

NOISE AND VIBRATION IMPACT ANALYSIS

**PCH AND VINCENT RESIDENTIAL PROJECT
REDONDO BEACH, CALIFORNIA**

LSA

July 2024

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TABLE OF CONTENTS

FIGURES AND TABLES	ii
LIST OF ABBREVIATIONS AND ACRONYMS.....	iii
INTRODUCTION	4
Project Location And Description.....	4
Existing Land Uses In The Project Area	4
NOISE AND VIBRATION FUNDAMENTALS	7
Characteristics of Sound.....	7
Measurement of Sound.....	7
Physiological Effects of Noise	8
Fundamentals of Vibration.....	10
REGULATORY SETTING	12
Applicable Noise Standards.....	12
California Code of Regulations	12
City of Redondo Beach	12
Federal Transit Administration.....	13
Applicable Vibration Standards.....	14
Federal Transit Administration.....	14
OVERVIEW OF THE EXISTING NOISE ENVIRONMENT.....	15
Ambient Noise Measurements	15
Long-Term Noise Measurements	15
Existing Aircraft Noise	15
PROJECT IMPACT ANALYSIS	17
Short-Term Construction Noise Impacts.....	17
Short-Term Construction Vibration Impacts	20
Long-Term Off-Site Traffic Noise Impacts	22
Stationary Operational Noise Impacts to Off-Site Receivers	22
Long-Term Traffic-Related Vibration Impacts	23
LAND USE COMPATIBILITY	24
Exterior Noise Assessment.....	24
Interior Noise Assessment.....	24
REFERENCES	25

APPENDICES

- A: NOISE MONITORING DATA
- B: CONSTRUCTION NOISE CALCULATIONS

FIGURES AND TABLES

FIGURES

Figure 1: Project Location and Vicinity	5
Figure 2: Project Site Plan.....	6
Figure 3: Noise Monitoring Locations	16

TABLES

Table A: Definitions of Acoustical Terms.....	9
Table B: Common Sound Levels and Their Noise Sources.....	10
Table C: Detailed Assessment Daytime Construction Noise Criteria	13
Table D: Interpretation of Vibration Criteria for Detailed Analysis.....	14
Table E: Construction Vibration Damage Criteria	14
Table F: Long-Term Ambient Noise Level Measurements	15
Table G: Typical Construction Equipment Noise Levels	18
Table H: Potential Construction Noise Impacts at Nearest Receptor	19
Table I: Vibration Source Amplitudes for Construction Equipment.....	20
Table J: Potential Construction Vibration Annoyance Impacts at Nearest Receptor.....	21
Table K: Potential Construction Vibration Damage Impacts at Nearest Receptor.....	21

LIST OF ABBREVIATIONS AND ACRONYMS

ADT	average daily trips
CalEEMod	California Emissions Estimator Model
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
D	distance
dB	decibel(s)
dBA	A-weighted decibel(s)
E.L.	noise emission level
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTA Manual	<i>FTA's Transit Noise and Vibration Impact Assessment Manual</i>
HVAC	heating, ventilation, and air conditioning
in/sec	inch/inches per second
L ₅₀	median noise level
L _{dn}	day-night average noise level
L _{eq}	equivalent continuous sound level
L _{max}	maximum instantaneous sound level
L _v	vibration velocity
PCH	Pacific Coast Highway
PPV	peak particle velocity
project	PCH and Vincent Residential Project
RMS	root-mean-square
sq ft	square foot/feet
U.F.	usage factor
V	RMS velocity amplitude
VdB	vibration velocity decibels
V _{ref}	reference velocity amplitude

INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and reduction measures associated with the proposed PCH and Vincent Residential Project (project) in Redondo Beach, California. This report is intended to satisfy the City of Redondo Beach's (City) requirement for a project-specific noise and vibration impact analysis by examining the impacts of the project site and evaluating reduction measures that the project may require.

PROJECT LOCATION AND DESCRIPTION

The approximately 1.56-acre project site is located at the southeast corner of the intersection of Pacific Coast Highway (PCH) and Vincent Street in Redondo Beach, California. Figure 1, Project Location and Vicinity, and Figure 2, Project Site Plan, are presented below.

The proposed project involves demolishing the existing St. James Catholic Church and School buildings located on the southeast corner of the intersection of PCH and Vincent Street and developing 43 multi-family dwelling units. Local access to the project is provided through a driveway along Vincent Street, which serves as the access for the 24 units in the western portion of the project, and from driveways from the existing alley, Central Court, for an additional 19 units. In addition, the proposed project is forecast to generate 53 net new daily trips, 62 net fewer AM, and 8 net new PM peak hour trips.

