Appendix D. Noise and Vibration Technical Memorandum

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Noise and Vibration Technical Memorandum

Spring Street Business Park Project

City of Long Beach, California

May 2019

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Acronyms

CNEL	community noise equivalent level
dB	decibel
dBA	A-weighted decibel
FTA	Federal Transit Administration
L_{dn}	day-night average sound level
L_{eq}	equivalent continuous sound level
L_{max}	maximum A-weighted sound level
PPV	peak particle velocity
project	Spring Street Business Park Project
rms	root mean square
SF	square feet
VdB	root mean square velocity in decibels

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1 Introduction

1.1 Purpose of the Report

This Noise and Vibration Technical Memorandum was completed for the Spring Street Business Park Project (project) to identify potential impacts on on-site and nearby sensitive land uses. Project construction and operational noise and vibration were calculated and compared with applicable laws, guidelines, and/or regulations.

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2 Project Location and Description

2.1 Project Location

The project site is approximately 7.8 acres and consists of a single parcel (Assessor's Parcel Number 7212-009-021) located along the City of Long Beach boundary with the adjacent City of Signal Hill to the east. The project site is vacant and is immediately bounded by Spring Street on the north, Willow Springs Park on the south, Orange Avenue on the east, and undeveloped property on the west (Figure 2-1). The project site can be accessed via Spring Street and Orange Avenue.

Surrounding land uses include:

- North – Spring Street: The land across Spring Street is occupied by a MySnug camper shell sales facility and Maxim Crane Works yard.
- East – Orange Avenue: The land across Orange Avenue is occupied by a Signal Hill Petroleum facility and Signal Hill Business Park in the City of Signal Hill.
- South – The land south of the project site is part of Willow Springs Park. A property with oil wells is also located south of the project site.
- West – The land west of the project site is vacant.

2.2 Project Description

The project is a proposed business park with off-site street improvements along Spring Street and Orange Avenue and park enhancements consistent with the Willow Springs Park Master Plan. Project improvements are consistent with the land use and development standards of the Medium Industrial zoning district.

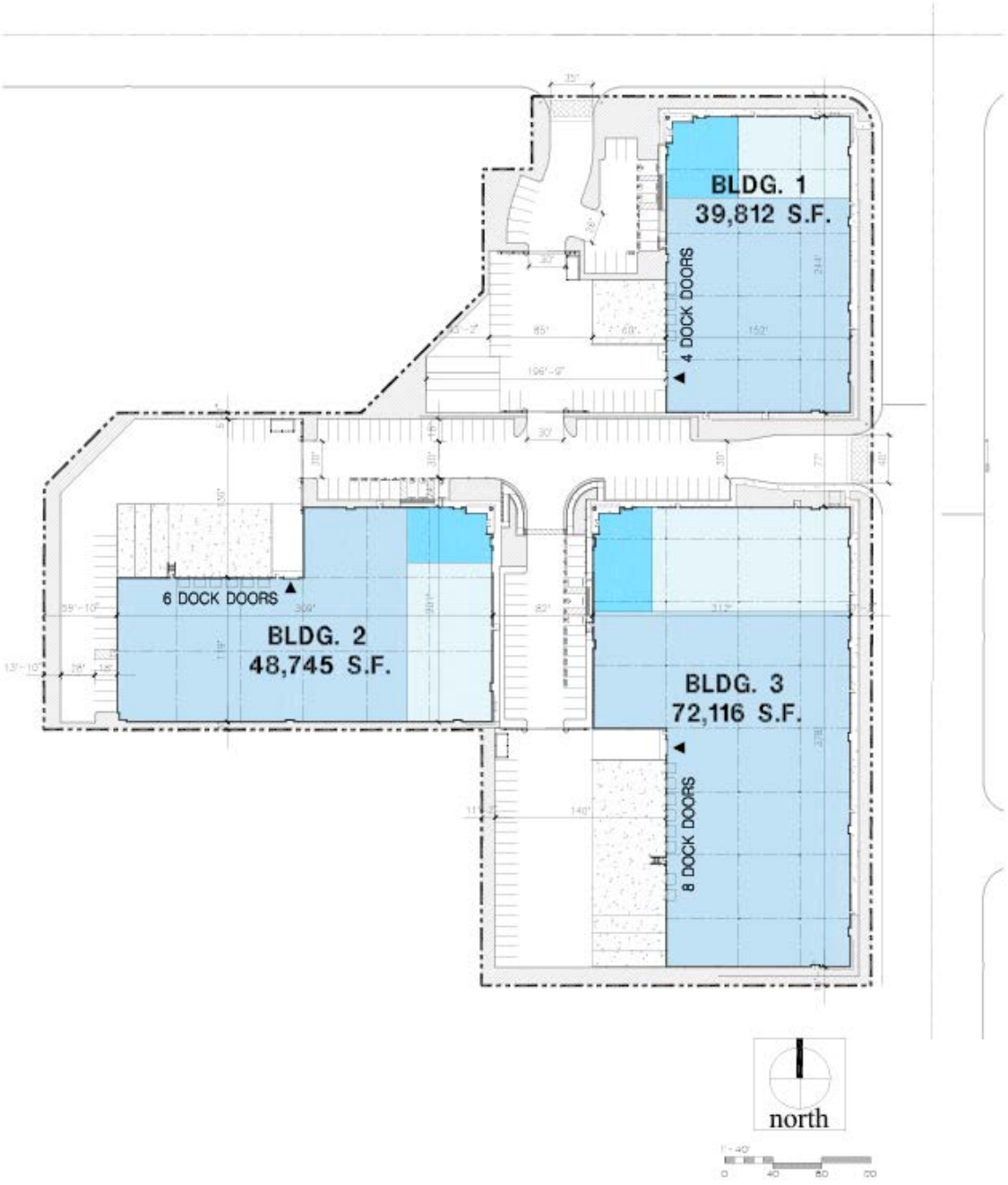
The project includes the following primary components:

- Business park complex – The project includes development of three new concrete tilt-up buildings for new industrial with accessory office uses. Table 2-1 summarizes the key elements associated with the three buildings, and Figure 2-2 depicts the proposed site plan.
- Off-site street improvements – The project includes the following improvements to adjacent city streets:
    - Orange Avenue widening (adjacent and east of the project site) – demolition and reconstruction of the sidewalk pavement, curb, curb gutter, bus pad, and roadway, to achieve a 100-foot public right-of-way; 40-foot-wide roadway and 10-foot-wide sidewalk located on both sides of the roadway.
    - An additional 2 feet of sidewalk would be provided in the vicinity of the bus stop on Orange Avenue adjacent to the project site, achieving a 12-foot wide public sidewalk. Unused driveways and curb cuts would be replaced with full-height curb, curb gutter and sidewalk;
    - Spring Street (adjacent and north of the project site) – Reconstruction of cracked, deteriorated, or uplifted/depressed sections of sidewalk pavement, curb and curb gutter;

  - Resetting to grade of manholes, pull boxes, meters, and other existing facilities in conjunction with the required street improvements
  - New crosswalks at project site entrances
  - Construction of new bicycle facilities along Orange Avenue and Spring Street in accordance with the City's Bicycle Master Plan (or contribution of a fair share fee to the City for future implementation).
- Off-site park improvements – The project includes grading, planting, and irrigating of the property west and south of, and immediately adjacent to, the project site to create a park buffer zone, consistent with future plans for the City of Long Beach's Willow Springs Park.

