58 inches of mercury, and the wind was blowing around seven miles per hour. Overnight, the sky was partly cloudy and the temperature dropped to 58 degrees Fahrenheit. At the conclusion of the noise measurements, the sky was cloudy, the temperature was 69 degrees Fahrenheit, the humidity was 53 percent, barometric pressure was 29.69 inches of mercury, and the wind was blowing around six miles per hour.

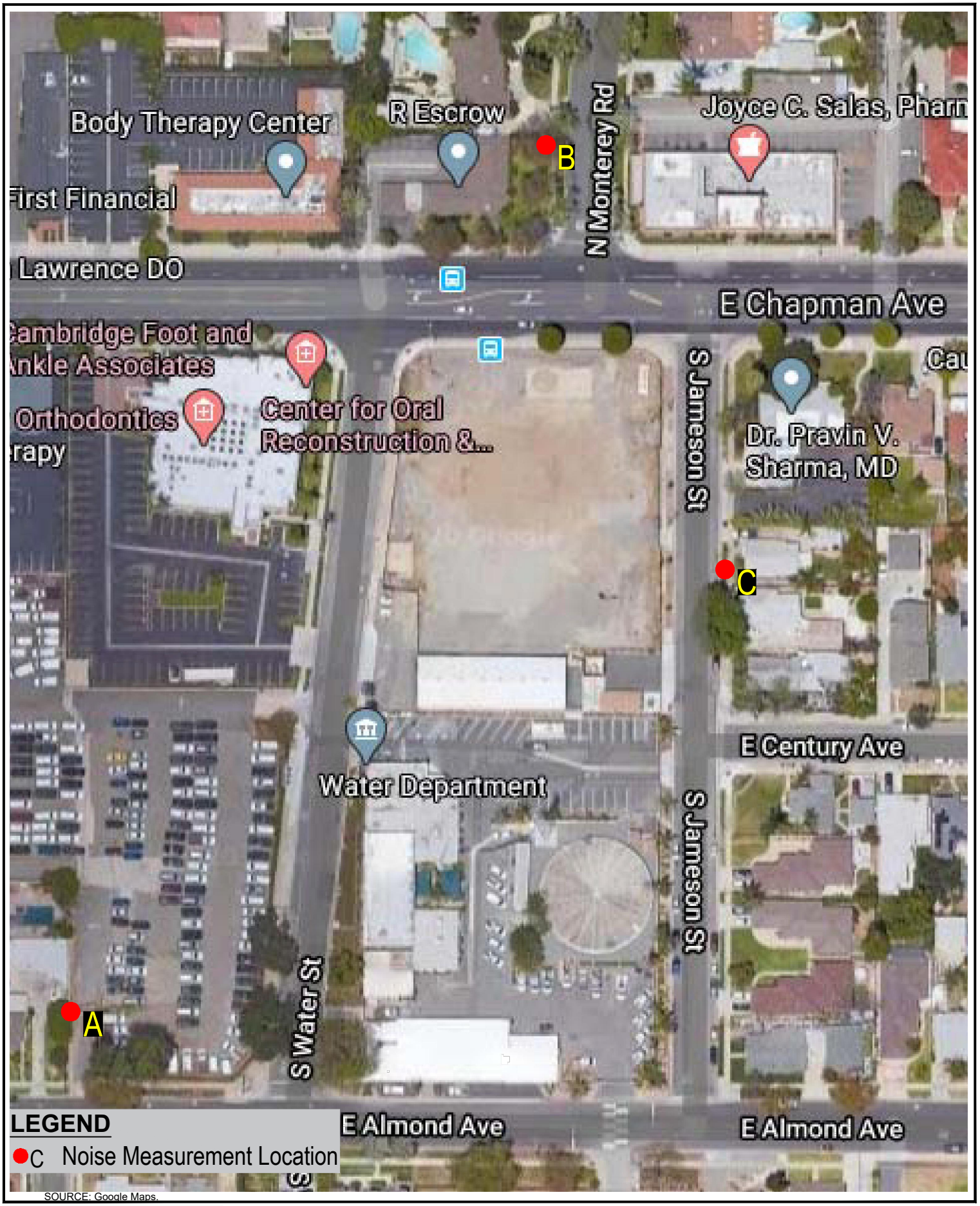
5.2 Noise Measurement Results

The results of the noise level measurements are presented in Table E. The measured sound pressure levels in dBA have been used to calculate the minimum and maximum L_{eq} averaged over 1-hour intervals. Table E also shows the L_{eq}, L_{max}, and CNEL, based on the entire measurement time. The noise monitoring data printouts are included in Appendix B. Figure 4 shows a graph of the 24-hour noise measurements.

Table E – Existing (Ambient) Noise Level Measurements

Site No.	Site Description	Average (dBA L_{eq})		1-hr Average (dBA L_{eq}/Time)		Average (dBA CNEL)
		Daytime[1]	Nighttime[2]	Minimum	Maximum	
A	Located approximately 100 feet south of the southwest corner of the Parking site, on a parking lot gate that is located approximately 90 feet north of Almond Ave Centerline.	54.8	47.0	38.5 12:58 a.m.	61.5 11:16 a.m.	56.3
B	Located approximately 160 feet north of the Fire Station site on a tree that is located approximately 35 feet west of Monterey Road centerline.	64.2	53.2	46.6 10:56 p.m.	68.8 1:48 a.m.	64.0
C	Located approximately 50 feet east of the Fire Station site on a sign in front of the home at 129 Jameson Street	56.8	47.2	40.1 1:13 a.m.	60.1 9:40 a.m.	60.1

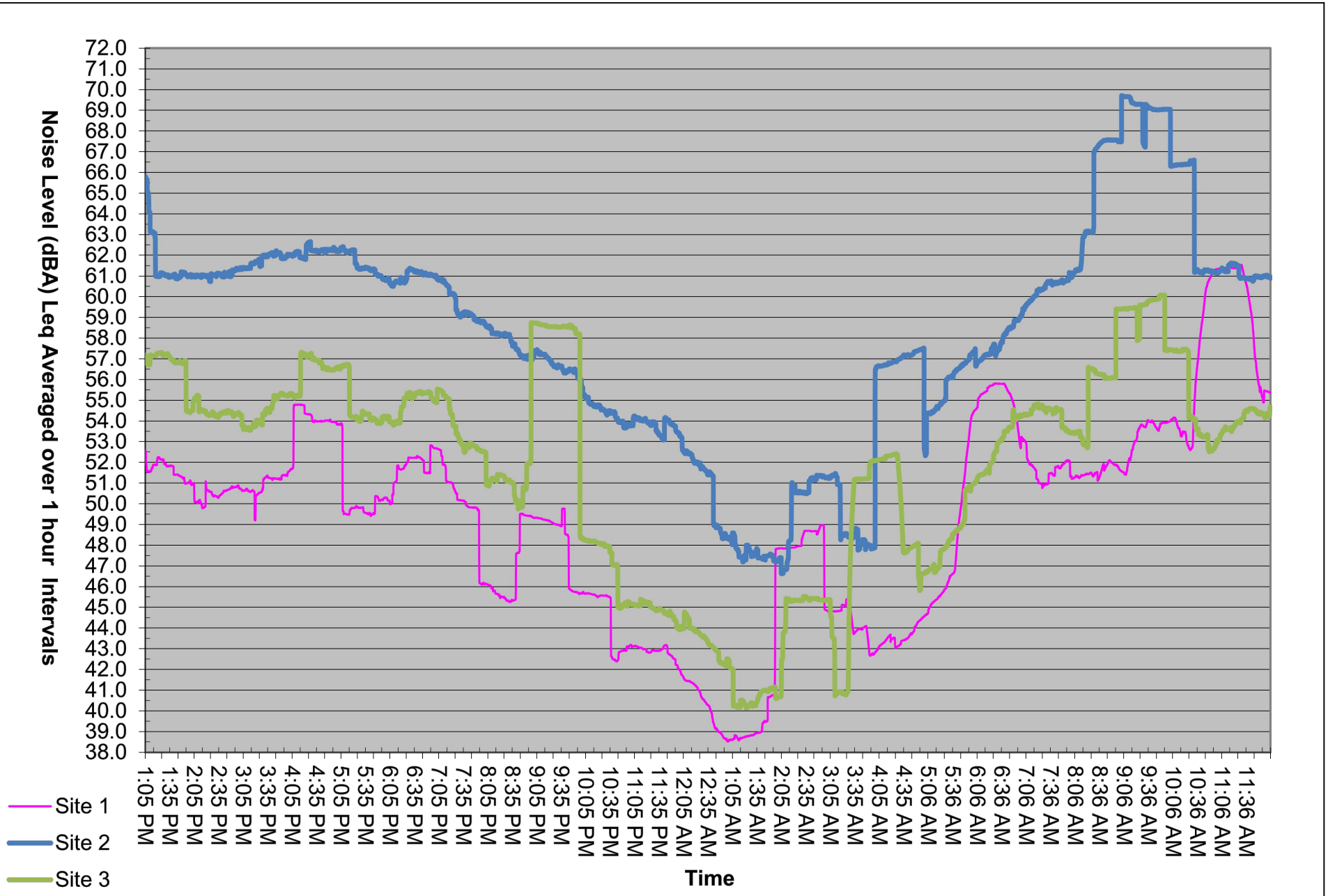
Notes:
[1] Daytime defined as 7:00 a.m. to 10:00 p.m. (Section 8.24.040 of the Municipal Code)
[2] Nighttime define as 10:0 p.m. to 7:00 a.m. (Section 8.24.040 of the Municipal Code)
Source: Noise measurements taken between Wednesday April 1, and Thursday, April 2, 2020.