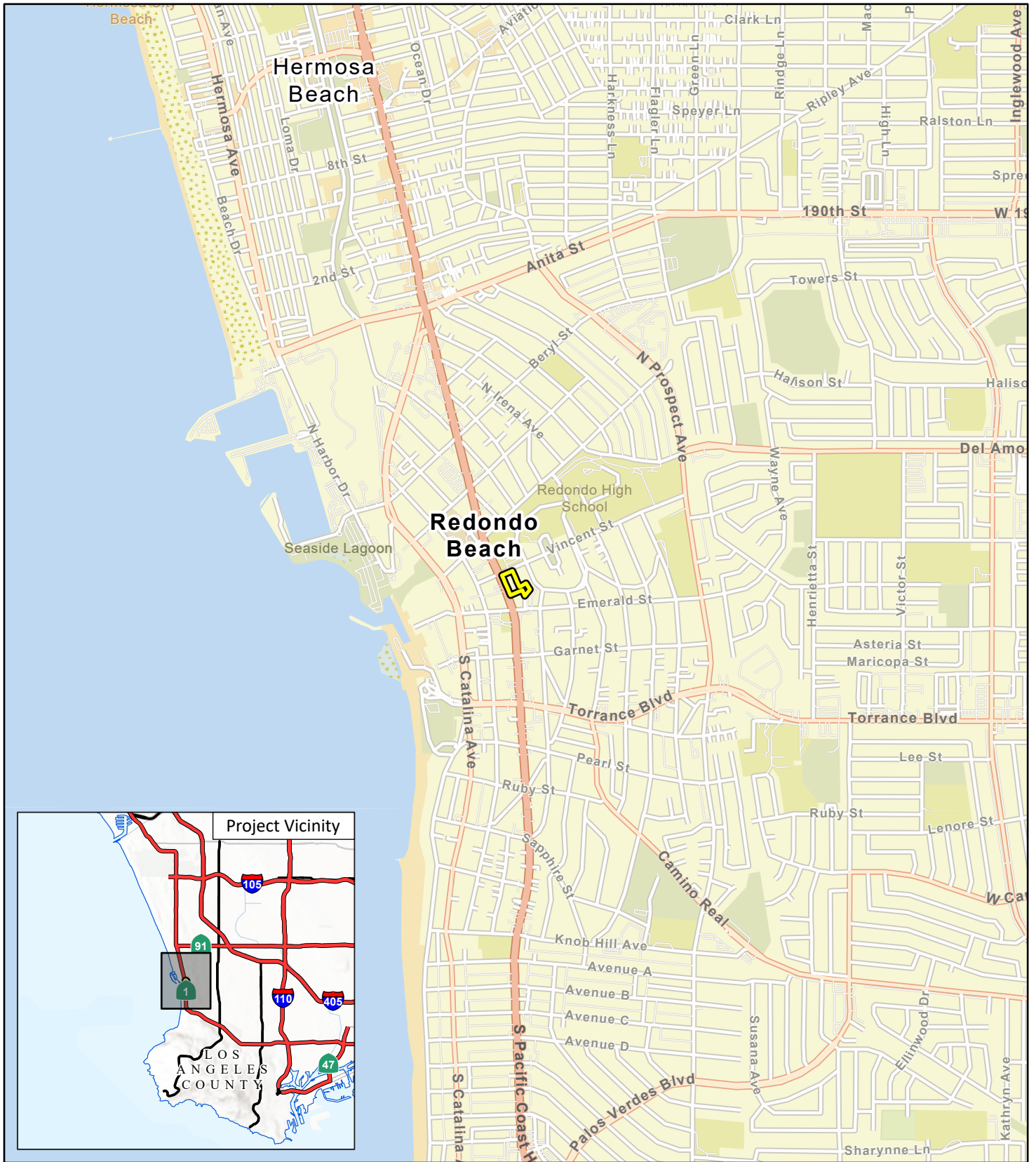
Construction would include demolition, site preparation, grading, building construction, paving, architectural coating, and the installation of landscaping and irrigation, lighting, storm drain facilities, and underground utilities. Site preparation, grading, and building activities would involve the use of standard earthmoving equipment such as large excavators, cranes, and other related equipment.

EXISTING LAND USES IN THE PROJECT AREA

The project site is primarily surrounded by residential and institutional uses. The areas adjacent to the project site include the following uses:

- **North:** Existing Government Office (Annex) opposite Vincent Street.
- **Northeast:** Existing single-family residences opposite Central Court Alley.
- **East:** Existing single-family residences
- **South:** Existing single-family residences
- **West:** Existing single-family residences opposite PCH

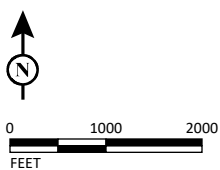
The closest sensitive receptors to the project site are the single-family homes located approximately 5 feet east of the project site boundary and the single-family homes located approximately 5 feet south of the project site boundary.



 Project Location

FIGURE 1

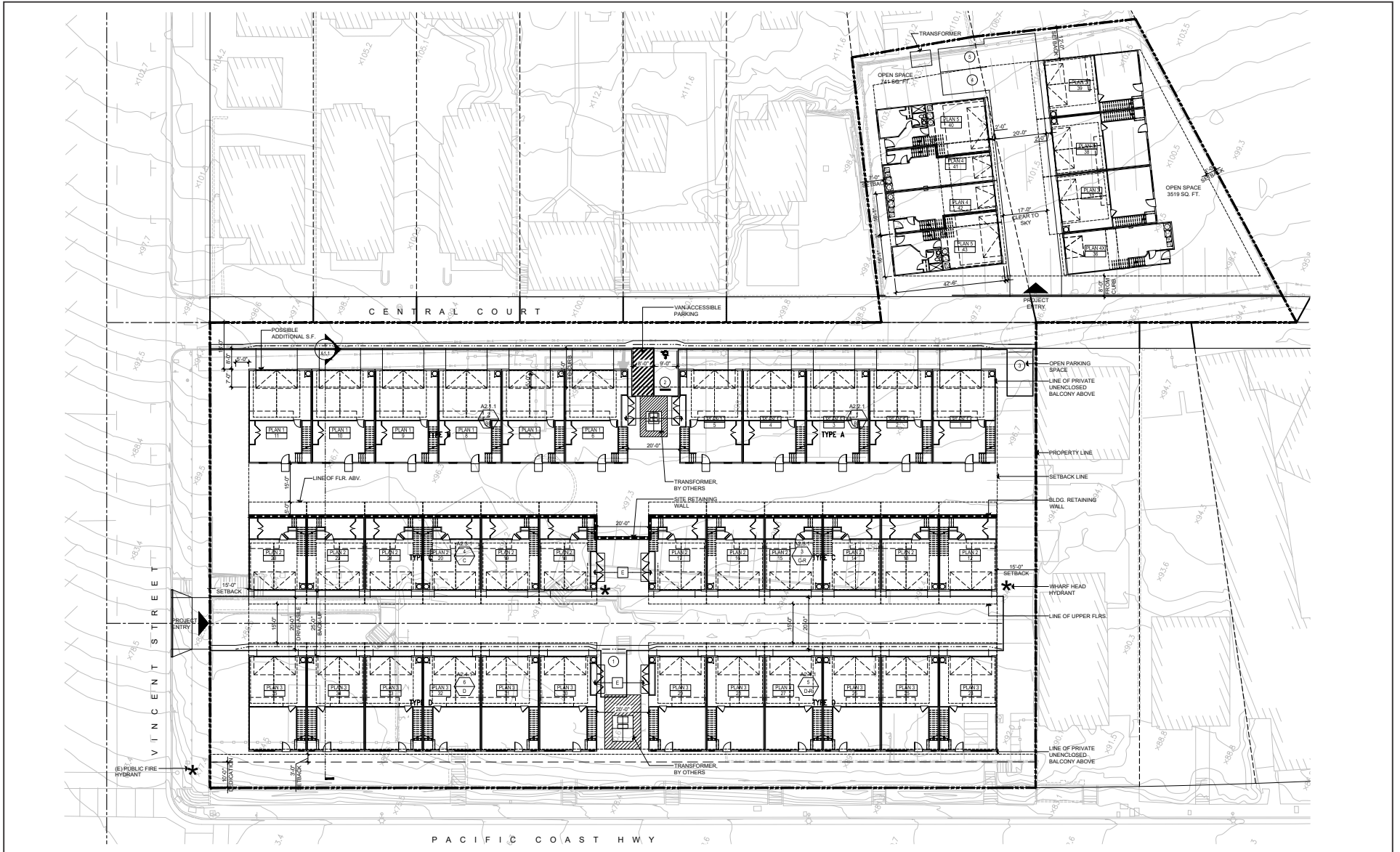
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PCH and Vincent Residential Project
Project Location