Figure 2-1. Regional Vicinity and Project Location

Figure 2-2. Project Site Plan



Source: Signal Hill Petroleum 2018

Table 2-1. Spring Street Business Park Project – Building and Site Characteristics

Project Element	Building 1	Building 2	Building 3	TOTAL
Site Area				
SF	—			339,027
Acres	—			7.783
Gross Building Area				
Footprint (SF)	36,812	45,745	68,116	150,673
Mezzanine (SF)	3,000	3,000	4,000	10,000
TOTAL (SF)	39,812	48,745	72,116	160,673
25% Office Area Allowable (SF)	9.953	12,186	18,029	40,168
Coverage	—	—	—	49%
Building Clear Height	28 Feet (ft)	28 ft	30 ft	
Auto Parking Required				
Office & Warehouse: 1/1,000 SF (Office area greater than 25% calculated separately)	40	49	73	162 stalls
Auto Parking Provided				
Standard (8.5 ft x18 ft)	32	41	60	133 stalls
ADA Accessible (9 ft x18 ft)	2	2	2	6
Van Accessible (12 ft x18 ft)	1	1	1	3
Clean Air Vehicle (8.5 ft x18 ft)	3	3	6	12
EV Charging (8.5 ft x18 ft)	2	2	4	8
TOTAL	40	49	73	162 stalls
Trailer Parking Required				
0 – 3,000 @ not applicable	N/A	N/A	N/A	N/A
3,001 – 10,000 @ 1 space	1	1	1	3 stalls
10,001 – 40,000 @ 1 space	1	1	1	3 stalls

Table 2-1. Spring Street Business Park Project – Building and Site Characteristics

Project Element	Building 1	Building 2	Building 3	TOTAL
Above 40,000 @ 1 space per 40,000	0	1	1	2 stalls
TOTAL	2	3	3	8 stalls
Trailer Parking Provided				
Trailer (14 ft x60 ft)	2	3	3	8 stalls
Maximum Building Height Allowed				
Height – 45 ft				
Maximum Lot Coverage				
Coverage – 60%				
Setbacks				
Arterial Street – 10 ft				
Local Street – none				
Yard abutting Alley – 10 ft from centerline				
Parking fronting street – 5 ft				
Zoning Designation				
IM				

Notes:
AC=acres; ADA=Americans with Disabilities Act; EV=electric vehicle; IM=Medium Industrial; SF=square feet

3 Acoustic and Vibration Terminology

3.1 Acoustic Terminology

Noise levels are presented on a logarithmic scale to account for the large pressure response range of the human ear and are expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals. Because the human ear does not perceive every frequency with equal loudness, sounds are often adjusted with a weighting filter. The A-weighted decibel (dBA) filter is applied to compensate for the frequency response of the human auditory system. An inherent property of the logarithmic decibel scale is that the sound pressure levels of two separate sources are not directly additive. For example, if a sound of 50 dBA is added to another sound of 50 dBA in the proximity, the result is a 3-decibel increase (or 53 dBA), not an arithmetic doubling to 100 dBA. With respect to how the human ear perceives changes in sound pressure level relative to changes in "loudness," scientific research demonstrates the following general relationships between sound level and human perception for two sound levels with the same or very similar frequency characteristics:

- One dBA is the practical limit of accuracy for sound measurement systems and corresponds to an approximate 10 percent variation in the sound pressure level. A 1 dBA increase or decrease is a non-perceptible change in sound.
- A 3-dBA increase or decrease is a doubling (or halving) of acoustic pressure level, and it corresponds to the threshold of change in loudness perceptible in a laboratory environment. In practice, the average person is not able to distinguish a 3-dBA difference in environmental sound outdoors.
- A 5-dBA increase or decrease is described as a perceptible change in sound level and is a discernible change in an outdoor environment.
- A 10-dBA increase or decrease is a tenfold increase or decrease in acoustic pressure level but is perceived as a doubling or halving in loudness (i.e., the average person will judge a 10-dBA change in sound level to be twice or half as loud).

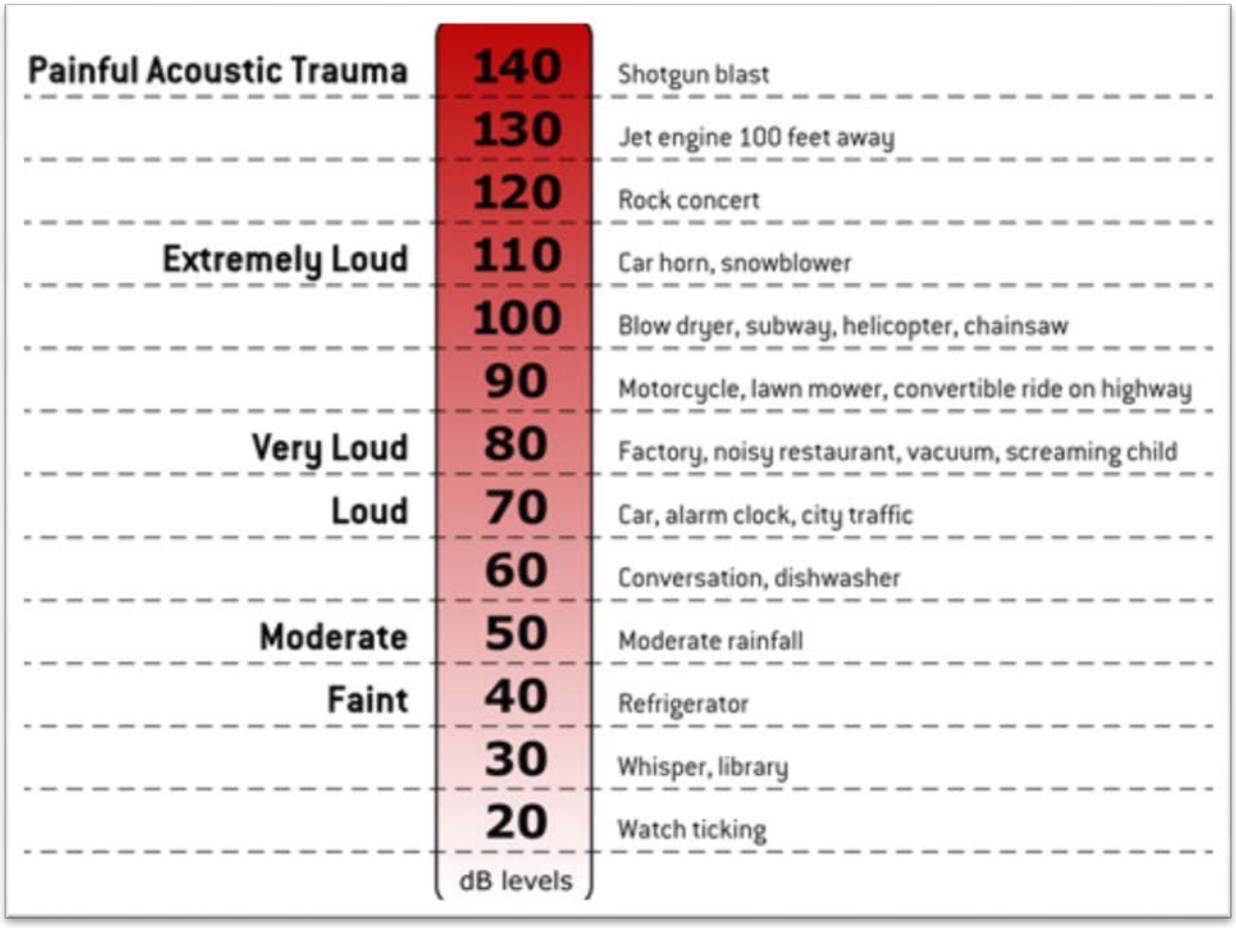
Estimations of common noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented on Figure 3-1.

Noise levels can be measured, modeled, and presented in various formats. The noise metrics that were employed in this analysis have the following definitions:

- ***L_{eq}:*** Conventionally expressed in dBA, the L_{eq} is the equivalent continuous sound level over a specified time period. It is defined as the steady, continuous sound level over a specified time, which has the same acoustic energy as the actual varying sound levels over the specified period. It is a mean average sound level.
- ***L_{max}:*** L_{max} is the maximum A-weighted sound level as determined during a specified measurement period. It can also be described as the maximum instantaneous sound pressure level generated by a piece of equipment or during a construction activity.
- ***L_{dn}:*** The L_{dn} is the day-night average sound level over a 24-hour period with a 10 dB penalty added to sound levels occurring during the evening hours (7:00 p.m. to 10:00 p.m.) to account for individuals' increased sensitivity to noise levels during nighttime hours.

- ***CNEL:*** Community noise equivalent level is another average A-weighted L_{eq} sound level measured over a 24-hour period; however, this noise scale is adjusted to account for some individuals' increased sensitivity to noise levels during the evening and nighttime hours. A CNEL noise measurement is obtained after adding 5 dB to sound levels occurring during evening hours (7:00 p.m. to 10:00 p.m.) and 10 dB to noise levels occurring during nighttime hours (10:00 p.m. to 7:00 a.m.).

Figure 3-1. Relative Loudness



3.2 Vibration Terminology

According to the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (FTA 2018), construction activities can be a source of ground-borne vibration. Activities such as pile driving and operation of heavy equipment may cause ground-borne vibration during project construction. Vibration is an oscillatory motion that can be described in terms of the displacement, velocity, or acceleration (FTA 2006). Velocity or acceleration is typically used to describe vibration. Two descriptors are frequently used when discussing quantification of vibration, the peak particle velocity (PPV) and the root mean square (rms):

- ***PPV:*** PPV is the maximum instantaneous positive or negative peak of the vibration signal (FTA 2006). The potential for damage to buildings due to construction-related vibration is evaluated using PPV.
- ***Rms:*** RMS is the square root of the average of the squared amplitude of the vibration signal, typically calculated over a 1-second period (FTA 2006). The potential to annoy humans due to construction-related vibration is evaluated using rms.