SOURCE: Google Maps.

VISTA ENVIRONMENTAL

Figure 3
Field Noise Monitoring Locations



SOURCE: Three Larson Davis Model LXT1 Type 1 Sound Level Meters.

VISTA ENVIRONMENTAL

Figure 4
Field Noise Measurements Graph

6.0 MODELING PARAMETERS AND ASSUMPTIONS

6.1 Construction Noise

The noise impacts from construction of the proposed project have been analyzed through use of the FHWA's Roadway Construction Noise Model (RCNM). The FHWA compiled noise measurement data regarding the noise generating characteristics of several different types of construction equipment used during the Central Artery/Tunnel project in Boston. Table F below provides a list of the construction equipment anticipated to be used for each phase of construction as detailed in *Air Quality, Energy and Greenhouse Gas Emissions Impact Analysis Fire Station No. 1 & Headquarters Project* (Air Quality Analysis), prepared by Vista Environmental, June 22, 2020.

Table F – Construction Equipment Noise Emissions and Usage Factors

Equipment Description	Number of Equipment	Acoustical Use Factor[1] (percent)	Spec 721.560 Lmax at 50 feet[2] (dBA, slow[3])	Actual Measured Lmax at 50 feet4 (dBA, slow3)
Demolition				
Concrete/Industrial Saws	1	20	90	90
Rubber Tired Dozers	1	40	85	82
Tractors/Loaders/Backhoes	3	40	84	N/A
Grading				
Grader	1	40	85	83
Rubber Tired Dozer	1	40	85	82
Excavator	1	40	85	81
Tractor, Loader or Backhoe[5]	2	40	84	N/A
Building Construction				
Crane	1	16	85	81
Forklift (Gradall)	2	40	85	83
Generator	1	50	82	81
Tractor, Loader or Backhoe[5]	1	40	84	N/A
Welder	3	40	73	74
Paving				
Cement & Mortar Mixer[5]	1	50	80	80
Paver	1	50	85	77
Paving Equipment	1	50	85	77
Roller	2	20	85	80
Tractor, Loader or Backhoe[5]	1	40	84	N/A
Architectural Coating				
Air Compressor	1	40	80	78

Notes:
[1] Acoustical use factor is the percentage of time each piece of equipment is operational during a typical workday.
[2] Spec 721.560 is the equipment noise level utilized by the RCNM program.
[3] The "slow" response averages sound levels over 1-second increments. A "fast" response averages sound levels over 0.125-second increments.
[4] Actual Measured is the average noise level measured of each piece of equipment during the Central Artery/Tunnel project in Boston, Massachusetts primarily during the 1990s.
[5] For the tractor/loader/backhoe, the tractor noise level was utilized, since it is the loudest of the three types of equipment.
[6] For the cement & mortar mixer, the concrete mixer truck noise level was utilized.
Source: Federal Highway Administration, 2006 and CalEEMod default equipment mix.

Table F also shows the associated measured noise emissions for each piece of equipment from the RCNM model and measured percentage of typical equipment use per day. Construction noise impacts to the nearby sensitive receptors have been calculated according to the equipment noise levels and usage factors listed in Table F and through use of the RCNM. For each phase of construction, the nearest piece of equipment was placed at the shortest distance of possible locations for the proposed activity to the nearest sensitive receptor and each subsequent piece of equipment was placed an additional 50 feet away. In order to account for the existing approximately 6 foot high wall located between the Parking site and the nearest home located to the southwest, 5 dB of shielding was added to the RCNM model. The RCNM printouts are provided in Appendix C.

6.2 Operational Noise

The proposed project would consist of the relocation of Fire Station No. 1 & Headquarters from its current location at 176 S Grand Street to its proposed location at 105 Water Street. In order to determine the noise that will be created by the proposed project, a 24-hour noise measurement was taken in the yard at the existing Fire Station No. 1, that captured all fire station-related noise sources, including if sirens were on when vehicles left the station. In addition, a reference noise measurement of operational rooftop mechanical equipment and the manufacturer noise specifications for a 250 kW backup generator have been utilized to provide a complete assessment of the potential operational noise that will be created by the proposed project. The following describes the 24-hour reference measurement procedure and reference noise measurement results.

24-hour Reference Noise Measurement Procedure

The 24 hour reference noise measurement of the existing Fire Station No. 1 & Headquarters was taken between 11:59 a.m. on April 29, 2020 and 11:59 a.m. on April 30, 2020, using a Larson-Davis Model 831 Type 1 precision sound level meter programmed in “slow” mode to record noise levels in “A” weighted form as well as the frequency spectrum of the noise broken down into 1/3 octaves. The sound level meter and microphone were mounted on a pole in the yard of the Fire Station, which is located approximately 8 feet east of the rear property line and approximately 30 feet west of the back doors to the Fire Station, that are normally left open. The sound level meter was calibrated before and after the monitoring using a Larson-Davis calibrator, Model CAL 200. The accuracy of the calibrator is maintained through a program established through the manufacturer and is traceable to the National Bureau of Standards. The unit meets the requirements of ANSI Standard S1.4-1984 and IEC Standard 942: 1988 for Class 1 equipment. All noise level measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA).

Reference Noise Measurement and Manufacturer Noise Specification Results

The results of the 24 hour reference noise level measurement taken at Fire Station No. 1 & Headquarters, a reference noise measurement of rooftop mechanical equipment, and the manufacturer noise specifications for a 250 kW backup generator are presented in Table G and the reference noise measurement data printouts are included in Appendix D.

Table G – Reference Noise Level Measurements and Equipment Noise Specifications

Noise Measurement/Equipment Specification	Average Distance from Noise Sources (feet)	Noise Level (dBA)		
		L50	Leq	Lmax
24-hour Noise Measurement at Fire Station No.1 that captured vehicles, equipment and sirens	30	47.9	55.7	86.8
Rooftop noise measurement that captured HVAC equipment	10	66.6	66.6	67.6
Generac SD250 Diesel Generator with waterproof enclosure	23	83	83	83
Generac SD250 Diesel Generator with Level 2 Sound Enclosure	23	74	74	74

Source: Reference Noise Measurement printouts provided in Appendix D.

6.3 Vibration

Construction activity can result in varying degrees of ground vibration, depending on the equipment used on the site. Operation of construction equipment causes ground vibrations that spread through the ground and diminish in strength with distance. Buildings in the vicinity of the construction site respond to these vibrations with varying results ranging from no perceptible effects at the low levels to slight damage at the highest levels. Table H gives approximate vibration levels for particular construction activities. The data in Table H provides a reasonable estimate for a wide range of soil conditions.

Table H – Vibration Source Levels for Construction Equipment

Equipment		Peak Particle Velocity (inches/second)	Approximate Vibration Level (L_v)at 25 feet
Pile driver (impact)	Upper range	1.518	112
	typical	0.644	104
Pile driver (sonic)	Upper range	0.734	105
	typical	0.170	93
Clam shovel drop (slurry wall)		0.202	94
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drill		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Federal Transit Administration, 2018.

The construction-related vibration impacts have been calculated through the vibration levels shown above in Table H and through typical vibration propagation rates. The equipment assumptions were based on the equipment lists provided above in Table F.

7.0 IMPACT ANALYSIS

7.1 CEQA Thresholds of Significance

Consistent with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines, a significant impact related to noise would occur if a proposed project is determined to result in:

- 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;
- Generation of excessive groundborne vibration or groundborne noise levels; or
- For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels.