SOURCE: Esri Street Map 2024

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SOURCE: KTG

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FIGURE 2

PCH and Vincent Residential Project
Site Plan

NOISE AND VIBRATION FUNDAMENTALS

CHARACTERISTICS OF SOUND

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

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

MEASUREMENT OF SOUND

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

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

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

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

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

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

Physiological Effects of Noise

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

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

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

Table A: Definitions of Acoustical Terms

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

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

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

FTA = Federal Transit Administration

Table B: Common Sound Levels and Their Noise Sources

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

Source: Compiled by LSA (2022).

FUNDAMENTALS OF VIBRATION

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

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile-driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 feet from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 feet. When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne

vibration from street traffic will not exceed the impact criteria; however, construction of the project could result in ground-borne vibration that may be perceptible and annoying.

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

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for train-induced ground-borne vibration to cause even cosmetic building damage, there is potential for construction processes such as blasting and pile-driving to cause vibration of sufficient amplitudes to damage nearby buildings. Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize the potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

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

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

REGULATORY SETTING

APPLICABLE NOISE STANDARDS

The applicable noise standards governing the project site include the criteria in the California Code of Regulations, the City's General Plan, and the City of Redondo Beach Code of Ordinances.

California Code of Regulations

Interior noise levels for residential habitable rooms are regulated by Title 24 of the California Code of Regulations California Noise Insulation Standards. Title 24, Chapter 12, Section 1206.4, of the 2022 California Building Code requires that interior noise levels attributable to exterior sources not exceed 45 CNEL/L_{dn} in any habitable room. A habitable room is a room used for living, sleeping, eating, or cooking. Bathrooms, closets, hallways, utility spaces, and similar areas are not considered habitable rooms for this regulation (Title 24 California Code of Regulations, Chapter 12, Section 1206.4). As established in the State of California Department of Health and Safety's Land Use Compatibility for Community Noise Environments, the highest recommended "normally acceptable" exterior noise level exposure is 65 dBA CNEL/L_{dn} for multi-family residential.

City of Redondo Beach

General Plan Noise Element

The Noise Element of the City's General Plan provides the goals and policies related to noise. The City has identified the following goals and policies relative to both overall (ambient) and stationary source noise conditions and impacts in the City of Redondo Beach which are applicable to the project:

- **Goal N-1:** An environment where public health and welfare are protected by reducing existing noise problems and preventing future degradation of the acoustic environment.
 - **Policy N-1.1 Noise Compatibility:** Require mitigation to ensure existing and future land use compatibility as required by the City's Noise Ordinance, and interior and exterior noise standards identified in the building code.
 - **Policy N-1.2 Enforcement and Maintenance of Local Standards:** Enforce the City's Noise Ordinance to effectively regulate noise conditions that are expected to occur within the City. Update the ordinance when necessary to regulate new or previously unidentified noise conditions, comply with new laws and regulations, and reflect best practices in noise regulation.
 - **Policy N-1.3 Building Standards:** Require new projects comply with noise insulation and vibration standards of local, regional, and state building code regulations.
 - **Policy N-1.4 Residential Development:** When new residential development or redevelopment is proposed adjacent to land designated for mixed-, industrial or commercial

uses, require the developer to assess the potential noise impacts of the adjacent use on the proposed residential uses and fund feasible noise-related mitigation measures.

- **Policy N-1.10 Construction Noise:** Minimize the impacts of construction noise on adjacent uses through the enforcement of mitigation requirements established in the City’s Noise Ordinance, such as legal hours of operation, advance noticing of construction operations, incorporating physical barriers as necessary, and using tools and equipment properly outfitted with sound-dampeners.

Code of Ordinances

Noise Standards. The City’s standards for noise impacts on neighboring residential areas are found in Title 4, Chapter 24 Noise Regulation, of the City’s Code of Ordinance. For medium density residential areas, the exterior noise limit is 50 dBA during nighttime hours (10 p.m. to 7 a.m.) and 55 dBA during daytime hours (7 a.m. to 10 p.m.). The interior noise level standard is 40 dBA during nighttime hours (10 p.m. to 7 a.m.) and 45 dBA during daytime hours (7 a.m. to 10 p.m.).

Construction Noise Standards. The City has set restrictions to control noise impacts associated with construction. According to statement (a) in Section 9-1.12 Construction noise, “All construction activity shall be prohibited, except between hours of 7:00 a.m. and 6:00 p.m. on Monday, Tuesday, Wednesday, Thursday, and Friday and between the hours of 9:00 a.m. and 5:00 p.m. on Saturday. No construction activity shall be permitted on Sundays, or the days on which the holidays designated as Memorial Day, the Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, and New Year’s Day are observed.”

Federal Transit Administration

Although the City does not have daytime construction noise level limits for activities that occur within the specified hours in the City’s Municipal Code to determine potential California Environmental Quality Act (CEQA) noise impacts, construction noise was assessed using criteria from the *Transit Noise and Vibration Impact Assessment Manual* (Federal Transit Administration [FTA] 2018) (FTA Manual). Table C shows the FTA’s General Assessment Construction Noise Criteria based on the composite noise levels per construction phase.