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4 Regulatory Setting

This section provides an overview of state and local regulations related to noise issues applicable to the project.

4.1 State

4.1.1 California Department of Health Services

Noise Guidelines

In 1976, the California Department of Health Services published guidelines for the noise element of local general plans (Governor's Office of Planning and Research 2017). These guidelines include a noise level/land use compatibility chart that categorizes various outdoor L_{dn} ranges up to four compatibility categories (normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable), depending on land use. For many land uses, the chart shows exterior L_{dn} ranges for two or more compatibility categories. The noise element guidelines chart identifies the normally acceptable range for low-density residential uses as less than 60 dBA, while the conditionally acceptable range is 60 to 70 dBA. The normally acceptable range for high-density residential uses is identified as Ldn values below 65 dBA, while the conditionally acceptable range is identified as 65 to 70 dBA. For educational and medical facilities, L_{dn} values below 60 dB are considered normally acceptable, while Ldn values of 60 to 70 dBA are considered conditionally acceptable. For office and commercial land uses, L_{dn} values below 67.5 dBA are considered normally acceptable, while L_{dn} values of 67.5 to 77.5 dBA are categorized as conditionally acceptable.

These normally and conditionally acceptable L_{dn} ranges are intended to indicate that local conditions (existing noise levels and community attitudes toward dominant noise sources) should be considered in evaluating land use compatibility at specific locations. These guidelines are used by many agencies, environmental planners, and acoustical specialists as a starting point to evaluate the potential for noise impact on and by a project. The guidelines are also employed to evaluate methods for achieving noise compatibility with respect to nearby existing uses. Table 4-1 summarizes these guidelines for the normally and conditionally acceptable L_{dn} exposures.

Table 4-1. California Department of Health Services Noise Guidelines

Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dBA)	
	Normally Acceptable	Conditionally Acceptable
Residential – Low Density	50 - 60	60 - 70
Residential – High Density	50 - 65	65 - 70
Transient Lodging – Motels, Hotels	50 - 65	65 – 70
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 – 60	60 - 65
Auditoriums, Concert Halls, Amphitheaters	—	50 - 70
Sports Arenas, Outdoor Spectator Sports	—	50 - 75

Table 4-1. California Department of Health Services Noise Guidelines

Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dBA)	
	Normally Acceptable	Conditionally Acceptable
Playgrounds, Neighborhood Parks	50 – 67.5	—
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50 - 70	—
Office Buildings, Business Commercial and Professional	50 – 67.5	67.5 – 77.5
Industrial, Manufacturing, Utilities, Agriculture	50 - 70	70 - 80

Notes:
CNEL=community noise equivalent level; dBA=A-weighted decibel; L_{dn}=average hourly noise level

4.1.2 California Environmental Quality Act

The California Environmental Quality Act requires that significant environmental impacts be identified and that such impacts be eliminated or mitigated to the extent feasible. Appendix G of the *California Environmental Quality Act Statutes and Guidelines* (Office of Planning and Research and the Natural Resources Agency 2019) sets forth a series of suggested thresholds for determining a potentially significant impact. Under the thresholds suggested in Appendix G, a project could be considered to have significant noise and vibration impacts if it results in one or more of the following:

- 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
- 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 2 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

4.2 City of Long Beach Noise Standards

4.2.1 Noise Element of the General Plan

The goals and policies contained in the *City of Long Beach General Plan* Noise Element address noise in relation to land use planning, the noise environment, transportation noise, construction and industrial noise, population and housing noise, and public health and safety (City of Long Beach 1975). Table 4-2 summarizes the criteria for sensitive receivers.

Table 4-2. Recommended Criteria for Maximum Acceptable Noise Levels (A-weighted Decibels)

Major Land Use Type	Outdoor			Indoor
	Maximum Single Hourly Peak	L10	L50	L_{dn}
Residential (7 a.m. to 10 p.m.)	70	55	45	45
Residential (10 p.m. to 7 a.m.)	60	45	35	35
Commercial (anytime)	75	65	55	—
Industrial (anytime)	85	70	60	—

Notes:
L10=noise level exceeded 10 percent of the time during a stated period; L50=median noise level; L_{dn}=average hourly noise level

4.2.2 Municipal Code

Chapter 8.80, Noise, of the municipal code establishes exterior and interior noise limits for the generation of sound within the City of Long Beach. The maximum noise levels vary based on the receiving land use type and the cumulative duration of noise.

Exterior Noise Limits

Section 8.80.150 of the municipal code establishes the exterior noise limits by receiving land use. Table 4-3 summarizes the exterior noise limits.

No person shall operate or cause to be operated any source of sound at any location within the incorporated limits of the city or allow the creation of any noise on property owned, leased, occupied, or otherwise controlled by such person, which causes the noise level when measured from any other property, either incorporated or unincorporated, to exceed:

1. The noise standard for that land use district as specified in Table 4-3 for a cumulative period of more than 30 minutes in any hour; or
2. The noise standard plus 5 decibels for a cumulative period of more than 15 minutes in any hour; or
3. The noise standard plus 10 decibels for a cumulative period of more than 5 minutes in any hour; or
4. The noise standard plus 15 decibels for a cumulative period of more than 1 minute in any hour; or
5. The noise standard plus 20 decibels or the maximum measured ambient, for any period of time.

Table 4-3. Exterior Noise Limits

Receiving Land Use District	Time Period	Noise Level (dBA)	L_{max} (dBA)
District One	Night (10 p.m. to 7 a.m.)	45	65
	Day (7 a.m. to 10 p.m.)	50	70
District Two	Night (10 p.m. to 7 a.m.)	55	75
	Day (7 a.m. to 10 p.m.)	60	80
District Three	Any time	65	85
District Four	Any time	70	90
District Five	Regulated by other agencies and laws		

Notes:
District One: Predominantly residential with other land use types also present
District Two: Predominantly commercial with other land use types also present
District Three and Four: Predominantly industrial with other land use types also present
District Five: Airports, freeways, and waterways regulated by other agencies
District Three and Four limits are intended primarily for use at their boundaries rather than for noise control within those districts
dBA=A-weighted decibel; L_{max}= maximum A-weighted sound level

Interior Noise Limits

Section 8.80.170 of the municipal code establishes the interior noise limits by receiving land use. Table 4-4 summarizes the interior noise limits.

Table 4-4. Interior Noise Limits

Receiving Land Use District	Type of Land Use	Time Interval	Allowable Interior Noise Level (dBA)
All	Residential	10 p.m. to 7 a.m. 7 a.m. to 10 p.m.	35 45
All	School	7 a.m. to 10 p.m. (while school is in session	45
Hospital, designated quiet zones, and noise sensitive zones	—	Any time	40

Notes:
dBA=A-weighted decibel

No person shall operate, or cause to be operated, any source of sound indoors at any location within the incorporated limits of the city or allow the creation of any indoor noise which causes the noise level when measured inside the receiving dwelling unit to exceed:

1. The noise standard for that land use district, as specified in Table 4-4, for a cumulative period of more than 5 minutes in any hour; or
2. The noise standard plus 5 dB for a cumulative period of more than 1 minute in any hour; or
3. The noise standard plus 10 dB or the maximum measured ambient, for any period of time.

Construction Noise Limits

Section 8.80.202 of the municipal code restricts construction activities to weekdays between 7:00 a.m. and 7:00 p.m. and Saturdays between 9:00 a.m. and 6:00 p.m., except for emergency work. Construction work on Sundays is prohibited unless the City of Long Beach's Noise Control Officer issues a permit. The permit may allow work on Sundays between 9:00 a.m. and 6:00 p.m.

Loading and Unloading Noise Limits

Section 8.80.200(E) of the municipal code states that loading, unloading, opening, closing, or other handling of boxes, crates, containers, building materials, garbage cans, or similar objects between 10:00 p.m. and 7:00 a.m. is restricted to the noise level provisions of exterior noise limits shown in Table 4-3 and the interior noise limits shown in Table 4-4.