7.2 Generation of Noise Levels in Excess of Standards

The proposed project would not generate 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. The following section calculates the potential noise emissions associated with the temporary construction activities and long-term operations of the proposed project and compares the noise levels to the City standards.

Construction-Related Noise

The construction activities for the proposed project are anticipated to include demolition and grading of both project sites, building construction, paving of the onsite driveways and parking lots, and application of architectural coatings. Noise impacts from construction activities associated with the proposed project would be a function of the noise generated by construction equipment, equipment location, sensitivity of nearby land uses, and the timing and duration of the construction activities. The nearest sensitive receptors to the Fire Station site are homes located on the east side of Jameson Street, which are as near as 60 feet east of the Fire Station site. The nearest sensitive receptors to the Parking site are homes located as near as 30 feet southwest of the Parking site.

Section 8.24.050(E) of the Municipal Code exempts construction noise from the City noise standards that occurs between 7:00 a.m. and 8:00 p.m. Monday through Saturday and between 9:00 a.m. and 8:00 p.m. on Sundays and holidays. However, the City construction noise standards do not provide any limits to the noise levels that may be created from construction activities and even with adherence to the City standards, the resultant construction noise levels may result in a significant substantial temporary noise increase to the nearby residents and offsite workers.

In order to determine if the proposed construction activities would create a significant substantial temporary noise increase, the FTA construction noise criteria thresholds detailed above in Section 4.1 have been utilized, which shows that a significant construction noise impact would occur if construction noise exceeds 90 dBA Leq at any of the nearby sensitive receptors. The calculated construction noise results are shown below in Table I and the RCNM printouts are provided in Appendix C.

Table I – Construction Noise Levels at the Nearest Homes

Construction Phase	Construction Noise Level (dBA Leq) at:	
	Nearest Homes to Fire Station Site[1]	Nearest Homes to Parking Site[2]
Demolition	82	82
Grading	81	81
Building Construction	76	61
Paving	74	73
Painting	71	71
FTA Construction Noise Threshold[3]	**90**	**90**
Exceed Threshold?	No	No

[1] The nearest homes to the Fire Station site are located on the east side of Jameson Street and are as near as 60 feet east of the Fire Station site.
[2] The nearest homes to the Parking site are located as near as 30 feet southwest from the southwest corner of the Parking site. 5 dB of shielding was added to account for the existing 6 foot high wall located on the home's property line.
[3] FTA Construction Noise Threshold obtained from Table A above.
Source: RCNM, Federal Highway Administration, 2006

Table I shows that the greatest noise impacts would occur during the demolition phase of construction, with a noise level as high as 82 dBA Leq at the nearest homes to the Fire Station site and nearest homes to the Parking site. Table I also shows that none of the construction phases would exceed the FTA construction noise standard of 90 dBA for residential uses. Therefore, through adherence to allowable construction times provided in 8.24.050(E) of the Municipal Code, the construction activities for the proposed project would not create a substantial temporary increase in ambient noise levels that are in excess of applicable noise standards. Impacts would be less than significant.

Operational-Related Noise

The proposed project would consist of the relocation of Fire Station No. 1 & Headquarters. Potential noise impacts associated with the operations of the proposed project would be from project-generated vehicular traffic on the nearby roadways as well as from onsite noise sources associated with the operation of the proposed project.

Roadway Vehicular Noise

Vehicle noise is a combination of the noise produced by the engine, exhaust and tires. According to the General Plan 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 60 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.

Since the proposed project consists of the relocation of the Fire Station No. 1 & Headquarters from 176 S Grand Street to the proposed location, which is approximately 0.7 mile away, no traffic analysis was prepared for the project, since the project generated vehicle trips would occur on the same roads for both without and with project conditions. However, the proposed project has the potential to increase traffic on Chapman Avenue in the immediate vicinity of the project site. According to the *Program Environmental Impact Report Orange General Plan,* March 2010, in the year 2030 Chapman Avenue

between Cambridge Street and Tustin Street will have 28,400 vehicles per day. According to the CalEEMod model run in the Air Quality Analysis the proposed project would generate up to 1,932 daily trips, which would result in up to a 6.8 percent increase of daily trips on Chapman Avenue in the vicinity of the project site.

In order for project-generated vehicular traffic to increase the noise level on Chapman Avenue by 3 dB, the roadway traffic would have to double, and for the roadway noise levels to increase by 1.5 dB, the roadway traffic would have to increase by 50 percent. Since the proposed project would only result in a maximum of a 6.8 percent increase in traffic volumes on Chapman Avenue, the project-related roadway noise increase is anticipated to be negligible. It should also be noted that a large percentage of trips generated from the existing Fire Station No. 1 & Headquarters currently travel on Chapman Avenue in the vicinity of the project site, so the actual project trip generation would be much less than 6.8 percent of the traffic on Chapman Avenue. Roadway noise impacts created from the proposed project would be less than significant.

Onsite Noise Impacts

The operation of the proposed Fire Station No. 1 & Headquarters may create an increase in noise levels created onsite from fire station activities, rooftop mechanical equipment, and the backup generator at the nearby homes located as near as 60 feet east of the Fire Station site. The Parking site would consist long-term employee parking behind a security gate, with only two visitor parking spaces. The Parking site would have very little parking activity that would create noise levels that would be well below City noise standards.

Section 8.24.040(A) of the City's Municipal Code limits noise generated from onsite activities at the nearby residential properties to 55 dBA Leq and 70 dBA Lmax between the hours of 7:00 a.m. and 10:00 p.m. and 50 dBA Leq and 65 dBA Lmax between the hours of 10:00 p.m. and 7:00 a.m..

In order to determine the noise impacts from onsite from fire station activities that include siren use at a fire station, rooftop mechanical equipment, and the backup generator, reference noise measurements were taken or manufacturer specifications were obtained for each noise source and have been detailed above in Section 6.2 and printouts of the reference noise measurements are provided in Appendix C.

Table J provides a summary of the reference noise levels that are detailed above in Section 6.2 and shows the anticipated noise level from each source at the nearest homes located on the east side of the Fire Station site. The operational reference noise measurements are shown in Appendix D and the noise reduction calculations provided by the proposed minimum 7.7 foot high sound wall on the east side of the staff parking area that is detailed in Project Design Feature 1, a 4 foot high parapet wall that will shield the rooftop equipment, and use of a sound enclosure on the backup generator that is detailed in Project Design Feature 2 are shown in Appendix E.

Table J –Operational Noise Levels at the Nearest Homes to the Fire Station Site

Noise Source	Reference Noise		Calculated Noise Levels		City Noise Standards (Day/Night)	Exceed Standard? (Day/Night)
	Distance Receptor to Source (feet)	Reference Noise Level (dBA)	Distance to Homes (feet)	Noise Level[1] (dBA Leq)		
Fire Station Activities (including siren use)	30	55.7 Leq	150	34 Leq	55/50	No/No
		67.9 Lmax		65 Lmax	70/65	No/No
Rooftop Equipment	10	66.6 Leq	70	31 Leq	55/50	No/No
		79.2 Lmax		43 Lmax	70/65	No/No
Backup Generator	23	76.0 Leq	200	50 Leq	55/50	No/No
		76.0 Lmax		50 Lmax	70/65	No/No

Notes:
[1] The calculated noise levels account for the noise reduction provided by Project Design Feature 1 of the proposed 7.7-foot high wall on the east side of staff parking area and the proposed 4-foot parapet wall on the roof for the Rooftop Equipment and Project Design Feature 2 that requires a sound enclosure for the backup generator (see Appendix H).

Table I shows that with implementation of Project Design Features 1 and 2 that the onsite operational noise levels created by the proposed Fire Station No. 1 & Headquarters would be within the City's daytime and nighttime average and maximum noise standards at the nearest homes, located on the east side of the Fire Station site. Therefore, the proposed project would not result in a substantial permanent increase in ambient noise levels from onsite noise sources. Impacts would be less than significant.

Emergency Vehicle Siren Noise on Nearby Roads

The onsite noise analysis, provided above, analyzed the noise impacts created from all anticipated onsite noise impacts, including emergency vehicle siren noise. However, there is potential that the proposed relocation of Fire Station No. & Headquarters, will result in increased emergency vehicle siren use on the nearby roads. According to the Fire Department, Fire Station No. 1 received 16,483 total calls in 2019, which equates to an average of 45 calls per day. It should be noted that a majority of calls do not require the use of sirens (typically less than 23 calls per day use sirens) and that approximately a quarter of the calls from the existing Fire Station No. 1 travel along Chapman Avenue in the vicinity of the project site (approximately 6 calls per day currently travel on Chapman Avenue from Fire Station No. 1), so the proposed relocation of Fire Station No. 1 would likely result in an increase of siren use in the vicinity of the project site by an average of approximately 17 calls per day (i.e., 45/2 = 23 – 6 = 17).