Table C: Detailed Assessment Daytime Construction Noise Criteria

Land Use	Daytime 1-hour L_{eq} (dBA)
Residential	90
Commercial	100
Industrial	100

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
 dBA = A-weighted decibels
 FTA = Federal Transit Administration
 L_{eq} = equivalent continuous sound level

APPLICABLE VIBRATION STANDARDS

Federal Transit Administration

Vibration standards included in the FTA Manual are used in this analysis for ground-borne vibration impacts on human annoyance. The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table D provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table D: Interpretation of Vibration Criteria for Detailed Analysis

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

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

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

FTA = Federal Transit Administration

Max = maximum

L_v = velocity in decibels

VdB = vibration velocity decibels

Table E lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA Manual. FTA guidelines show that a vibration level of up to 0.5 in/sec in PPV is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster) and would not result in any construction vibration damage. For non-engineered timber and masonry buildings, the construction building vibration damage criterion is 0.2 in/sec in PPV.

Table E: Construction Vibration Damage Criteria

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

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

FTA = Federal Transit Administration

PPV = peak particle velocity

in/sec = inch/inches per second

OVERVIEW OF THE EXISTING NOISE ENVIRONMENT

The primary existing noise source in the project area is vehicle traffic. Local traffic on PCH and Vincent Street is a steady source of ambient noise.

AMBIENT NOISE MEASUREMENTS

Long-Term Noise Measurements

Long-term (24-hour) noise level measurements were conducted on June 25 and 26, 2024, using three Larson Davis Spark 706RC Dosimeters. Table F provides a summary of the measured hourly noise levels from the noise level measurements. Hourly noise levels at surrounding sensitive uses are as low as 40.6 dBA L_{eq} during nighttime hours and 47.9 dBA L_{eq} during daytime hours. Noise monitoring data results are provided in Appendix A. Figure 3 shows the noise monitoring locations.

Table F: Long-Term Ambient Noise Level Measurements

Location		Daytime Noise Levels ¹ (dBA L_{eq})	Nighttime Noise Levels ² (dBA L_{eq})	Daily Noise levels (dBA L_{dn})
LT-1	On a chain link fence on the western end of the project site, approximately 50 ft away from the PCH centerline.	68.1–74.6	59.9–70.5	73.5
LT-2	On a chain link fence on the northern end of the project site, approximately 170 ft away from the Vincent Street centerline and 205 ft away from the PCH centerline.	50.1–62.9	42.7–52.0	57.4
LT-3	On a horizontal utility pole against residential brick wall facing open parking lot on project site, residential units north and east, approximately 320 ft away from the PCH centerline.	47.9-56.6	40.6-48.0	54.0

Source: Compiled by LSA (2024).

Note: Noise measurements were conducted from June 25 to June 26, 2024, starting at 4:00 p.m.

¹ Daytime Noise Levels = Noise levels during the hours from 7:00 a.m. to 10:00 p.m.

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

L_{dn} = day-night average noise level

dBA = A-weighted decibels

ft = foot/feet

L_{eq} = equivalent continuous sound level

EXISTING AIRCRAFT NOISE

Airport-related noise levels are primarily associated with aircraft engine noise made while aircraft are taking off, landing, or running their engines while still on the ground. The closest airport to the proposed project site is the Torrance Municipal Airport located approximately 3.4 miles southeast of the project site. The project site is well outside the 60 dBA CNEL noise contour based on Figure N-3 of the City’s Noise Element (City of Torrance 2010). Because the project site is outside the 60 dBA CNEL noise contour, no further analysis associated with aircraft noise impacts is necessary.

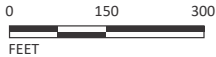


FIGURE 3

LSA

LEGEND

- Project Location
- LT-1** Long-term Noise Monitoring Location



SOURCE: Google Earth 2024

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PCH and Vincent Residential Project
Noise Monitoring Locations

PROJECT IMPACT ANALYSIS

SHORT-TERM CONSTRUCTION NOISE IMPACTS

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

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

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

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

Where $L_{eq}(equip)$ is L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period, E.L. is the noise emission level of the particular piece of equipment at a reference distance of 50 feet, U.F. is the usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time, and D is the distance from the receiver to the piece of equipment.

Table G: Typical Construction Equipment Noise Levels

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

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

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

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

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

FHWA = Federal Highway Administration

ft = foot/feet

L_{max} = maximum instantaneous sound level

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

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

Using the equations from the methodology above, the reference information in Table G, and the construction equipment list based on a similar size project, the composite noise level of each construction phase was calculated. The project construction composite noise levels at a distance of 50 feet would range from 74 dBA L_{eq} to 86 dBA L_{eq}, with the highest noise levels occurring during the grading and building construction phases.

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

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

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

Table H shows the nearest sensitive uses to the project site, their distance from the center of construction activities, and composite noise levels expected during construction. Calculating from the center of the project site presents the average noise level expected to be experienced and is appropriately compared to the FTA noise criteria which is an average noise level standard. These noise level projections do not consider intervening topography or barriers. Construction equipment calculations are provided in Appendix B.

Table H: Potential Construction Noise Impacts at Nearest Receptor

Receptor (Location)	Composite Noise Level (dBA Leq) at 50 ft ¹	Distance (ft)	Composite Noise Level (dBA Leq)
Residences (east and south)	86	75	82
Residences (northeast)		90	81
Residences (west)		180	75
Government Office (North)		290	71

Source: Compiled by LSA (2024).

¹ The composite construction noise level represents the grading and building construction phases which are expected to result in the greatest noise level as compared to other phases.

dBA = A-weighted decibels

ft = foot/feet

Leq = equivalent continuous sound level

While construction noise will vary, it is expected that composite noise levels during construction at the nearest off-site sensitive uses to the east and south would reach an average noise level of 82 dBA Leq during daytime hours. These predicted noise levels would only occur when all construction equipment is operating simultaneously and, therefore, are assumed to be rather conservative in nature. While construction-related short-term noise levels have the potential to be higher than existing ambient noise levels in the project area under existing conditions, the noise impacts would no longer occur once project construction is completed.

As stated above, noise impacts associated with construction activities are regulated by the City’s noise ordinance. The proposed project would comply with the construction hours specified in the City’s Noise Ordinance, which states that construction activities are allowed between the hours of 7:00 a.m. and 6:00 p.m., Monday through Friday and between the hours of 9:00 a.m. and 5:00 p.m. on Saturday.