4.3 Vibration

4.3.1 Vibration Annoyance

Ground-borne noise is the vibration of floors and walls that may cause rattling of items, such as windows or dishes on shelves, or a rumbling noise. The rumbling is created by the motion of the room surfaces, which act as a giant loudspeaker. FTA provides criteria for acceptable levels of ground-borne vibration based on the relative perception of a vibration event for vibration-sensitive land uses (Table 4-5).

Table 4-5. Ground-borne Vibration and Noise Impact Criteria – Human Annoyance

Land Use Category	Max Lv (VdB)[1]	Description
Workshop	90	Distinctly felt vibration. Appropriate to workshops and non-sensitive areas.
Office	84	Felt vibration. Appropriate to offices and non-sensitive areas.
Residential – daytime	78	Barely felt vibration. Adequate for computer equipment.
Residential – nighttime	72	Vibration not felt, but ground-borne noise may be audible inside quiet rooms.

Notes:
[1] As measured in 1/3-octave bands of frequency over the frequency ranges of 8 to 80 Hertz
Lv=vibration level; VdB=RMS velocity in decibels

4.3.2 Vibration-related Structural Damage

The level at which ground-borne vibration is strong enough to cause structural damage has not been determined conclusively. The most conservative estimates are reflected in the FTA standards, shown in Table 4-6. Vibration-related problems generally occur due to resonances in the structural components of a building. The maximum vibration amplitudes of the floors and walls of a building will often be at the resonance frequencies of various components of the building. That is, structures amplify ground-borne vibration. Wood-frame buildings, such as typical residential structures, are more easily excited by ground vibration than heavier buildings. According to *Transportation Related Earthborne Vibration* (California Department of Transportation 2002), extreme care must be taken when sustained

pile driving occurs within 25 feet of any building, the threshold at which there is a risk of architectural damage to normal houses with plastered walls and ceilings is 0.2 inch per second.

Table 4-6. Ground-borne Vibration and Noise Impact Criteria – Structural Damage

Building Category	PPV (inch/second)[1]	VdB
I. Reinforced concrete, steel, or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Nonengineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Notes:
[1] RMS velocity calculated from vibration level (VdB) using the reference of 1 microinch/second
PPV=peak particle velocity; VdB=RMS velocity calculated from vibration level

5 Existing Conditions

5.1 Sensitive Land Uses

Certain land uses are considered more sensitive to noise than others. Examples of these types of land uses include residential areas, educational facilities, hospitals, childcare facilities, and senior housing. The project site is located in an urban area. The majority of the land uses in the project area are commercial and industrial in nature. The Calvary Chapel – Signal Hill church is located east of the project site across Orange Avenue. The closest residences to the project site are the homes located 1,200 feet north across I-405.

5.2 Overview of the Existing Noise Environment

The primary existing noise sources in the project area are transportation facilities. Traffic on Spring Street and Orange Avenue is the dominant source contributing to area ambient noise levels. Noise from motor vehicles is generated by engine vibrations, the interaction between the tires and the road, and the exhaust system.

5.3 Existing Traffic Noise Levels

The primary existing noise source in the project area is traffic on the local roadways. The Federal Highway Administration (FHWA) highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate highway traffic-related noise conditions along the roadway segments in the project vicinity. Existing traffic volumes included in the traffic study prepared for the project (Linscott Law & Greenspan 2019) were used to assess the existing traffic noise levels. A typical vehicle mix for Southern California was used. Table 5-1 provides the traffic noise levels along the roadways adjacent to the project site under the existing conditions. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. The specific assumptions used in developing these noise levels and model printouts are provided in Appendix A.

Table 5-1. Existing Traffic Volumes

Roadway Segment	Average Daily Traffic	Centerline to 70 CNEL (feet)	Centerline to 65 CNEL (feet)	Centerline to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane
Spring Street between California Avenue and Orange Avenue	20,695	<50	146.2	462.4	67.9
Spring Street between Orange Avenue and Walnut Avenue	20,940	<50	147.9	467.8	68.0
Orange Avenue between I-405 and Spring Street	17,175	<50	87.5	276.7	65.7
Orange Avenue between Spring Street and 29th Street	13,655	<50	96.5	305.1	66.1
Orange Avenue between 29th Street and Willow Street	13,485	<50	95.3	301.3	66.1

Table 5-1. Existing Traffic Volumes

Roadway Segment	Average Daily Traffic	Centerline to 70 CNEL (feet)	Centerline to 65 CNEL (feet)	Centerline to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane
29th Street east of Orange Avenue	680	<50	<50	<50	52.9

Notes:
CNEL=community noise equivalent level; dBA=A-weighted decibels

6 Noise and Vibration Impact Analysis

Noise generated by the project would consist of (1) short duration noise resulting from construction activities and (2) long-term noise from on-site stationary sources and off-site traffic noise from vehicles operated by employees using the proposed industrial buildings. Vibration from the project would only result during construction. Construction activities would take place only during daytime hours. An evaluation was performed of anticipated noise and vibration levels compared to regulatory requirements.

Airborne noise dissipates with increasing distance from the noise source. The distances involved depend primarily on the intensity of the noise generated by the source, terrain, and ground cover between source and receiver, as well as weather conditions, such as wind speed and direction, the height and strength of temperature inversions, and the height of cloud cover. Temperature inversions and cloud cover can reflect or refract sound that is radiated upward; this effect can increase noise levels at locations that receive the reflected or refracted sound. Such reflection and refraction effects are important primarily for high intensity sounds and the calculation of sound propagation over large distances. For noise sources such as construction activity and vehicle traffic, the region of influence is typically less than 0.5 mile from the noise source. Temperature inversions and cloud cover are not accounted for in this analysis.

The region of interest for noise and vibration issues is typically localized. Ground-borne vibrations generally attenuate rapidly with increasing distance from the vibration source. The distances involved depend primarily on the intensity of the vibrations generated by the source, as well as soil and geologic conditions. Detectable vibrations will travel the greatest distance through solid rock and the least distance through loose, unconsolidated soils or saturated soils. For vibration sources such as construction activity and vehicle traffic, the region of influence is typically less than 1,000 feet from the vibration source.

6.1 Construction

6.1.1 Noise

Construction noise, although temporary, can potentially affect nearby sensitive receptors, such as residences closest to the project site. Project construction would require the use of heavy equipment that may be periodically audible at off-site locations. Received noise levels would fluctuate, depending on the construction activity, equipment type, and distance between noise source and receiver. Additionally, noise from construction equipment would vary dependent on the construction phase and the number and type of equipment at a location at any given time. For the purposes of the noise evaluation, the project is divided into five phases of construction consistent with the CalEEMod:

1. Site preparation
2. Grading
3. Building construction
4. Paving
5. Architectural coating

The variation in power and usage of the various construction equipment types creates complexity in characterizing construction noise levels. Expected equipment types for each phase of construction are presented in Table 6-1 and were used to screen for potential construction noise impacts. Each phase identified would require different types of construction equipment. The estimated composite site noise level is based on the assumption that all equipment would operate at a given usage load factor, for a given hour (i.e., front end loaders are assumed to be used for up to 40 percent of 1 hour, or 24 minutes), to calculate the composite average daytime hourly L_{eq}. The load factor accounts for the fraction of time that the equipment is in use over the specified time period. The composite noise level from several pieces of equipment operating during the same phase is obtained from decibel addition of the L_{eq} of each individual unit. Although it is not possible for all the construction equipment to operate at one point simultaneously, the screening level analysis represented in Table 6-1 conservatively assumes concurrent operation of equipment in the same location.

The nearest sensitive receptors to the project site is the existing church to the east across Orange Avenue. At its closest point, the construction activity would be located within 150 feet of these land uses. The average distance from the construction activities on the project site to these sensitive land uses on a daily basis is approximately 500 feet. Construction noise would attenuate with increased distance from the noise sources.

Maximum noise levels at 150 feet and composite L_{eq} noise levels at 500 feet represented in Table 6-1 were evaluated assuming spherical free-field spreading. As a general construction practice, functional mufflers are anticipated to be maintained on all equipment to attenuate noise levels as low as reasonably achievable. As shown in Table 6-1, during the loudest construction phase, the maximum noise level is projected to be 75.5 dBA L_{max}, and the average level is projected to be 64.9 dBA L_{eq}.

Compliance with the City of Long Beach's Noise Ordinance would ensure construction noise impacts are reduced to the greatest extent feasible. Although construction noise would be higher than the ambient noise in the project vicinity, construction noise would cease to occur once project construction is complete.