Section 8.24.050(D) of the Municipal Code exempts noise created from emergency vehicles and Section 8.24.050(L) of the Municipal Code exempts noise created from vehicles operating on public roadways. As such, emergency vehicle siren use is exempt from the Municipal Code noise standards. However, the General Plan details that 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 60 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.

It is anticipated that the home at that would experience the greatest impact from increased siren use is located at 120 N Monterey Road, which is located as near as 175 feet north of the proposed Fire Station exit driveway on Chapman Avenue. The distance between the nearest home and Chapman Avenue that is located in front of the proposed fire station driveway was selected, since that is the nearest point to the home that would capture sire noise from emergency vehicles traveling both east and west on Chapman Avenue and represents the worst-case location for siren noise. Noise Measurement Site B that is shown above in Table E, was taken near the south property line at 120 N Monterey Road, and measured a noise level of 64.0 dBA CNEL.

Most emergency vehicle sirens are rated around 124 dB at 10 feet from the siren (https://www.fireapparatusmagazine.com/2017/04/04/siren-limitation-training/#gref). Based on standard geometric spreading of noise, at 175 feet, the siren noise would be 99 dB. The nearest home is located behind a row of commercial buildings and Caltrans research (Caltrans, 2013) has found that a row of buildings provide approximately 5 dB of attenuation. As such, this would lower the siren noise to 94 dB at the nearest home.

It is assumed that the peak siren noise level would last approximately 10 seconds at the nearest home to the proposed Fire Station driveway. Based on the average increase of 17 calls with sirens per day, this would result in a 2.8 minute increase in siren noise per day at the nearest home, which represents 1/508 of the day (24 hour period). Based on the arithmetic averaging of noise, the increased siren use would increase the noise at the home to 68.7 dBA CNEL ((1 x 94 dB + 507 x 64 dB)/508 = 68.7 dBA). The increased siren use would result in a 4.7 dB noise level increase at the nearest home to the proposed Fire Station No. 1 driveway, which is within the 5 dB increase threshold detailed above. It should be noted, that due to the local nature of the proposed fire station calls, the number of new trips and associated siren use would drop-off quickly as you move away from the project site, and therefore other homes in the vicinity of the project site would experience much lower siren noise impacts than the nearest home to the proposed Fire Station No. 1 driveway. Therefore, emergency vehicle siren noise impacts would be less than significant.

Level of Significance

Less than significant impact.

7.3 Generation of Excessive Groundborne Vibration

The proposed project would not expose persons to or generation of excessive groundborne vibration or groundborne noise levels. The following section analyzes the potential vibration impacts associated with the construction and operations of the proposed project.

Construction-Related Vibration Impacts

The construction activities for the proposed project are anticipated to include demolition and grading of both project sites, building construction, paving of the onsite driveways and parking lots, and application of architectural coatings. Vibration impacts from construction activities associated with the proposed project would typically be created from the operation of heavy off-road equipment. The nearest sensitive receptors to the Fire Station site are homes located on the east side of Jameson Street, which are as near as 60 feet east of the Fire Station site. The nearest sensitive receptors to the Parking site are homes located as near as 30 feet southwest of the Parking site.

Section 5.10.3 of the *City of Orange General Plan Program EIR* (General Plan EIR), March 2010, determined that a significant vibration impact would occur if vibration levels would exceed 0.2 inch per second PPV at any nearby building.

The primary source of vibration during construction would be from the operation of a bulldozer. From Table H above a large bulldozer would create a vibration level of 0.089 inch per second PPV at 25 feet. Based on typical propagation rates, the vibration level at the nearest offsite residential structure (30 feet away) would be 0.073 inch per second PPV. The vibration level at the nearest offsite structure would be below the 0.2 inch per second PPV threshold detailed above. Impacts would be less than significant.

Operations-Related Vibration Impacts

The proposed project would consist of the relocation of Fire Station No. 1 & Headquarters. The proposed project would result in the operation of fire trucks on the Fire Station site, which are a known source of vibration. The nearest receptors to the Fire Station site are homes located on the east side of Jameson Street, which are as near as 150 feet east of where fire trucks would operate on the Fire Station site.

Caltrans has done extensive research on vibration level created along freeways and State Routes and their vibration measurements of roads have never exceeded 0.08 inches per second PPV at 15 feet from the center of the nearest lane, with the worst combinations of heavy trucks. Fire truck activities would occur onsite as near as 150 feet from the nearest offsite receptor. Based on typical propagation rates, the vibration level at the nearest offsite receptor would by 0.006 inch per second PPV. Therefore, vibration created from operation of the proposed project would be within the 0.2 inch per second PPV threshold of detailed above. Impacts would be less than significant.

Level of Significance

Less than significant impact.

7.4 Aircraft Noise

The proposed project would not expose people residing or working in the project area to excessive noise levels from aircraft. The nearest airport is Fullerton Municipal Airport that is located approximately five miles northwest of the project site. The project site is located outside of the 60 dBA CNEL noise contours of Fullerton Municipal Airport. John Wayne Airport is located approximately seven miles southwest of the project site. The project site is located outside the 60 dBA CNEL noise contours of John Wayne Airport. No impacts would occur from aircraft noise.

Level of Significance

No impact.

8.0 REFERENCES

California Department of Transportation, *2016 Annual Average Daily Truck Traffic on the California State Highway System*, 2018.

California Department of Transportation (Caltrans), *Technical Noise Supplement to the Traffic Noise Analytics Protocol*, September 2013.

California Department of Transportation, *Transportation- and Construction-Induced Vibration Guidance Manual*, September 2013.

City of Orange, *City of Orange General Plan*, March 9, 2010.

City of Orange, *Orange General Plan Program Environmental Impact Report*, March, 2010.

City of Orange, *Orange California Code of Ordinances Chapter 8.24 – Noise Control*, August 12, 2014.

Federal Transit Administration, *Transit Noise and Vibration Impact Assessment,* September 2018.

U.S. Department of Transportation, *FHWA Roadway Construction Noise Model User's Guide,* January, 2006.

Vista Environmental, *Air Quality, Energy, and Greenhouse Gas Emissions Impact Analysis Fire Station No. 1 & Headquarters Project,* June 22, 2020.

APPENDIX A

Field Noise Measurements Photo Index

Noise Measurement Site A - looking north

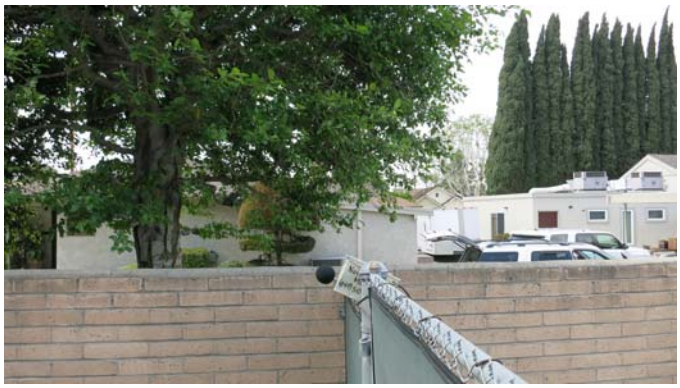
Noise Measurement Site A - looking northeast

Noise Measurement Site A - looking east

Noise Measurement Site A - looking southeast

Noise Measurement Site A - looking south

Noise Measurement Site A - looking southwest



Noise Measurement Site A - looking west

Noise Measurement Site A - looking northwest

Noise Measurement Site B- looking north

Noise Measurement Site B- looking northeast

Noise Measurement Site B- looking east

Noise Measurement Site B- looking southeast

Noise Measurement Site B- looking south

Noise Measurement Site B- looking southwest

Noise Measurement Site B- looking west

Noise Measurement Site B- looking northwest

Noise Measurement Site C - looking north

Noise Measurement Site C - looking northeast

Noise Measurement Site C - looking east

Noise Measurement Site C - looking southeast

Noise Measurement Site C - looking south

Noise Measurement Site C - looking southwest

Noise Measurement Site C - looking west

Noise Measurement Site C - looking northwest

APPENDIX B

Field Noise Measurements Printouts

Measurement Report

Report Summary

Meter's File Name	LxT_Data.001	Computer's File Name	SLM_0004671_LxT_Data_001.10.ldbin
Meter	LxT1		
Firmware	2.302		
User	GT	Location	
Description	Orange Firestation 1 - Headquarters		
Note	Southwest Side - Near Maplewood St & Almond Ave Intersection		
Start Time	2020-04-01 12:35:28	Duration	24:00:00.0
End Time	2020-04-02 12:35:28	Run Time	24:00:00.0
Pause Time	0:00:00.0		