As it relates to off-site uses, construction-related noise levels would remain below the daytime 90 dBA Leq 1-hour construction noise level criteria established by the FTA for residential and similar sensitive uses and, therefore, would be considered less than significant. The following best construction practices would also minimize noise generated at surrounding receptors:

- The project construction contractor shall equip all construction equipment, fixed or mobile, with properly operating and maintained noise mufflers consistent with manufacturers’ standards.
- The project construction contractor shall locate staging areas away from off-site sensitive uses during the later phases of project development.
- The project construction contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site whenever feasible.

SHORT-TERM CONSTRUCTION VIBRATION IMPACTS

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

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

Table I: Vibration Source Amplitudes for Construction Equipment

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

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

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

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

µin/sec = microinches per second

L_v = vibration velocity

ft = foot/feet
FTA = Federal Transit Administration
in/sec = inch/inches per second

PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

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

$$L_{vdB}(D) = L_{vdB}(25 \text{ feet}) - 30 \text{ Log}(D/25)$$

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

Table J: Potential Construction Vibration Annoyance Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (VdB) at 25 ft ¹	Distance (ft) ²	Vibration Level (VdB)
Residences (east and south)	87	75	73
Residences (northeast)		90	70
Residences (west)		180	61
Government Office (North)		290	55

Source: Compiled by LSA (2024).

- ¹ The reference vibration level is associated with a large bulldozer, which is expected to be representative of the heavy equipment used during construction.
- ² The reference distance is associated with the average condition, identified by the distance from the center of construction activities to surrounding uses.

ft = foot/feet
VdB = vibration velocity decibels

Table K: Potential Construction Vibration Damage Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (PPV) at 25 ft ¹	Distance (ft) ²	Vibration Level (PPV)
Residences (east and south)	0.089	5	0.995
Residences (northeast)		25	0.089
Residences (west)		80	0.016
Government Office (North)		135	0.007

Source: Compiled by LSA (2024).

- ¹ The reference vibration level is associated with a large bulldozer, which is expected to be representative of the heavy equipment used during construction.
- ² The reference distance is associated with the peak condition, identified by the distance from the perimeter of construction activities to surrounding structures.

ft = foot/feet
PPV = peak particle velocity

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

Based on the information provided in Table J, representative vibration levels are expected to approach 73 VdB at the closest sensitive uses to the east and south of the project site, which is below the 78 VdB threshold for annoyance.

Based on the information provided in Table K, the closest structure to external construction activities are the residential uses to the east and south, within 5 feet of the eastern and southern project construction boundary. Because heavy equipment such as dump trucks and large bulldozers would not be used 15 feet of the property line, due to the size of the project site, vibration levels would be below the 0.2 PPV (in/sec) threshold. Because construction activities are regulated by the City's Municipal Code, , vibration impacts would not occur during the more sensitive nighttime hours. With the implementation of the above practices, vibration impacts would be less than significant.

LONG-TERM OFF-SITE TRAFFIC NOISE IMPACTS

As a result of the implementation of the proposed project, off-site traffic volumes on surrounding roadways have the potential to increase. According to the *Level of Service (LOS) and Vehicle Miles Traveled (VMT) Screening Analysis document* (EPD Solutions, Inc. 2024), the proposed project would result in a net increase of 53 average daily trips (ADT). The Existing (2007) ADT volume on the adjacent segment of Vincent Street Drive is between 1,000 – 9,000 (City of Redondo Beach Traffic Flow Map 2007). While the current (2024) daily traffic volume could be higher, using the 2007 volume and lower bound of 1,000 ADT would be considered as a conservative approach. Using the equation below, with an increase of 53 ADT, the noise level increase would be 0.2 dBA L_{dn} .

$$\text{Change in } L_{dn} = 10 \log_{10} [V_{e+p}/V_{\text{existing}}]$$

Where: V_{existing} = the existing daily volume

V_{e+p} = existing daily volumes plus project

Change in L_{dn} = the increase in noise level due to the project

A noise level increase of less than 1 dBA would not be perceptible to the human ear; therefore, the traffic noise increase along Vincent Street resulting from the project would be less than significant.

STATIONARY OPERATIONAL NOISE IMPACTS TO OFF-SITE RECEIVERS

The proposed project would install heating, ventilation, and air conditioning (HVAC) equipment. The HVAC equipment could operate 24 hours per day and generate noise levels of 66.6 dBA L_{eq} at 5 ft per HVAC unit based on previous measurements conducted by LSA.

The closest off-site sensitive uses to the proposed location of on-site HVAC units would be the single-family residence located approximately 36 ft away south of the nearest HVAC unit at the project site. Per the site plans, the HVAC units would be shielded by the proposed residential buildings, which would reduce noise levels by a minimum of 5 dBA. After distance attenuation, noise generated from the closest HVAC equipment would be up to 44.5 dBA L_{eq} at the nearest sensitive use. This noise level would not exceed the City's exterior daytime (7:00 a.m. to 11:00 p.m.) and nighttime (11:00 p.m. to 7:00 a.m.) noise standards of 55 dBA L_{eq} and 50 dBA L_{eq} , respectively. The other HVAC equipment at each proposed residence would be farther away and would receive greater noise reduction due to additional distance attenuation and shielding from the buildings and

thus are not expected to contribute to the combined noise level. Therefore, noise associated with the on-site HVAC equipment would be less than significant, and no mitigation is required.

LONG-TERM TRAFFIC-RELATED VIBRATION IMPACTS

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

LAND USE COMPATIBILITY

The dominant source of noise in the project vicinity is traffic noise from the roadways in the vicinity of the project.

EXTERIOR NOISE ASSESSMENT

Based on the monitoring results shown in Table F, the existing measured noise levels at the project site range from approximately 54 dBA L_{dn} to 74 dBA L_{dn} . As established in the State of California Department of Health and Safety's Land Use Compatibility for Community Noise Environments, the highest recommended "normally acceptable" exterior noise level exposure is 65 dBA CNEL for multi-family residential. Where such units are proposed in areas subject to exterior noise levels greater than 65 dBA CNEL, the standards require an acoustical analysis demonstrating how dwelling units have been designed to meet the interior standard.