Traffic noise associated with project construction is not anticipated to be a significant source of noise. Traffic noise is not greatly influenced by lower levels of traffic, such as those associated with the project's construction effort. For example, traffic levels would have to double for traffic noise on adjacent roadways to increase by 3 dBA. The project's construction traffic on adjacent roadways would increase hourly traffic volumes by much less than a factor of two; therefore, the increase in construction related traffic noise would be less than 3 dBA and is not significant.

Table 6-1. Project Construction Noise Levels by Phase

Phase	Equipment[1]			Composite Sound Level[3]	
	Type	Quantity	L_{max} at 50 feet[2]	L_{max} at 150 feet[2]	L_{eq} at 500 feet
Site preparation	Dozer	3	81.7	72.1	64.9
	Loader	4	79.1		
Grading	Scraper	1	83.6	75.5	64.4
	Grader	1	85.0		
	Dozer	1	81.7		
Building construction	Crane	2	80.6	71.1	63.4
	Forklift	3	74.7		
	Generator	1	80.6		
	Loader	3	79.1		
	Welder	1	74.0		
Paving	Paver	2	77.2	70.5	61.6
	Paving equipment	2	77.2		
	Roller	2	80.0		
Architectural coating	Compressor	2	80.6	71.1	60.6

[1] Equipment mix obtained from the CalEEMod emission calculations prepared for the project (HDR 2019).
[2] Measured L_{max} at given reference distance obtained from the 2006 FHWA Roadway Construction Noise Model.
[3] Distance factor determined by the inverse square law defined as 6 dBA per doubling of distance as sound travels away from an idealized point.
L_{eq}=equivalent continuous sound level; L_{max}=maximum A-weighted sound level

6.1.2 Vibration

Construction activities generate ground-borne vibration when heavy equipment travels over unpaved surfaces or when it is engaged in soil movement. The effects of ground-borne vibration include discernable movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Vibration-related problems generally occur due to resonances in the structural components of a building because structures amplify ground-borne vibration.

Table 6-2 lists the vibration source amplitudes for construction equipment. As pile driving may be required, the highest reference PPV for the proposed project would be 0.644 inches per second.

Table 6-2. Vibration Source Amplitudes for Construction Equipment

Equipment	PPV at 25 feet (inch/second)	Approximate Lv[1] at 25 feet (VdB)
Pile driver (impact) – upper range	1.518	112
Pile driver (impact) – typical	0.644	104
Pile drive (sonic) – upper range	0.734	105
Pile drive (sonic) – typical	0.170	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall) – in soil	0.008	66
Hydromill (slurry wall) – in rock	0.017	75
Vibratory roller	0.210	94
Hoe ram	0.089	87
Large bulldozer	0.089	87
Caisson drilling	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: FTA 2018

[1] RMS velocity in decibels (VdB) re 1 micro-inch/second

Lv=vibration level; PPV=peak particle velocity; VdB=RMS velocity calculated from vibration level

The church east of the project site would be located approximately 200 feet from the building footprint where pile driving may occur. The FTA vibration guidance provides the following equation to calculate PPV at sensitive receptors:

$$PPV_{equipment} = PPV_{Ref} (25/D)^{n} \text{ (inch/second)}$$

Where:

PPVRef = reference PPV at 25 feet

D = distance from equipment to the receiver in feet

n = 1.5 is a value related to the vibration attenuation rate through ground

Distance attenuation would reduce the construction vibration levels from the proposed project to 0.03 inch/second. This level is lower than the 0.12 inch/second threshold listed in Table 4-6 for buildings extremely susceptible to vibration damage.

For consideration of annoyance or interference with vibration-sensitive activities, the vibration level (Lv) at any distance is calculated using the following formula:

$L_v(D) = L_v(25\ ft) – 30\log(D/25)$

Where:

Lv(D) = Vibration level at distance D

D = distance from equipment to the receiver in feet

Lv(25 ft) = reference vibration level at 25 feet from source

At 200 feet, the pile driver vibration level would be reduced from 104 to 77 VdB. This level would not exceed FTA's daytime annoyance threshold of 78 VdB listed in Table 4-5. Therefore, there would be no impacts from construction vibration.

6.2 Operation

6.2.1 Long-term Traffic Noise Impacts

Project-related long-term vehicular trip increases are anticipated to be minimal when distributed to adjacent street segments. The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate highway traffic-related noise conditions along the roadway segments in the project vicinity. The typical vehicle mix for Southern California was used.

As discussed in Section 3, a 3-dBA increase or decrease is a doubling (or halving) of sound pressure level, and it corresponds to the threshold of change in loudness perceptible in a laboratory environment. In practice, the average person is not able to distinguish a 3-dBA difference in environmental sound outdoors. An increase of 3-dBA is considered to be a significant off-site traffic noise impact requiring mitigation. The City of Long Beach has not established an exterior CNEL noise standard for industrial uses. Therefore, for the purposes of this analysis, a significant on-site traffic noise impact would occur if the interior noise exceeds 45 dBA CNEL.

Existing Year Conditions

Table 5-1 provides the existing year traffic noise levels in the area around the project site. Table 6-3 provides the existing traffic noise level with project conditions on the roadways in the project area.

As shown in Table 6-3, the project-related traffic noise level increase would be 0.2 dBA or less for all analyzed roadway segments. Therefore, no significant off-site traffic noise impacts would occur under existing year conditions. No mitigation measures would be required for off-site land uses.

Table 6-3. Existing With Project Traffic Noise Levels

Roadway Segment	Average Daily Traffic	Centerline to 70 CNEL (feet)	Centerline to 65 CNEL (feet)	Centerline to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	Project Related Increase CNEL (Dba)
Spring Street between California Avenue and Orange Avenue	20,845	<50	147.3	465.7	68.0	0.0
Spring Street between Orange Avenue and Walnut Avenue	21,160	<50	149.5	472.8	68.0	0.0
Orange Avenue between I-405 and Spring Street	17,840	<50	90.9	287.4	65.9	0.2
Orange Avenue between Spring Street and 29th Street	14,275	<50	100.9	318.9	66.3	0.2
Orange Avenue between 29th Street and Willow Street	13,875	<50	98.0	310.0	66.2	0.1
29th Street east of Orange Avenue	680	<50	<50	<50	52.9	0.0

Notes:
CNEL=community noise equivalent level; dBA=A-weighted decibels

Cumulative (2038) Conditions

Table 6-4 provides the traffic noise levels along the roadways adjacent to the project site under the cumulative (2038) without project traffic conditions. Table 6-5 provides the cumulative (2038) traffic noise level with project conditions on the roadways adjacent to the project site.

As shown in Table 6-5, the project-related traffic noise level increase would be 0.2 dBA or less for all analyzed roadway segments. Therefore, no significant off-site traffic noise impacts would occur under the cumulative conditions. No mitigation measures would be required for off-site land uses. The on-site buildings would be located at a distance of approximately 60 feet from the roadway centerline of Spring Street and Orange Avenue. At this distance, based on the noise levels listed in Table 6-5 the buildings along Spring Street would be exposed to an exterior noise level of 70 dBA CNEL, and the buildings along Orange Avenue would be exposed to an exterior noise level of 68 dBA CNEL. Standard building construction provides 25 dBA of exterior to interior noise attenuation when windows are closed and 15 dBA of exterior to interior noise attenuation when windows are open (United States Environmental Protection Agency 1978). All new construction requires some form of mechanical ventilation to ensure that proper indoor air quality is maintained even with all windows and doors closed. Therefore, with windows and doors closed, interior noise levels would be meet the 45 Dba CNEL standard (i.e., 70 dBA – 25 dBA = 45 dBA). In addition, modern industrial building construction would likely provide more than the standard 25 dBA of noise attenuation. Therefore, no exterior mitigation measures are required.