Results

Overall Metrics

LA_{eq}	52.5 dB		
LAE	101.9 dB	SEA	--- dB
EA	1.7 mPa²h		
EA8	568.8 µPa²h		
EA40	2.8 mPa²h		
LAS_{peak}	110.0 dB	2020-04-01 12:36:14	
LAS_{max}	80.8 dB	2020-04-01 12:35:32	
LAS_{min}	34.3 dB	2020-04-02 01:22:13	
LA_{eq}	52.5 dB		
LC_{eq}	61.9 dB	LC_{eq} - LA_{eq}	9.4 dB
LAI_{eq}	56.9 dB	LAI_{eq} - LA_{eq}	4.4 dB

Exceedances

	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LASpeak > 135.0 dB	0	0:00:00.0
LASpeak > 137.0 dB	0	0:00:00.0
LASpeak > 140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight
--- dB	--- dB	0.0 dB

LDEN	LDay	LEve	LNight
--- dB	--- dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	52.5 dB		--- dB		--- dB	
$LS_{(max)}$	80.8 dB	2020-04-01 12:35:32	--- dB		--- dB	
$LS_{(min)}$	34.3 dB	2020-04-02 01:22:13	--- dB		--- dB	
$L_{Peak(max)}$	110.0 dB	2020-04-01 12:36:14	--- dB		--- dB	

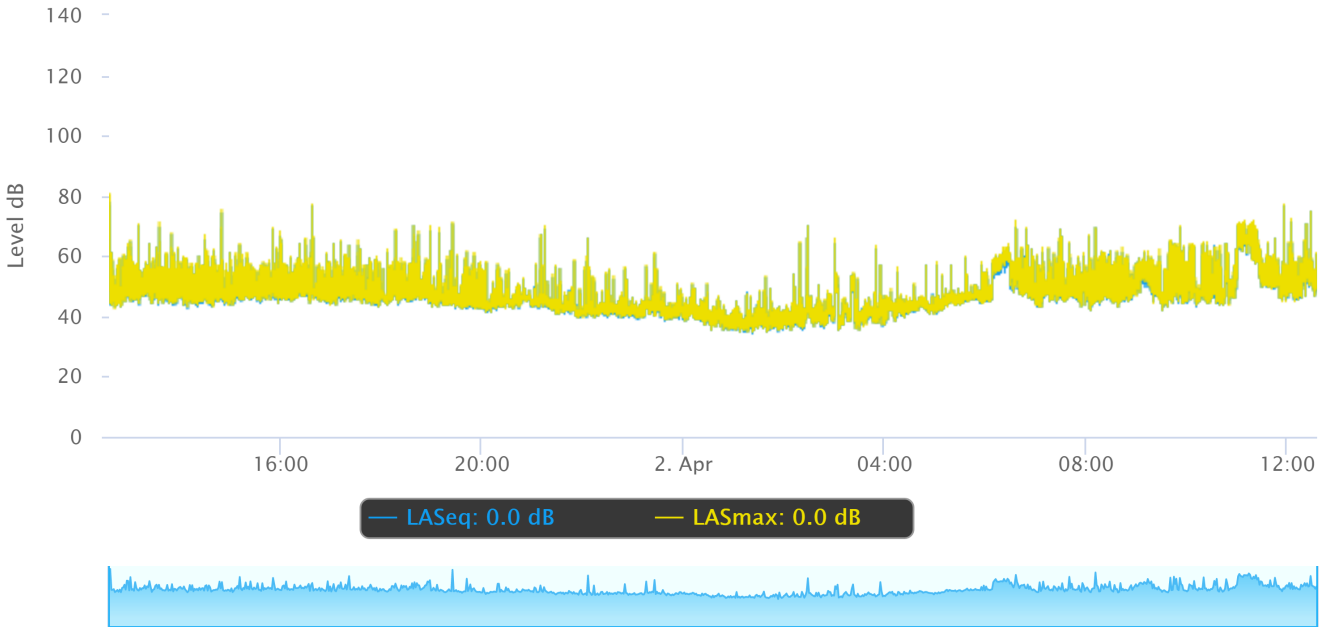
Overloads

Count	Duration
0	0:00:00.0

Statistics

LAS 5.0	57.7 dB
LAS 10.0	54.2 dB
LAS 33.3	47.7 dB
LAS 50.0	46.0 dB
LAS 66.6	44.1 dB
LAS 90.0	39.7 dB

Time History



Measurement Report

Report Summary

Meter's File Name	LxT_Data.001	Computer's File Name	SLM_0006082_LxT_Data_001.02.ldbin
Meter	LxT1		
Firmware	2.402		
User	GT	Location	
Description	Orange Firestation 1 - Headquarters		
Note	North Side on Monterey Rd		
Start Time	2020-04-01 12:18:57	Duration	24:00:00.0
End Time	2020-04-02 12:18:57	Run Time	24:00:00.0
Pause Time	0:00:00.0		

Results

Overall Metrics

LA_{eq}	61.9 dB		
LAE	111.2 dB	SEA	132.3 dB
EA	14.8 mPa²h		
EA8	4.9 mPa²h		
EA40	24.7 mPa²h		
LZS_{peak}	122.3 dB	2020-04-01 12:20:01	
LAS_{max}	96.9 dB	2020-04-02 09:16:14	
LAS_{min}	34.7 dB	2020-04-02 01:10:42	
LA_{eq}	61.9 dB		
LC_{eq}	68.0 dB	LC_{eq} - LA_{eq}	6.1 dB
LAI_{eq}	64.8 dB	LAI_{eq} - LA_{eq}	2.9 dB

Exceedances

	Count	Duration
LAS > 85.0 dB	6	0:00:32.3
LAS > 115.0 dB	0	0:00:00.0
LZSpeak > 135.0 dB	0	0:00:00.0
LZSpeak > 137.0 dB	0	0:00:00.0
LZSpeak > 140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight
--- dB	--- dB	0.0 dB

LDEN	LDay	LEve	LNight
--- dB	--- dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	61.9 dB		--- dB		--- dB	
$L_{S(max)}$	96.9 dB	2020-04-02 09:16:14	--- dB		--- dB	
$L_{S(min)}$	34.7 dB	2020-04-02 01:10:42	--- dB		--- dB	
$L_{Peak(max)}$	--- dB		--- dB		122.3 dB	2020-04-01 12:20:01

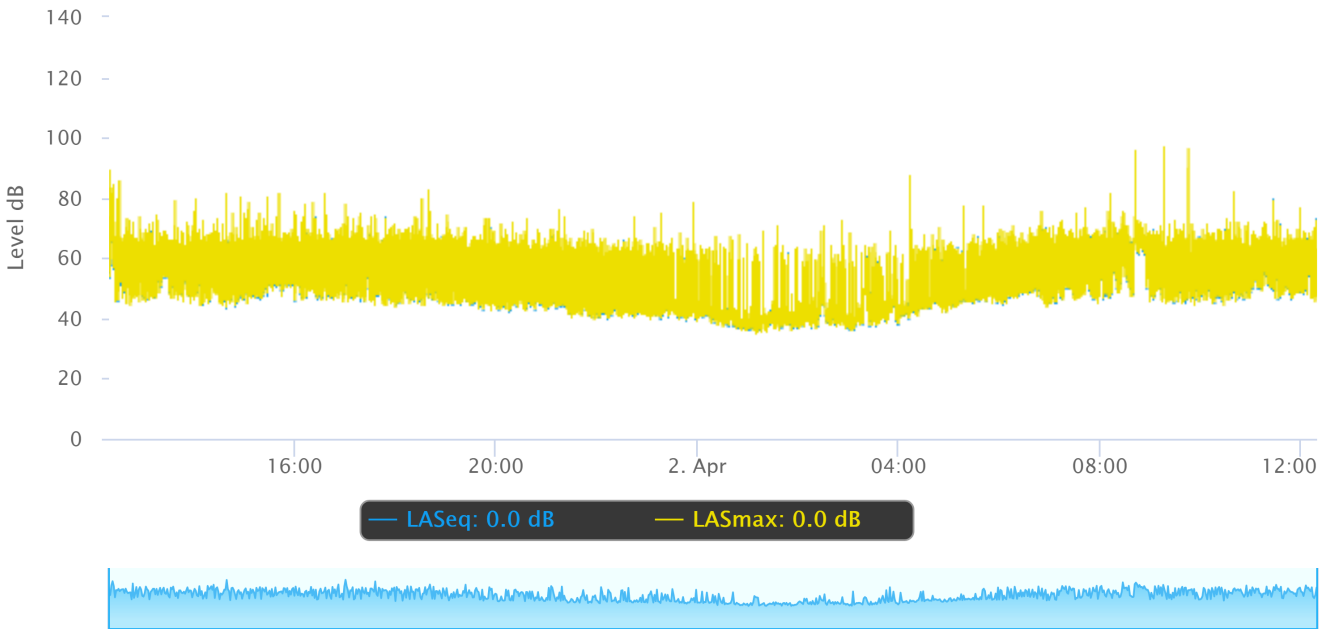
Overloads

Count	Duration
0	0:00:00.0

Statistics

LAS 5.0	65.4 dB
LAS 10.0	63.6 dB
LAS 33.3	58.0 dB
LAS 50.0	52.5 dB
LAS 66.6	47.1 dB
LAS 90.0	40.7 dB