INTERIOR NOISE ASSESSMENT

As described above, the project must demonstrate compliance with the interior noise standards of 45 dBA CNEL/ L_{dn} for residential uses. Based on the expected exterior noise levels at the western façades of the proposed building closest to PCH, noise levels would approach 74 dBA L_{dn} , and a minimum noise reduction of 29 dBA would be required.

Based on reference information from transmission loss test reports for various Milgard windows (Milgard 2008), the necessary reduction can be achieved with standard building construction and upgraded windows with Sound Transmission Class (STC) ratings of 30–35, depending on the window-to-glass ratio, at the lots closest to PCH. For all other lots farther from PCH, standard building construction along with standard windows, typically in the STC 25–28 range, interior noise levels of 45 dBA CNEL/ L_{dn} or less would be achieved.

Once final plans are available to detail the exterior wall construction and a window manufacturer has been chosen, a Final Acoustical Report would be required to confirm the reduction capability of the exterior façades and to identify any specific upgrades necessary to achieve an interior noise level of 45 dBA CNEL/ L_{dn} or below.

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APPENDIX A

NOISE MONITORING DATA

Noise Measurement Survey – 24 HR

Project Number: ESL2201.89

Test Personnel: Amber Hazelrigg

Project Name: Vincent Redondo Beach

Equipment: Spark 706RC (SN: 17206)

Site Number: LT-1 Date: 6/25/24

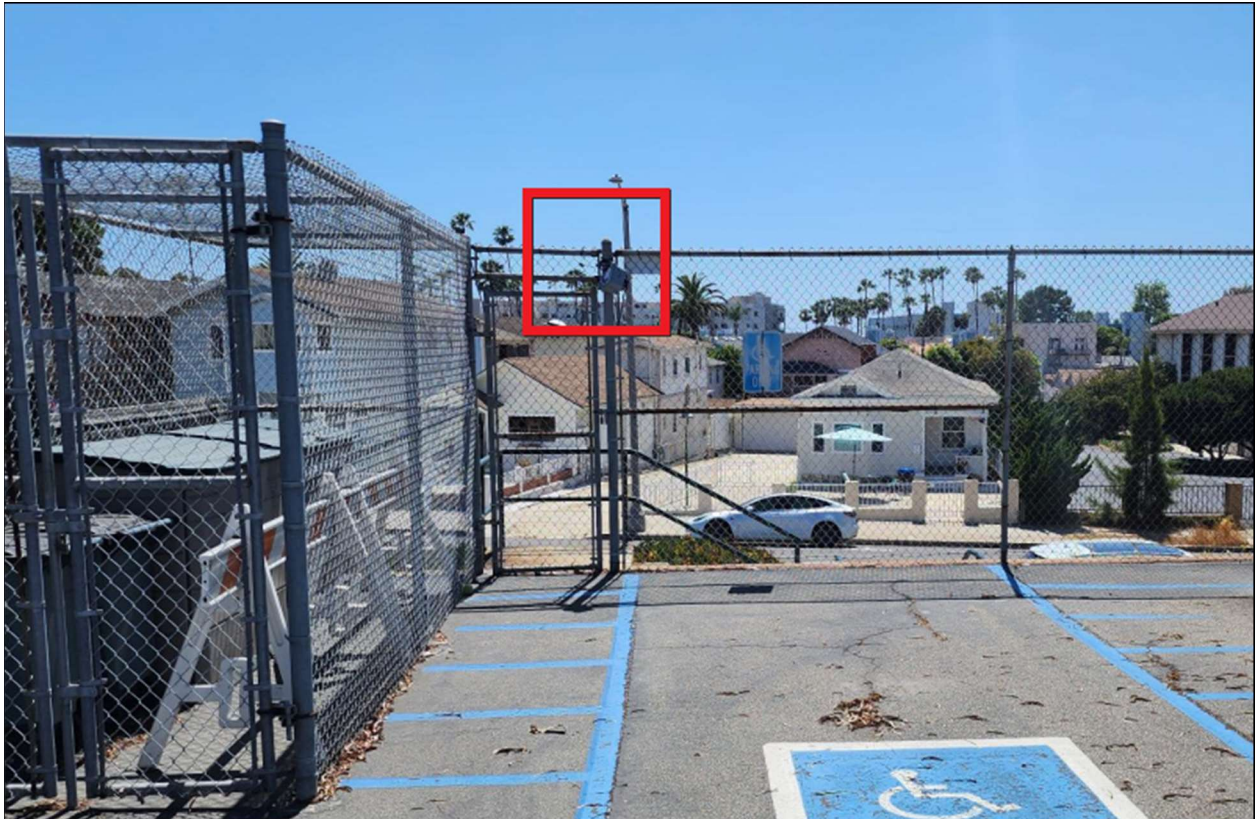
Time: From 3PM To 3PM

Site Location: On a chain link fence on the western end of site, approximately 50 ft, from the center of Pacific Coast Highway (Highway 1).

Primary Noise Sources: Vehicle traffic from Pacific Coast Highway (primary), neighborhood noise (secondary)

Comments: _____

Photo:



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

Start Time	Date	Noise Level (dBA)		
		L _{eq}	L _{max}	L _{min}
3:00 PM	6/25/24	70.1	80.8	49.3
4:00 PM	6/25/24	70.2	85.2	50.4
5:00 PM	6/25/24	70.3	83.7	50.3
6:00 PM	6/25/24	74.6	101.6	48.2
7:00 PM	6/25/24	69.7	81.6	46.8
8:00 PM	6/25/24	68.4	83.3	46.0
9:00 PM	6/25/24	68.1	80.9	45.8
10:00 PM	6/25/24	67.0	79.2	43.0
11:00 PM	6/25/24	65.4	82.2	40.4
12:00 AM	6/25/24	64.3	88.4	39.7
1:00 AM	6/25/24	66.6	97.2	37.8
2:00 AM	6/25/24	59.9	75.4	36.7
3:00 AM	6/25/24	61.3	76.5	36.4
4:00 AM	6/25/24	64.7	77.7	36.7
5:00 AM	6/25/24	67.8	79.3	38.0
6:00 AM	6/25/24	70.5	82.3	40.6
7:00 AM	6/25/24	69.7	77.5	46.7
8:00 AM	6/25/24	69.9	81.7	47.9
9:00 AM	6/25/24	69.6	79.6	44.6
10:00 AM	6/25/24	69.9	85.4	47.3
11:00 AM	6/25/24	69.8	81.9	50.7
12:00 PM	6/25/24	70.3	94.8	48.2
1:00 PM	6/25/24	69.4	84.2	47.0
2:00 PM	6/25/24	69.6	87.6	49.3