Table 6-4. 2038 Without Project Traffic Volumes

Roadway Segment	Average Daily Traffic	Centerline to 70 CNEL (feet)	Centerline to 65 CNEL (feet)	Centerline to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane
Spring Street between California Avenue and Orange Avenue	25,245	56.4	178.4	564.0	68.8
Spring Street between Orange Avenue and Walnut Avenue	25,590	57.2	180.8	571.7	68.9
Orange Avenue between I-405 and Spring Street	21,480	<50	109.4	346.1	66.7
Orange Avenue between Spring Street and 29th Street	17,365	<50	122.7	388.0	67.2
Orange Avenue between 29th Street and Willow Street	17,165	<50	121.3	383.5	67.1
29th Street east of Orange Avenue	810	<50	<50	<50	53.7

Notes:
CNEL=community noise equivalent level; dBA=A-weighted decibels

Table 6-5. 2038 With Project Traffic Volumes

Roadway Segment	Average Daily Traffic	Centerline to 70 CNEL (feet)	Centerline to 65 CNEL (feet)	Centerline to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	Project-Related Increase CNEL (dBA)
Spring Street between California Avenue and Orange Avenue	25,395	56.7	179.4	567.4	68.8	0.0
Spring Street between Orange Avenue and Walnut Avenue	25,810	57.7	182.4	576.6	68.9	0.0
Orange Avenue between I-405 and Spring Street	22,145	<50	112.8	356.8	66.8	0.1
Orange Avenue between Spring Street and 29th Street	17,985	<50	127.1	401.8	67.3	0.2
Orange Avenue between 29th Street and Willow Street	17,555	<50	124.0	392.2	67.2	0.1
29th Street east of Orange Avenue	810	<50	<50	<50	53.7	0.0

Notes:
CNEL=community noise equivalent level; dBA=A-weighted decibels

6.2.2 Stationary Noise Impacts

Project operation would result in some acoustic emissions but would not result in vibration emissions. On-site stationary noise would include building heating, ventilation, and air conditioning systems, parking lot usage, including door closing/slamming, horn honking, and car alarms, and on-site truck movements. Heating, ventilation, and air conditioning systems typically result in noise levels that average between 50 and 60 dBA L_{max} at 50 feet from the equipment. Parking lots typically generate noise levels of up to 70 dBA L_{max} at 50 feet. Truck movements typically generate noise levels of up to 75 dBA L_{max} at 50 feet. The closest sensitive receptors to the project site, the church to the east, are located within 150 feet of the on-site stationary sources. Distance attenuation would reduce the on-site stationary noise by 10 dB to 65 dBA L_{max}. Therefore, the proposed project's stationary source noise impacts would be lower than the City of Long Beach's District One daytime threshold of 70 dBA L_{max} (Table 4-3).

6.2.3 Airport Noise Impacts

The project site is located approximately 1 mile west of the Long Beach Airport. Although located within 2 miles of the airport, based on the airport's influence area map, the project site would be located outside of the 65 dBA CNEL noise contour. Therefore, aircraft noise levels would be below a level of significance.

7 Mitigation Measures

7.1 Construction Noise

Construction shall be limited to the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday and Saturdays between 9:00 a.m. and 6:00 p.m., in accordance with City of Long Beach standards. No construction activities shall occur outside of these hours or on federal holidays. Construction work on Sundays is prohibited unless the City of Long Beach's Noise Control Officer issues a permit. The permit may allow work on Sundays between 9:00 a.m. and 6:00 p.m.

The following measures shall be implemented to reduce potential construction noise impacts on nearby sensitive receptors.

1. During all site excavation and grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.
2. The project contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.
3. The construction contractor shall locate equipment staging in areas that would create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

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8 Conclusion

Project construction and operational noise and vibration were calculated and compared with applicable laws, guidelines, and/or regulations. Restricting construction activity to daytime hours (7:00 a.m. to 7:00 p.m. Monday through Friday, 9:00 a.m. and 6:00 p.m. on Saturdays, or by permit on Sundays 9:00 a.m. to 6:00 p.m.) would reduce the noise and vibration impacts to below a level of significance.

Operational noise is not predicted to result in an increase in received noise levels at nearby noise sensitive receptors. On-site uses would not be exposed to significant traffic noise levels.

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9 References

California Department of Transportation. 2002. *Transportation Related Earthborne Vibration.* Sacramento, California.

City of Long Beach. 1975. City of Long Beach General Plan. Noise Element. Website: http://www.lbds.info/noise_element_update/ (Accessed February 2019).

Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual*. Website: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf (Accessed February 2019).

HDR. 2019. *Air Quality and Greenhouse Gas Technical Memorandum*. Draft. Prepared for the City of Long Beach.

Governor's Office of Planning and Research. 2017. *Guidelines for the Preparation and Content of the Noise Element of the General Plan*. Appendix D in the State of California General Plan Guidelines. Sacramento, CA.

Governor's Office of Planning and Research and the Natural Resources Agency. 2018. *California Environmental Quality Act Statues and Guidelines*. Website: http://opr.ca.gov/ceqa/updates/guidelines/ (Accessed February 2019).

Linscott Law & Greenspan. 2019. *Spring Street Industrial Traffic Impact Analysis*.

Signal Hill Petroleum. 2018. City Application: Site Plan. August

United States Environmental Protection Agency. 1978. *Protective Noise Levels: Condensed Version of EPA Levels Document*.

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Appendix A. Traffic and Construction Noise Calculations

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Site Prep
Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 03/07/2019
Case Description: Site Preparation

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Lmax	Residential	60.0	50.0	55.0

Description	Impact Device	Usage (%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	150.0	0.0
Dozer	No	40		81.7	150.0	0.0
Dozer	No	40		81.7	150.0	0.0
Dozer	No	40		81.7	150.0	0.0
Front End Loader	No	40		79.1	150.0	0.0
Front End Loader	No	40		79.1	150.0	0.0
Front End Loader	No	40		79.1	150.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Front End Loader	69.6	65.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	72.1	68.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	72.1	68.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	72.1	68.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	69.6	65.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Site Prep

N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Front End Loader		69.6	65.6		N/A	N/A	N/A	N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Front End Loader		69.6	65.6		N/A	N/A	N/A	N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
	Total	72.1	75.3		N/A	N/A	N/A	N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

**** Receptor #2 ****

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Church - Leq	Residential	60.0	50.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	500.0	0.0
Dozer	No	40		81.7	500.0	0.0
Dozer	No	40		81.7	500.0	0.0
Dozer	No	40		81.7	500.0	0.0
Front End Loader	No	40		79.1	500.0	0.0
Front End Loader	No	40		79.1	500.0	0.0
Front End Loader	No	40		79.1	500.0	0.0

Results

										Noise Limits (dBA)		Noise Limit Exceedance (dBA)	
		Calculated (dBA)				Day		Evening					
Night		Day		Evening		Night							
Equipment		Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq				
Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq						
Front End Loader		59.1	55.1		N/A	N/A	N/A	N/A					
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Dozer		61.7	57.7		N/A	N/A	N/A	N/A					
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Dozer		61.7	57.7		N/A	N/A	N/A	N/A					
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						

Site Prep

Dozer			61.7	57.7		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A		N/A		N/A					
Front End Loader			59.1	55.1		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A		N/A		N/A					
Front End Loader			59.1	55.1		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A		N/A		N/A					
Front End Loader			59.1	55.1		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A		N/A		N/A					
	Total		61.7	64.9		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A		N/A		N/A					

**** Receptor #3 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
		0.0	0.0	0.0

Description	Impact Device	Usage (%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	0.0	0.0
Dozer	No	40		81.7	0.0	0.0
Dozer	No	40		81.7	0.0	0.0
Dozer	No	40		81.7	0.0	0.0
Front End Loader	No	40		79.1	0.0	0.0
Front End Loader	No	40		79.1	0.0	0.0
Front End Loader	No	40		79.1	0.0	0.0

Results

(dBA)	Noise Limit Exceedance (dBA)	Noise Limits

	Calculated (dBA)				Day		Evening		Night	
	Day		Evening		Night					
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Front End Loader			-4.0		N/A		N/A		N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Dozer			-4.0		N/A		N/A		N/A	

				Site Prep					
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Dozer				-4.0	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Dozer				0.0		0.0		0.0	
	0.0		0.0		0.0		0.0		
Front End Loader				0.0		0.0		0.0	
	0.0		0.0		0.0		0.0		
Front End Loader				0.0		0.0		0.0	
	0.0		0.0		0.0		0.0		
Front End Loader				0.0		0.0		0.0	
	0.0		0.0		0.0		0.0		
	Total		0.0	0.8	N/A	N/A	N/A	N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

Grading
Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 03/20/2019
Case Description: Grading

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Lmax	Residential	60.0	50.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Scraper	No	40		83.6	150.0	0.0
Grader	No	40	85.0		150.0	0.0
Dozer	No	40		81.7	150.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Calculated (dBA)

Equipment	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Scraper	74.0	70.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	75.5	71.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	72.1	68.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	75.5	74.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night

		Grading		
Church - Leq	Residential	60.0	50.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Scraper	No	40		83.6	500.0	0.0
Grader	No	40	85.0		500.0	0.0
Dozer	No	40		81.7	500.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Calculated (dBA)				Day		Evening	
Night		Day		Evening		Night	
		Lmax	Leq	Lmax	Leq	Lmax	Leq
Equipment							
Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Scraper		63.6	59.6	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader		65.0	61.0	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer		61.7	57.7	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total		65.0	64.4	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #3 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
		0.0	0.0	0.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)