Time History



Measurement Report

Report Summary

Meter's File Name	LxT_Data.001	Computer's File Name	SLM_0004209_LxT_Data_001.09.ldbin
Meter	LxT1		
Firmware	2.302		
User	GT	Location	
Description	Orange Firestation 1 - Headquarters		
Note	East Side on Jameson St		
Start Time	2020-04-01 12:26:13	Duration	24:00:00.0
End Time	2020-04-02 12:26:13	Run Time	24:00:00.0
Pause Time	0:00:00.0		

Results

Overall Metrics

LA_{eq}	54.2 dB		
LAE	103.6 dB	SEA	--- dB
EA	2.5 mPa²h		
EA8	847.3 µPa²h		
EA40	4.2 mPa²h		
LAS_{peak}	107.7 dB	2020-04-01 12:27:05	
LAS_{max}	91.0 dB	2020-04-01 21:19:17	
LAS_{min}	34.8 dB	2020-04-02 01:16:20	
LA_{eq}	54.2 dB		
LC_{eq}	63.3 dB	LC_{eq} - LA_{eq}	9.0 dB
LAI_{eq}	57.8 dB	LAI_{eq} - LA_{eq}	3.6 dB

Exceedances	Count	Duration
LAS > 85.0 dB	3	0:00:06.9
LAS > 115.0 dB	0	0:00:00.0
LASpeak > 135.0 dB	0	0:00:00.0
LASpeak > 137.0 dB	0	0:00:00.0
LASpeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight
	--- dB	--- dB	0.0 dB

	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

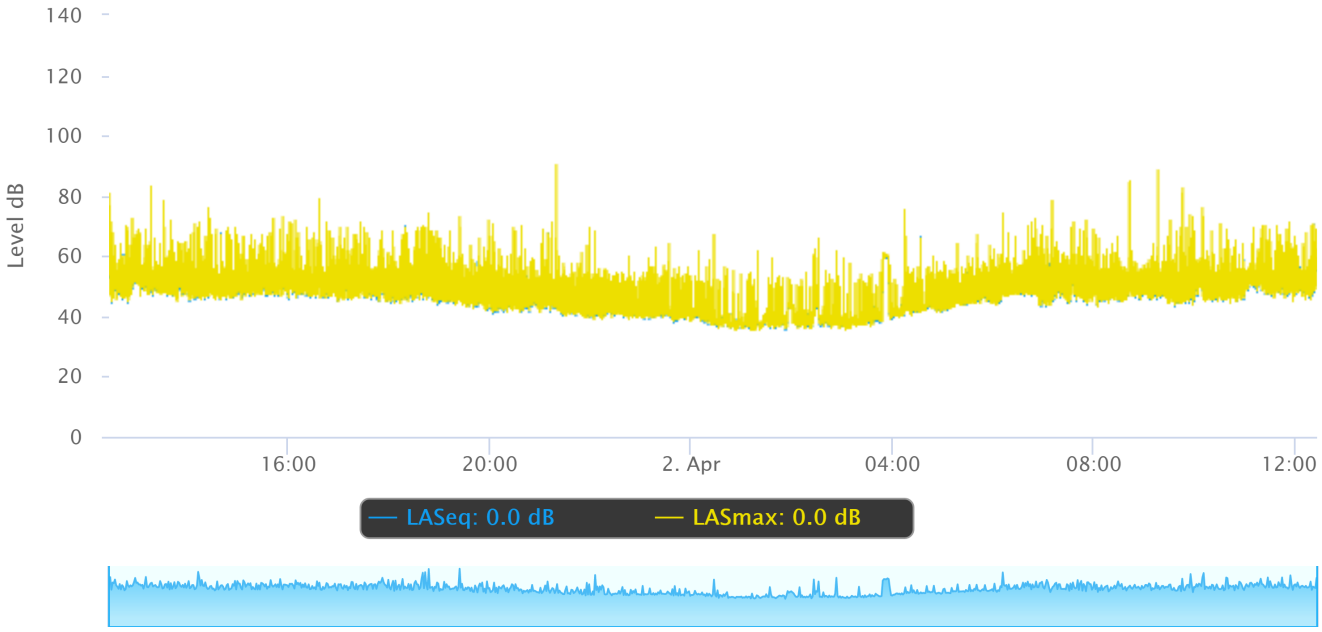
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	54.2 dB		--- dB		--- dB	
$LS_{(max)}$	91.0 dB	2020-04-01 21:19:17	--- dB		--- dB	
$LS_{(min)}$	34.8 dB	2020-04-02 01:16:20	--- dB		--- dB	
$L_{Peak(max)}$	107.7 dB	2020-04-01 12:27:05	--- dB		--- dB	

Overloads	Count	Duration
	0	0:00:00.0

Statistics

LAS 5.0	57.1 dB
LAS 10.0	54.5 dB
LAS 33.3	50.5 dB
LAS 50.0	48.1 dB
LAS 66.6	45.2 dB
LAS 90.0	39.0 dB

Time History



APPENDIX C

RCNM Model Construction Noise Calculation Printouts

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Demolition

				---- Receptor #1 ----
		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Nearest home to Fire Station Site	Residential	56.8	56.8	47.2

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Concrete Saw	No	20		89.6	60	0
Dozer	No	40		81.7	110	0
Tractor	No	40	84		160	0
Tractor	No	40	84		210	0
Tractor	No	40	84		260	0

			Results			
	Calculated (dBA)		Noise Limits (dBA)			
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	88.0	81.0	N/A	N/A	N/A	N/A
Dozer	74.8	70.8	N/A	N/A	N/A	N/A
Tractor	73.9	69.9	N/A	N/A	N/A	N/A
Tractor	71.5	67.6	N/A	N/A	N/A	N/A
Tractor	69.7	65.7	N/A	N/A	N/A	N/A
Total	**88**	**82**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Demolition

				---- Receptor #2 ----
		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Nearest home to Parking Site	Residential	55	55	47

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	30	5
Dozer	No	40		81.7	80	5
Tractor	No	40	84		130	5
Tractor	No	40	84		180	5
Tractor	No	40	84		230	5

			Results			
	Calculated (dBA)		Noise Limits (dBA)			
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	89.0	82.0	N/A	N/A	N/A	N/A
Dozer	72.6	68.6	N/A	N/A	N/A	N/A
Tractor	70.7	66.7	N/A	N/A	N/A	N/A
Tractor	67.9	63.9	N/A	N/A	N/A	N/A
Tractor	65.7	61.8	N/A	N/A	N/A	N/A
Total	**89**	**82**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Grading

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Nearest home to Fire Station Site	Residential	56.8	56.8	47.2

Description	Impact Device	Usage(%	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Grader	No	40	85		60	0
Dozer	No	40		81.7	110	0
Excavator	No	40		80.7	160	0
Tractor	No	40	84		210	0
Tractor	No	40	84		260	0

	Results Calculated (dBA)		Noise Limits (dBA) Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Grader	83.4	79.4	N/A	N/A	N/A	N/A
Dozer	74.8	70.8	N/A	N/A	N/A	N/A
Excavator	70.6	66.6	N/A	N/A	N/A	N/A
Tractor	71.5	67.6	N/A	N/A	N/A	N/A
Tractor	69.7	65.7	N/A	N/A	N/A	N/A
Total	**83**	**81**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Grading

---- Receptor #2 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Nearest home to Parking Site	Residential	54.8	54.8	47