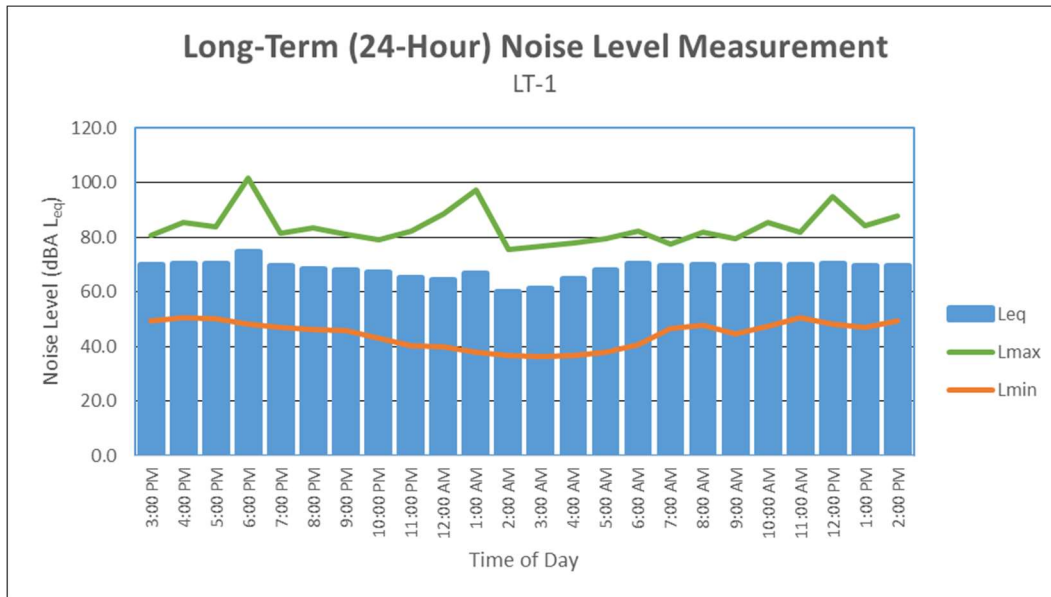
Source: Compiled by LSA Associates, Inc. (2024).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: ESL2201.89
Project Name: Vincent Redondo Beach

Test Personnel: Amber Hazelrigg
Equipment: Spark 706RC (SN: 17815)

Site Number: LT-2 Date: 6/25/24

Time: From 4PM To 4PM

Site Location: On a chain link fence on the northern side of site, approximately 170 ft. from the center of Vincent and 205 ft. from the center of Pacific Coast Highway (Highway 1).

Primary Noise Sources: Vehicle traffic from Pacific Coast Highway (primary), neighborhood noise (secondary)

Comments: _____

Photo:



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

Start Time	Date	Noise Level (dBA)		
		L _{eq}	L _{max}	L _{min}
4:00 PM	6/25/24	55.5	73.2	46.4
5:00 PM	6/25/24	55.2	72.1	45.2
6:00 PM	6/25/24	55.9	76.2	43.7
7:00 PM	6/25/24	54.9	67.2	44.9
8:00 PM	6/25/24	54.7	67.0	43.7
9:00 PM	6/25/24	50.1	62.7	41.7
10:00 PM	6/25/24	49.3	56.7	41.0
11:00 PM	6/25/24	47.8	61.1	39.0
12:00 AM	6/26/24	47.7	70.4	38.7
1:00 AM	6/26/24	51.5	80.2	36.9
2:00 AM	6/26/24	42.7	55.3	36.8
3:00 AM	6/26/24	43.5	55.9	36.6
4:00 AM	6/26/24	45.7	54.7	36.3
5:00 AM	6/26/24	48.4	62.2	36.7
6:00 AM	6/26/24	52.0	62.7	38.4
7:00 AM	6/26/24	53.2	79.5	42.4
8:00 AM	6/26/24	59.2	82.5	43.2
9:00 AM	6/26/24	52.4	68.6	42.4
10:00 AM	6/26/24	53.9	72.2	44.2
11:00 AM	6/26/24	55.2	71.5	45.6
12:00 PM	6/26/24	54.6	77.6	45.5
1:00 PM	6/26/24	55.8	82.1	44.1
2:00 PM	6/26/24	62.9	87.0	46.3
3:00 PM	6/26/24	55.6	66.9	46.0

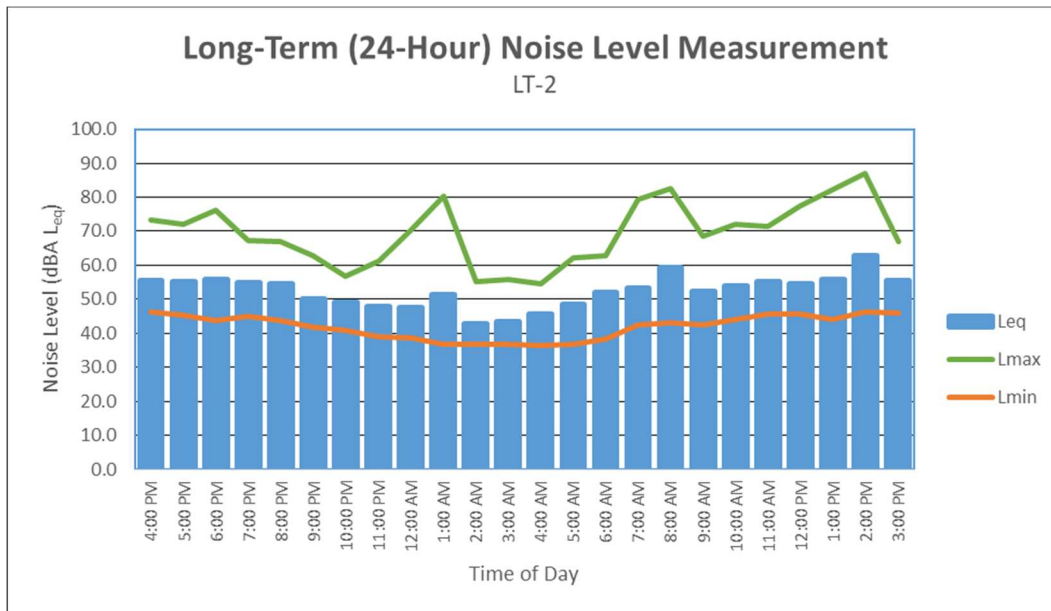
Source: Compiled by LSA Associates, Inc. (2024).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: ESL2201.89
Project Name: Vincent Redondo Beach