		Grading				
Scraper	No	40		83.6	0.0	0.0
Grader	No	40	85.0		0.0	0.0
Dozer	No	40		81.7	0.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Calculated (dBA)	Day		Evening		Night	
	Lmax	Leq	Lmax	Leq	Lmax	Leq
Equipment						
Scraper		-4.0	N/A	N/A	N/A	N/A
Grader		-4.0	N/A	N/A	N/A	N/A
Dozer		-4.0	N/A	N/A	N/A	N/A
Total	0.0	3.8	N/A	N/A	N/A	N/A

Day		Evening		Night	
Lmax	Leq	Lmax	Leq	Lmax	Leq
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Building Construction
Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 03/20/2019
Case Description: Building Construction

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Lmax	Residential	60.0	50.0	55.0

Description	Impact Device	Usage (%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	150.0	0.0
Front End Loader	No	40		79.1	150.0	0.0
Crane	No	16		80.6	150.0	0.0
Welder / Torch	No	40		74.0	150.0	0.0
Front End Loader	No	40		79.1	150.0	0.0
Generator	No	50		80.6	150.0	0.0
Man Lift	No	20		74.7	150.0	0.0
Crane	No	16		80.6	150.0	0.0
Man Lift	No	20		74.7	150.0	0.0
Man Lift	No	20		74.7	150.0	0.0

Results

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Front End Loader	69.6	65.6	N/A	N/A	N/A	N/A												
Front End Loader	69.6	65.6	N/A	N/A	N/A	N/A												
Crane	71.0	63.0	N/A	N/A	N/A	N/A												

Building Construction

Welder / Torch			64.5	60.5		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
Front End Loader			69.6	65.6		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
Generator			71.1	68.1		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
Man Lift			65.2	58.2		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
Crane			71.0	63.0		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
Man Lift			65.2	58.2		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
Man Lift			65.2	58.2		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				
	Total		71.1	73.9		N/A		N/A		N/A		N/A
N/A	N/A		N/A	N/A		N/A		N/A				

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Leq	Residential	60.0	50.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	500.0	0.0
Front End Loader	No	40		79.1	500.0	0.0
Crane	No	16		80.6	500.0	0.0
Welder / Torch	No	40		74.0	500.0	0.0
Front End Loader	No	40		79.1	500.0	0.0
Generator	No	50		80.6	500.0	0.0
Man Lift	No	20		74.7	500.0	0.0
Crane	No	16		80.6	500.0	0.0
Man Lift	No	20		74.7	500.0	0.0
Man Lift	No	20		74.7	500.0	0.0

Results

Calculated (dBA)			Noise Limits (dBA)		
Day	Evening	Night	Day	Evening	Night

Noise Limit Exceedance (dBA)

Building Construction

Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Front End Loader	59.1	55.1	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	59.1	55.1	N/A	N/A	N/A	N/A	N/A	N/A
Crane	60.6	52.6	N/A	N/A	N/A	N/A	N/A	N/A
Welder / Torch	54.0	50.0	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	59.1	55.1	N/A	N/A	N/A	N/A	N/A	N/A
Generator	60.6	57.6	N/A	N/A	N/A	N/A	N/A	N/A
Man Lift	54.7	47.7	N/A	N/A	N/A	N/A	N/A	N/A
Crane	60.6	52.6	N/A	N/A	N/A	N/A	N/A	N/A
Man Lift	54.7	47.7	N/A	N/A	N/A	N/A	N/A	N/A
Man Lift	54.7	47.7	N/A	N/A	N/A	N/A	N/A	N/A
Total	60.6	63.4	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #3 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
		0.0	0.0	0.0

Description	Impact Device	Usage (%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	0.0	0.0
Front End Loader	No	40		79.1	0.0	0.0
Crane	No	16		80.6	0.0	0.0
Welder / Torch	No	40		74.0	0.0	0.0
Front End Loader	No	40		79.1	0.0	0.0
Generator	No	50		80.6	0.0	0.0
Man Lift	No	20		74.7	0.0	0.0
Crane	No	16		80.6	0.0	0.0
Man Lift	No	20		74.7	0.0	0.0

		Building Construction			
Man Lift	No	20	74.7	0.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Front End Loader		-4.0		N/A		N/A		N/A		N/A		N/A
Front End Loader		-4.0		N/A		N/A		N/A		N/A		N/A
Crane		-4.0		N/A		N/A		N/A		N/A		N/A
Welder / Torch		-4.0		N/A		N/A		N/A		N/A		N/A
Front End Loader		-4.0		N/A		N/A		N/A		N/A		N/A
Generator		-3.0		N/A		N/A		N/A		N/A		N/A
Man Lift		-7.0		N/A		N/A		N/A		N/A		N/A
Crane		-8.0		N/A		N/A		N/A		N/A		N/A
Man Lift		-7.0		N/A		N/A		N/A		N/A		N/A
Man Lift		-7.0		N/A		N/A		N/A		N/A		N/A
Total	0.0	4.6		N/A		N/A		N/A		N/A		N/A

Arch Coating
Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 03/20/2019
Case Description: Architectural Coating

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Lmax	Residential	60.0	50.0	55.0

Description	Impact Device	Usage (%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Generator	No	50		80.6	150.0	0.0
Generator	No	50		80.6	150.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Generator		71.1	68.1		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Generator		71.1	68.1		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total		71.1	71.1		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Leq	Residential	60.0	50.0	55.0

Arch Coating

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Generator	No	50		80.6	500.0	0.0
Generator	No	50		80.6	500.0	0.0

Results

(dBA) Noise Limits

Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Generator	60.6	57.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Generator	57.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	60.6	57.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #3 ****

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
		0.0	0.0	0.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Generator	No	50		80.6	0.0	0.0
Generator	No	50		80.6	0.0	0.0

Results

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Generator			-3.0	N/A	N/A	N/A	N/A	N/A										
Generator			-3.0	N/A	N/A	N/A	N/A	N/A										
Total	0.0	-3.0	N/A	N/A	N/A	N/A	N/A	N/A										

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 03/07/2019
Case Description: Paving

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Lmax	Residential	60.0	50.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	150.0	0.0
Paver	No	50		77.2	150.0	0.0
Paver	No	50		77.2	150.0	0.0
Paver	No	50		77.2	150.0	0.0
Roller	No	20		80.0	150.0	0.0
Roller	No	20		80.0	150.0	0.0

Results

Noise Limits (dBA)

Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Paver		67.7	64.7		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver		67.7	64.7		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver		67.7	64.7		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver		67.7	64.7		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roller		70.5	63.5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Paving

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Roller	70.5	63.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	70.5	72.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Church - Leq	Residential	60.0	50.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	500.0	0.0
Paver	No	50		77.2	500.0	0.0
Paver	No	50		77.2	500.0	0.0
Paver	No	50		77.2	500.0	0.0
Roller	No	20		80.0	500.0	0.0
Roller	No	20		80.0	500.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Paver	57.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver	57.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver	57.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver	57.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roller	60.0	53.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Paving
Roller 60.0 53.0 N/A N/A N/A N/A
N/A N/A N/A N/A N/A N/A N/A N/A
Total 60.0 61.6 N/A N/A N/A N/A
N/A N/A N/A N/A N/A N/A N/A N/A

**** Receptor #3 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
		0.0	0.0	0.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	0.0	0.0
Paver	No	50		77.2	0.0	0.0
Paver	No	50		77.2	0.0	0.0
Paver	No	50		77.2	0.0	0.0
Roller	No	20		80.0	0.0	0.0
Roller	No	20		80.0	0.0	0.0

Results

Noise Limits
(dBA) Noise Limit Exceedance (dBA)

Calculated (dBA) Day Evening
Night Day Evening Night

Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Paver					-3.0		N/A		N/A		N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Paver					-3.0		N/A		N/A		N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Paver					-3.0		N/A		N/A		N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Paver					-3.0		N/A		N/A		N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Roller					-7.0		N/A		N/A		N/A	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					

				Paving											
Roller				-7.0		N/A		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A	N/A		N/A		N/A						
		Total		0.0		3.8		N/A		N/A		N/A		N/A	
N/A	N/A		N/A	N/A	N/A		N/A		N/A						