Description	Impact Device	Usage(%	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Grader	No	40	85		30	5
Dozer	No	40.0		81.7	80	5
Excavator	No	40		80.7	130	5
Tractor	No	40	84		180	5
Tractor	No	40	84		230	5

	Results					
	Calculated (dBA)		Noise Limits (dBA)			
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Grader	84.4	80.5	N/A	N/A	N/A	N/A
Dozer	72.6	68.6	N/A	N/A	N/A	N/A
Excavator	67.4	63.4	N/A	N/A	N/A	N/A
Tractor	67.9	63.9	N/A	N/A	N/A	N/A
Tractor	65.7	61.8	N/A	N/A	N/A	N/A
Total	**84**	**81**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Building

				---- Receptor #1 ----
		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Nearest home to Fire Station Site	Residential	56.8	56.8	47.2

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	70	0
Gradall	No	40		83.4	120	0
Gradall	No	40		83.4	170	0
Generator	No	50		80.6	220	0
Welder / Torch	No	40		74	270	0
Welder / Torch	No	40		74	320	0
Welder / Torch	No	40		74	370	0
Tractor	No	40	84		420	0

		Calculated (dBA)		Results Noise Limits (dBA)			
				Day		Evening	
Equipment		*Lmax	Leq	Lmax	Leq	Lmax	Leq
Crane		77.6	69.7	N/A	N/A	N/A	N/A
Gradall		75.8	71.8	N/A	N/A	N/A	N/A
Gradall		72.8	68.8	N/A	N/A	N/A	N/A
Generator		67.8	64.8	N/A	N/A	N/A	N/A
Welder / Torch		59.4	55.4	N/A	N/A	N/A	N/A
Welder / Torch		57.9	53.9	N/A	N/A	N/A	N/A
Welder / Torch		56.6	52.6	N/A	N/A	N/A	N/A
Tractor		65.5	61.5	N/A	N/A	N/A	N/A
	Total	**78**	**76**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Building

---- Receptor #2 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Nearest home to Parking Site	Residential	54.8	54.8	47

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	365	5
Gradall	No	40		83.4	415	5
Gradall	No	40		83.4	465	5
Generator	No	50		80.6	515	5
Welder / Torch	No	40		74	565	5
Welder / Torch	No	40		74	615	5
Welder / Torch	No	40		74	665	5
Tractor	No	40	84		715	5

Equipment	Calculated (dBA) *Lmax	Leq	Results Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq
Crane	58.3	50.3	N/A	N/A	N/A	N/A
Gradall	60.0	56.0	N/A	N/A	N/A	N/A
Gradall	59.0	55.1	N/A	N/A	N/A	N/A
Generator	55.4	52.4	N/A	N/A	N/A	N/A
Welder / Torch	47.9	44.0	N/A	N/A	N/A	N/A
Welder / Torch	47.2	43.2	N/A	N/A	N/A	N/A
Welder / Torch	46.5	42.5	N/A	N/A	N/A	N/A
Tractor	55.9	51.9	N/A	N/A	N/A	N/A
Total	**60**	**61**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Paving

				---- Receptor #1 ----
		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Nearest home to Fire Station Site	Residential	56.8	56.8	47.2

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Concrete Mixer Truck	No	40		78.8	70	0
Paver	No	50		77.2	120	0
Paver	No	50		77.2	170	0
Roller	No	20		80	220	0
Roller	No	20		80	270	0
Tractor	No	40	84		320	0

			Results			
	Calculated (dBA)			Noise Limits (dBA)		
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Mixer Truck	75.9	71.9	N/A	N/A	N/A	N/A
Paver	69.6	66.6	N/A	N/A	N/A	N/A
Paver	66.6	63.6	N/A	N/A	N/A	N/A
Roller	67.1	60.1	N/A	N/A	N/A	N/A
Roller	65.4	58.4	N/A	N/A	N/A	N/A
Tractor	67.9	63.9	N/A	N/A	N/A	N/A
Total	**76**	**74**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Paving

---- Receptor #2 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Nearest home to Parking Site	Residential	54.8	54.8	47.0

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Mixer Truck	No	40		78.8	40	5
Paver	No	50		77.2	90	5
Paver	No	50		77.2	140	5
Roller	No	20		80	190	5
Roller	No	20		80	240	5
Tractor	No	40	84		290	5

Equipment		Calculated (dBA) *Lmax	Leq	Results Day Lmax	Leq	Noise Limits (dBA) Evening Lmax	Leq
Concrete Mixer Truck		75.7	71.8	N/A	N/A	N/A	N/A
Paver		67.1	64.1	N/A	N/A	N/A	N/A
Paver		63.3	60.3	N/A	N/A	N/A	N/A
Roller		63.4	56.4	N/A	N/A	N/A	N/A
Roller		61.4	54.4	N/A	N/A	N/A	N/A
Tractor		63.7	59.8	N/A	N/A	N/A	N/A
	Total	**76**	**73**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2020
Case Description: Orange Fire Station No 1 & Headquarters - Painting

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Nearest home to Fire Station Site	Residential	56.8	56.8	47.2

Description	Impact Device	Usage(%	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compressor (air)	No	40		77.7	70	0

		Results Calculated (dBA)		Day	Noise Limits (dBA)	Evening	
Equipment		*Lmax	Leq	Lmax	Leq	Lmax	Leq
Compressor (air)		74.7	70.8	N/A	N/A	N/A	N/A
	Total	**75**	**71**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Nearest home to Parking Site	Residential	54.8	54.8	47.0

Description	Impact Device	Usage(%	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compressor (air)	No	40		77.7	40	5

		Results Calculated (dBA)		Day	Noise Limits (dBA)	Evening	
Equipment		*Lmax	Leq	Lmax	Leq	Lmax	Leq
Compressor (air)		74.6	70.6	N/A	N/A	N/A	N/A
	Total	**75**	**71**	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

APPENDIX D

Operational Reference Noise Measurements Printouts

Measurement Report

Report Summary

Meter's File Name	831_Data.001	Computer's File Name	SLM_0002509_831_Data_001.05.ldbin
Meter	831		
Firmware	2.314		
User	GT		Location
Description	Orange Fire Station No. 1 & Headquarters		
Note	Located on pole next to west property line of existing Fire Station at 176 S Grand St		
Start Time	2020-04-29 11:59:20	Duration	24:00:00.0
End Time	2020-04-30 11:59:20	Run Time	24:00:00.0
		Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	55.7 dB		
LAE	105.1 dB	SEA	--- dB
EA	3.6 mPa²h		
LZ_{peak}	110.9 dB	2020-04-29 11:59:24	
LAS_{max}	86.8 dB	2020-04-29 16:31:32	
LAS_{min}	35.7 dB	2020-04-30 06:27:41	
LA_{eq}	55.7 dB		
LC_{eq}	63.2 dB	LC_{eq} - LA_{eq}	7.5 dB
LAI_{eq}	58.6 dB	LAI_{eq} - LA_{eq}	2.9 dB

Exceedances

	Count	Duration
LAS > 65.0 dB	108	0:23:49.7
LAS > 85.0 dB	1	0:00:12.6
LZpeak > 135.0 dB	0	0:00:00.0
LZpeak > 137.0 dB	0	0:00:00.0
LZpeak > 140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight
58.1 dB	57.4 dB	0.0 dB

LDEN	LDay	LEve	LNight
58.5 dB	58.0 dB	53.3 dB	49.1 dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	55.7 dB		63.2 dB		70.4 dB	
$LS_{(max)}$	86.8 dB	2020-04-29 16:31:32	91.1 dB	2020-04-29 16:31:29	98.2 dB	2020-04-29 15:37:05
$LF_{(max)}$	89.0 dB	2020-04-29 11:59:24	92.5 dB	2020-04-29 16:31:29	104.3 dB	2020-04-29 15:37:05
$LI_{(max)}$	93.4 dB	2020-04-29 11:59:24	95.5 dB	2020-04-29 11:59:24	106.9 dB	2020-04-29 15:37:05
$LS_{(min)}$	35.7 dB	2020-04-30 06:27:41	50.2 dB	2020-04-30 04:02:40	54.2 dB	2020-04-30 04:15:23
$LF_{(min)}$	35.1 dB	2020-04-30 06:28:01	48.0 dB	2020-04-30 04:02:39	51.0 dB	2020-04-30 04:16:25
$LI_{(min)}$	35.7 dB	2020-04-30 06:28:01	50.7 dB	2020-04-30 04:04:33	55.5 dB	2020-04-30 04:14:25
$L_{Peak(max)}$	107.7 dB	2020-04-29 11:59:24	108.8 dB	2020-04-29 11:59:24	110.9 dB	2020-04-29 11:59:24

Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	1	0:00:02.0

Statistics

LAS 5.0	57.9 dB
LAS 10.0	53.4 dB
LAS 33.3	49.6 dB
LAS 50.0	47.9 dB
LAS 66.6	46.1 dB
LAS 90.0	41.7 dB

General Information

Serial Number	02509
Model	831
Firmware Version	2.112
Filename	831_Data.005
User	GT
Job Description	Northwest Fresno Walmart Relocation
Location	Rooftop HVAC Unit
Measurement Description	
Start Time	Saturday, 2013 July 27 18:31:43
Stop Time	Saturday, 2013 July 27 18:41:44
Duration	00:10:01.1
Run Time	00:10:01.1
Pause	00:00:00.0
Pre Calibration	Saturday, 2013 July 27 17:53:07
Post Calibration	None
Calibration Deviation	---

Note

Located 10 feet southeast of rooftop HVAC Unit 14 located on western side of roof
94 F, 30% Hu., 29.45 in Hg, no wind, partly cloudy

Overall Data

LAeq		66.6	dB
LASmax	2013 Jul 27 18:33:16	67.6	dB
LApeak (max)	2013 Jul 27 18:32:17	81.6	dB
LASmin	2013 Jul 27 18:41:08	65.8	dB
LCeq		75.8	dB
LAeq		66.6	dB
LCeq - LAeq		9.2	dB
LAIeq		67.2	dB
LAeq		66.6	dB
LAIeq - LAeq		0.6	dB
Ldn		66.6	dB
LDay 07:00-23:00		66.6	dB
LNight 23:00-07:00		---	dB
Lden		66.6	dB
LDay 07:00-19:00		66.6	dB
LEvening 19:00-23:00		---	dB
LNight 23:00-07:00		---	dB
LAE		94.4	dB
# Overloads		0	
Overload Duration		0.0	s
# OBA Overloads		0	
OBA Overload Duration		0.0	s

Statistics

LAS5.00	67.0	dBA
LAS10.00	66.9	dBA
LAS33.30	66.7	dBA
LAS50.00	66.6	dBA
LAS66.60	66.5	dBA
LAS90.00	66.3	dBA
LAS > 65.0 dB (Exceedence Counts / Duration)	1 / 601.1	s
LAS > 85.0 dB (Exceedence Counts / Duration)	0 / 0.0	s
LApeak > 135.0 dB (Exceedence Counts / Duration)	0 / 0.0	s
LApeak > 137.0 dB (Exceedence Counts / Duration)	0 / 0.0	s
LApeak > 140.0 dB (Exceedence Counts / Duration)	0 / 0.0	s

Settings

RMS Weight	A Weighting	
Peak Weight	A Weighting	
Detector	Slow	
Preamp	PRM831	
Integration Method	Linear	
OBA Range	Normal	
OBA Bandwidth	1/1 and 1/3	
OBA Freq. Weighting	Z Weighting	
OBA Max Spectrum	Bin Max	
Gain	+0	dB
Under Range Limit	26.2	dB
Under Range Peak	75.8	dB
Noise Floor	17.1	dB
Overload	143.4	dB

1/1 Spectra

Freq. (Hz):	8.0	16.0	31.5	63.0	125	250	500	1k	2k	4k	8k	16k
LZeq	70.9	64.4	61.4	74.2	68.2	64.9	66.3	61.7	55.1	49.9	44.3	44.0
LZSmax	83.8	78.9	70.0	78.4	72.3	66.1	67.8	63.1	56.9	53.2	46.7	45.4
LZSmin	53.2	56.5	56.7	67.7	66.1	63.5	65.0	60.7	53.9	48.4	43.2	43.7

1/3 Spectra

Freq. (Hz):	6.3	8.0	10.0	12.5	16.0	20.0	25.0	31.5	40.0	50.0	63.0	80.0
LZeq	68.1	65.7	63.2	61.0	58.0	59.3	56.0	57.8	55.8	69.7	72.0	59.3
LZSmax	82.3	79.5	78.7	77.2	72.8	72.3	67.9	63.5	64.0	74.2	76.1	72.0
LZSmin	41.9	46.3	48.8	48.7	46.5	49.7	50.1	51.8	41.2	63.9	67.9	54.5

Freq. (Hz):	100	125	160	200	250	315	400	500	630	800	1k	1.25k
LZeq	61.6	63.7	64.5	59.0	58.7	60.9	63.2	60.8	59.9	59.2	56.1	54.6
LZSmax	71.3	68.0	67.3	61.6	61.7	64.1	65.5	64.2	62.0	60.7	57.6	58.6
LZSmin	52.9	60.0	57.2	45.1	56.0	58.9	61.1	58.4	58.4	57.1	54.9	53.3

Freq. (Hz):	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
LZeq	52.0	49.8	48.4	46.4	45.4	42.8	41.1	38.6	38.5	38.4	39.0	40.2
LZSmax	54.4	52.3	51.2	50.2	49.7	45.7	45.4	41.6	40.4	40.4	41.4	41.3
LZSmin	50.9	48.4	46.9	45.0	43.7	41.4	39.6	37.5	37.9	38.0	38.7	39.9

Calibration History

Preamp	Date	dB re. 1V/Pa
PRM831	27 Jul 2013 17:53:07	-25.9
PRM831	27 Jul 2013 13:36:08	-25.6
PRM831	28 Apr 2013 15:34:24	-25.9
PRM831	23 Apr 2013 10:17:33	-25.0
PRM831	27 Feb 2013 19:15:30	-25.7
PRM831	24 Jan 2013 12:00:16	-25.6
PRM831	15 Jan 2013 07:50:44	-26.2
PRM831	04 Jan 2013 13:47:46	-26.5

APPENDIX E

Operational Noise Sound Wall Noise Reduction Calculations

Stationary Noise Calculations - Mitigated Average Noise Levels (Leq)

Stationary Noise Sources	Reference Distance	Reference Leq	Industrial to East Distance	Leq
Fire Station Activities	30	55.7	150	42
Rooftop HVAC	10	66.6	70	50
Generator with Sound Enclosure	23	76.0	200	57

1 (Line Source: hard=0, soft=.5; Point Source: hard=1, soft=1.5)
(eq. N-2141.2 of TeNS)

Stationary Noise Sources	Distance from Receptor to Wall	Distance from source to Wall	Height of Wall (feet)	Without Wall Noise Level at Residence	With Wall Noise Level at Residence	Source Height (feet)	Exterior Observer Height (feet)	Source Frequency (hz)	barrier to receiver - b (all)	source to barrier - a	source to receiver - c	path difference y =a+b-c (auto)	line of sight (slope)	fresnel	Barrier Atten
Fire Station Activitie	60	90	7.7	42	**34**	5	5	800	60.0607	90.04049	150	0.1012	1	0.287887	-7.36
Rooftop HVAC	60	10	4	50	**31**	30	5	800	60.0083	27.85678	74.33034	13.5348	1	38.49889	-18.97
Generator with Sou	60	140	7.7	57	**50**	5	5	800	60.0607	140.026	200	0.0868	1	0.246763	-7.08

Stationary Noise Calculations - Mitigated Maximum Noise Levels (Lmax)

Stationary Noise Sources	Reference Distance	Reference Lmax	Industrial to East Distance	Lmax	
Fire Station	30	86.8	150	73	1 (Line Source: hard=0, soft=.5; Point Source: hard=1, soft=1.5)
Rooftop HVAC	10	79.2	70	62	(eq. N-2141.2 of TeNS)
Generator with Sound Enclosure	23	76.0	200	57	

Stationary Noise Sources	Distance from Receptor to Wall	Distance from source to Wall	Height of Wall (feet)	Without Wall Noise Level at Residence	With Wall Noise Level at Residence	Source Height (feet)	Exterior Observer Height (feet)	Source Frequency (hz)	barrier to receiver - b (all)	source to barrier - a	source to receiver - c	path difference y =a+b-c (auto)	line of sight (slope)	fresnel	Barrier Atten
Fire Station	60	90	7.7	73	**65**	5	5	800	60.0607	90.04049	150	0.1012	1	0.287887	-7.36
Rooftop HVAC	60	10	4	62	**43**	30	5	800	60.0083	27.85678	74.33034	13.5348	1	38.49889	-18.97
Generator with Sou	60	140	7.7	57	**50**	5	5	800	60.0607	140.026	200	0.0868	1	0.246763	-7.08