Test Personnel: Amber Hazelrigg
Equipment: Spark 706RC (SN: 18571)

Site Number: LT-3 Date: 6/25/24

Time: From 4PM To 4PM

Site Location: On a horizontal utility pole against residential brick wall facing open parking lot on site, residential units north and east, approximately 320 ft, from the center of Pacific Coast Highway (Highway 1).

Primary Noise Sources: Neighborhood noise (primary), street noise from Pacific Coast Highway (secondary)

Comments: _____

Photo:



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

Start Time	Date	Noise Level (dBA)		
		L _{eq}	L _{max}	L _{min}
4:00 PM	6/25/24	52.7	67.8	44.8
5:00 PM	6/25/24	56.6	77.8	45.2
6:00 PM	6/25/24	53.5	73.0	44.2
7:00 PM	6/25/24	53.1	69.5	43.4
8:00 PM	6/25/24	50.7	70.0	42.1
9:00 PM	6/25/24	47.9	62.4	39.9
10:00 PM	6/25/24	47.2	58.7	39.0
11:00 PM	6/25/24	46.1	60.1	39.0
12:00 AM	6/26/24	46.6	72.0	38.1
1:00 AM	6/26/24	46.3	73.1	36.8
2:00 AM	6/26/24	40.6	52.7	36.5
3:00 AM	6/26/24	40.9	54.0	36.5
4:00 AM	6/26/24	42.8	53.1	36.5
5:00 AM	6/26/24	45.1	55.4	36.9
6:00 AM	6/26/24	48.0	62.7	37.3
7:00 AM	6/26/24	49.7	71.2	39.0
8:00 AM	6/26/24	52.9	70.2	41.8
9:00 AM	6/26/24	50.6	65.8	41.5
10:00 AM	6/26/24	50.9	64.9	43.6
11:00 AM	6/26/24	52.5	65.0	44.0
12:00 PM	6/26/24	51.7	70.3	43.0
1:00 PM	6/26/24	52.2	71.8	43.5
2:00 PM	6/26/24	55.1	73.4	44.6
3:00 PM	6/26/24	53.4	63.4	44.5

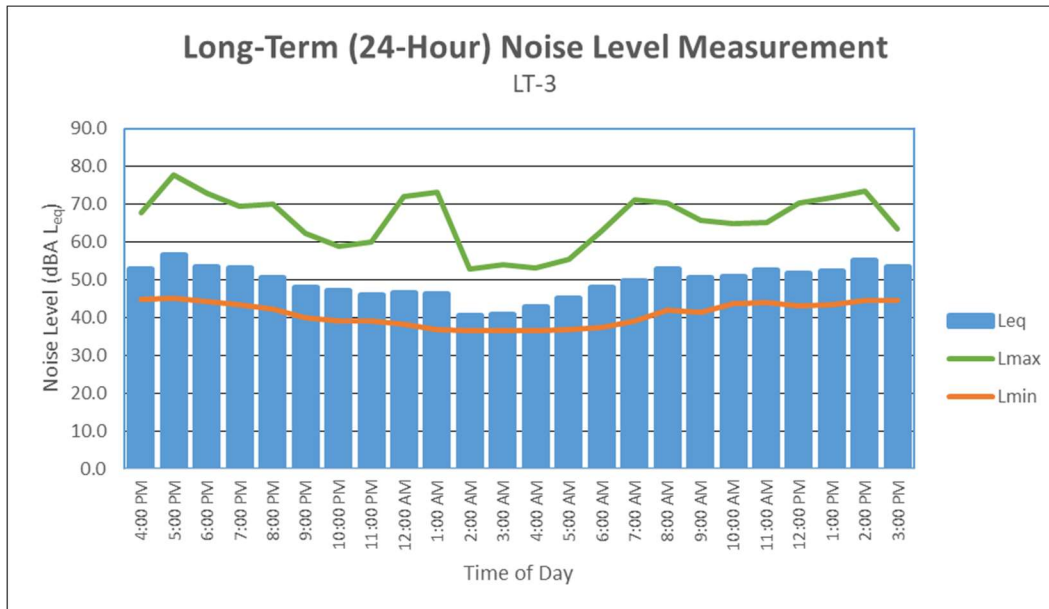
Source: Compiled by LSA Associates, Inc. (2024).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum instantaneous noise level

L_{min} = minimum measured sound level



APPENDIX B

CONSTRUCTION NOISE CALCULATIONS

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Concrete Saw	1	90	20	50	0.5	90	83
Tractor	3	81	40	50	0.5	81	82
Combined at 50 feet						91	85

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Tractor	1	84	40	50	0.5	84	80
Grader	1	85	40	50	0.5	85	81
Combined at 50 feet						88	84

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	3	82	40	50	0.5	82	83
Tractor	2	84	40	50	0.5	84	83
Combined at 50 feet						86	86
Combined at Receptor 75 feet						83	82
Combined at Receptor 90 feet						81	81
Combined at Receptor 180 feet						75	75
Combined at Receptor 290 feet						71	71

Phase: Building Construction

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Tractor	3	84	40	50	0.5	84	85
Generator	1	81	50	50	0.5	81	78
Combined at 50 feet						86	86

Phase: Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Tractor	1	84	40	50	0.5	84	80
All Other Equipment > 5 HP	1	85	50	50	0.5	85	82
Combined at 50 feet						88	84

Phase: Architectural Coating

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

Sources: RCNM

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

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level