FHWA Noise Model

Project Name: Spring Street
Year: Existing

Roadway Link	ADT	AHW	Speed	Hard or Soft Site? (H or S)	CNEL at 50ft from Centerline of Outside Lane	CNEL 50 feet from Centerline	Centerline to 70 dBA CNEL Countour	Centerline to 65 dBA CNEL Countour	Centerline to 60 dBA CNEL Countour
Spring Street between California Avenue and Orange Avenue	20,695	24	40	H	67.9	69.7	<50	146.2	462.4
Spring Street between Orange Avenue and Walnut Avenue	20,940	24	40	H	68.0	69.7	<50	147.9	467.8
Orange Avenue between I-405 and Spring Street	17,175	24	35	H	65.7	67.4	<50	87.5	276.7
Orange Avenue between Spring Street and 29th Street	13,655	24	40	H	66.1	67.9	<50	96.5	305.1
Orange Avenue between 29th Street and Willow Street	13,485	24	40	H	66.1	67.8	<50	95.3	301.3
29th Street east of Orange Avenue	680	6	35	H	52.9	53.4	<50	<50	<50

FHWA Noise Model

Project Name: Spring Street
Year: Existing Plus Project

Roadway Link	ADT	AHW	Speed	Hard or Soft Site? (H or S)	CNEL at 50ft from Centerline of Outside Lane	CNEL 50 feet from Centerline	Centerline to 70 dBA CNEL Countour	Centerline to 65 dBA CNEL Countour	Centerline to 60 dBA CNEL Countour	Increase from No Build
Spring Street between California Avenue and Orange Avenue	20,845	24	40	H	68.0	69.7	<50	147.3	465.7	0.0
Spring Street between Orange Avenue and Walnut Avenue	21,160	24	40	H	68.0	69.8	<50	149.5	472.8	0.0
Orange Avenue between I-405 and Spring Street	17,840	24	35	H	65.9	67.6	<50	90.9	287.4	0.2
Orange Avenue between Spring Street and 29th Street	14,275	24	40	H	66.3	68.0	<50	100.9	318.9	0.2
Orange Avenue between 29th Street and Willow Street	13,875	24	40	H	66.2	67.9	<50	98.0	310.0	0.1
29th Street east of Orange Avenue	680	6	35	H	52.9	53.4	<50	<50	<50	0.0
										0.0

FHWA Noise Model

Project Name: Spring Street
Year: 2038 No Project

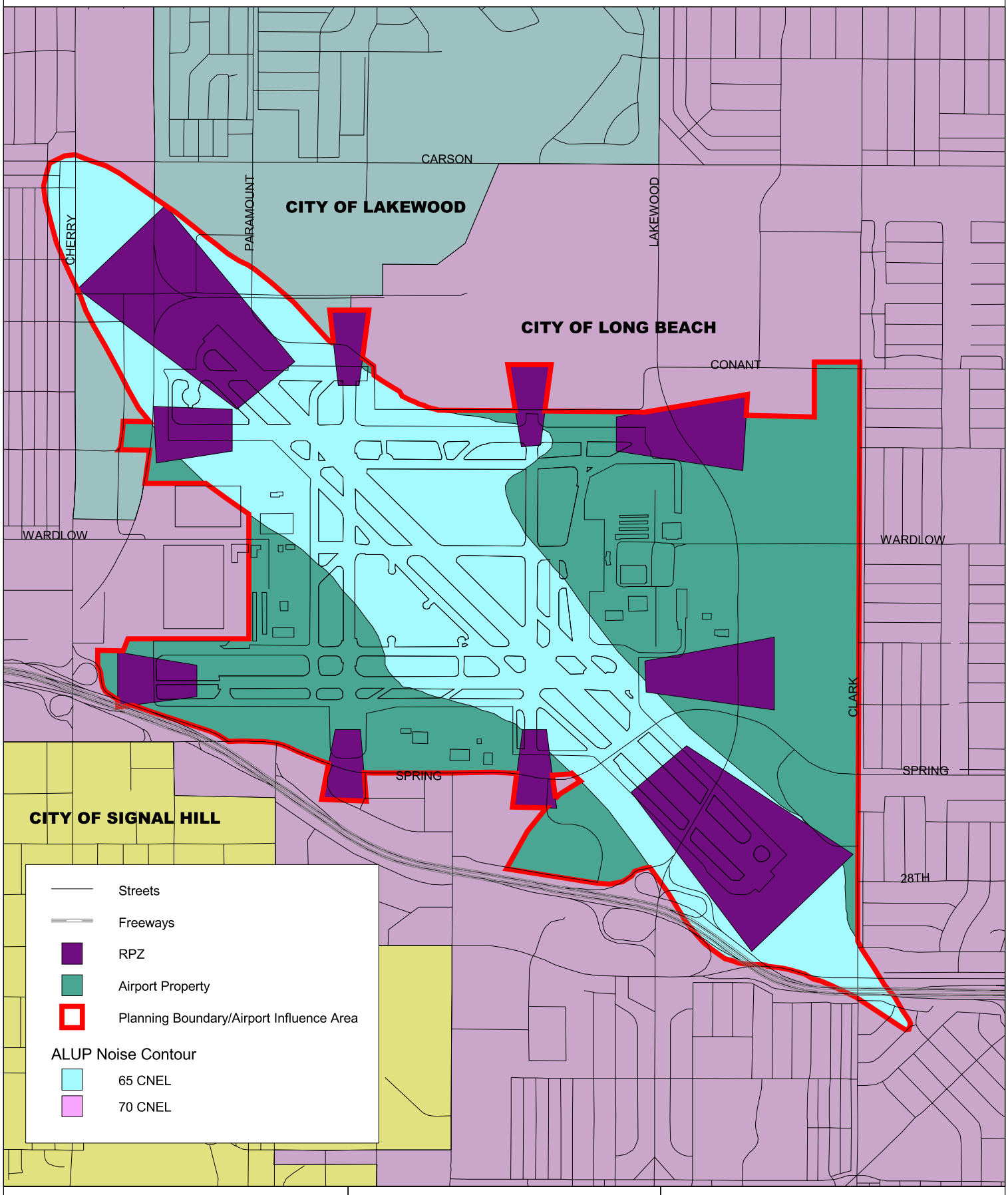
Roadway Link	ADT	AHW	Speed	Hard or Soft Site? (H or S)	CNEL at 50ft from Centerline of Outside Lane	CNEL 50 feet from Centerline	Centerline to 70 dBA CNEL Countour	Centerline to 65 dBA CNEL Countour	Centerline to 60 dBA CNEL Countour
Spring Street between California Avenue and Orange Avenue	25,245	24	40	H	68.8	70.5	56.4	178.4	564.0
Spring Street between Orange Avenue and Walnut Avenue	25,590	24	40	H	68.9	70.6	57.2	180.8	571.7
Orange Avenue between I-405 and Spring Street	21,480	24	35	H	66.7	68.4	<50	109.4	346.1
Orange Avenue between Spring Street and 29th Street	17,365	24	40	H	67.2	68.9	<50	122.7	388.0
Orange Avenue between 29th Street and Willow Street	17,165	24	40	H	67.1	68.8	<50	121.3	383.5
29th Street east of Orange Avenue	810	6	35	H	53.7	54.2	<50	<50	<50

FHWA Noise Model

Project Name: Spring Street
Year: 2038 Plus Project

Roadway Link	ADT	AHW	Speed	Hard or Soft Site? (H or S)	CNEL at 50ft from Centerline of Outside Lane	CNEL 50 feet from Centerline	Centerline to 70 dBA CNEL Countour	Centerline to 65 dBA CNEL Countour	Centerline to 60 dBA CNEL Countour	Increase from No Build
Spring Street between California Avenue and Orange Avenue	25,395	24	40	H	68.8	70.5	56.7	179.4	567.4	0.0
Spring Street between Orange Avenue and Walnut Avenue	25,810	24	40	H	68.9	70.6	57.7	182.4	576.6	0.0
Orange Avenue between I-405 and Spring Street	22,145	24	35	H	66.8	68.5	<50	112.8	356.8	0.1
Orange Avenue between Spring Street and 29th Street	17,985	24	40	H	67.3	69.1	<50	127.1	401.8	0.2
Orange Avenue between 29th Street and Willow Street	17,555	24	40	H	67.2	68.9	<50	124.0	392.2	0.1
29th Street east of Orange Avenue	810	6	35	H	53.7	54.2	<50	<50	<50	0.0
										0.0

LONG BEACH AIRPORT



LOS ANGELES COUNTY
AIRPORT LAND USE COMMISSION
320 W. Temple Street
Los Angeles, CA 90012
(213) 974-6425

AIRPORT INFLUENCE AREA

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5/13/03

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