Appendix H

Noise Technical Report

DRAFT

Noise Technical Report

SDSU Evolve Student Housing Project

DECEMBER 2024

Prepared for:

SAN DIEGO STATE UNIVERSITY
5500 Campanile Drive
San Diego, California 92182
Contact: Kara Peterson

Prepared by:

DUDEK

605 Third Street
Encinitas, California 92024
Contact: Nick Segovia

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Table of Contents

TABLES

EXHIBITS

FIGURES

APPENDICES

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
ADT	average daily traffic
Caltrans	California Department of Transportation
City	City of San Diego
CEQA	California Environmental Quality Act
CNEL	community noise equivalent level
dB	decibel
dBA	A-weighted decibel
FTA	Federal Transit Administration
HVAC	heating, ventilating, and air-conditioning
ips	inches per second
L_{90}	90% statistical sound level
L_{eq}	equivalent noise level
LT	long-term
MM	Mitigation Measure
Project or Proposed Project	SDSU Evolve Student Housing Project
PPV	peak particle velocity
SDSU	San Diego State University
SPL	sound pressure level
ST	short-term

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1 Introduction

1.1 Report Purpose and Scope

The purpose of this technical report is to assess the potential noise impacts associated with the construction and operation of the proposed San Diego State University (SDSU) Evolve Student Housing Project (Project or Proposed Project) located in the City of San Diego (City). This analysis was conducted pursuant to the California Environmental Quality Act (CEQA) and utilizes the significance criterion/thresholds in CEQA Guidelines Appendix G, Noise, and other applicable thresholds of significance (e.g., the California Department of Transportation [Caltrans]).

1.2 Regional and Local Setting

The SDSU campus is located along the Interstate 8 corridor, approximately 8 miles from downtown San Diego (see Figure 1, Regional Map, and Figure 2, Vicinity Map). The campus is located within the College Area Community of the City. The College Area Community is characterized by SDSU as a major hub of activity, with single-family and multifamily residential uses and neighborhood commercial developments that serve the surrounding community, including SDSU.

The Proposed Project consists of two components, the Peninsula Component and the University Towers East Component. The proposed Peninsula Component would be located within the approximately 10.3-acre site at the northern terminus of 55th Steet, at the northwest portion of campus just south of Interstate 8 and west of Canyon Crest Drive. The proposed University Towers East Component would be located on an approximately 1.1-acre site on Montezuma Road that is currently utilized as a parking lot (see Figure 2).

The SDSU campus can be accessed from the north by College Avenue, which also provides local access to Interstate 8. The campus can be accessed from the east or west by Montezuma Road, an east–west roadway near the southern boundary of the campus, and accessed from the south via College Avenue.

1.3 Project Description

The proposed Peninsula Component would be located on an approximately 10.3-acre site adjacent to the northwest portion of campus, just south of Interstate 8 and west of Canyon Crest Drive. Development of the Peninsula Component would include demolition of all 13 existing buildings, which presently provide housing for 702 students, and the subsequent phased development of one 9-story student housing building and five student housing buildings up to 13 stories in height that would contain a total of approximately 4,450 student beds. The Peninsula Component would also include the development of a 2-story amenities building for food service and program space. The proposed University Towers East Component would be developed on an approximately 1.1-acre site located immediately east of the existing University Towers Building, south of Montezuma Road. The existing parking lot would be demolished to allow for redevelopment of the site to include a new 9-story student housing building that would accommodate approximately 720 students.

Development of the Proposed Project would result in approximately 5,170 new student beds, a net increase of approximately 4,468 student beds to the main campus inventory.

1.4 Fundamentals of Noise and Vibration

The following is a brief discussion of fundamental noise concepts and terminology.

1.4.1 Sound, Noise, and Acoustics

Sound is actually a process that consists of three components: the sound source, sound path, and sound receiver. All three components must be present for sound to exist. Without a source to produce sound, there is no sound. Similarly, without a medium to transmit sound pressure waves, there is no sound. Finally, sound must be received; a hearing organ, sensor, or object must be present to perceive, register, or be affected by sound or noise. In most situations, there are many different sound sources, paths, and receptors rather than just one of each. Acoustics is the field of science that deals with the production, propagation, reception, effects, and control of sound. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired.

1.4.2 Sound Pressure Levels and Decibels

The amplitude of a sound determines its loudness. Loudness of sound increases with increasing amplitude. Sound pressure amplitude is measured in units of micronewton per square meter, also called micropascals. One micropascal is approximately one-hundred billionth (0.00000000001) of normal atmospheric pressure. The pressure of a very loud sound may be 200 million micropascals, or 10 million times the pressure of the weakest audible sound. Because expressing sound levels in terms of micropascals would be very cumbersome, sound pressure level (SPL) in logarithmic units is used instead to describe the ratio of actual sound pressure to a reference pressure squared. These units are called Bels. To provide a finer resolution, a Bel is subdivided into 10 decibels (dB).

1.4.3 A-Weighted Sound Level

Sound pressure level alone is not a reliable indicator of loudness. The frequency, or pitch, of a sound also has a substantial effect on how humans will respond. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness, or human response, is determined by the characteristics of the human ear.

Human hearing is limited not only in the range of audible frequencies, but also in the way it perceives the sound in that range. In general, the healthy human ear is most sensitive to sounds between 1,000 and 5,000 hertz, and it perceives a sound within that range as more intense than a sound of higher or lower frequency with the same magnitude. To approximate the frequency response of the human ear, a series of sound level adjustments is usually applied to the sound measured by a sound level meter. The adjustments (referred to as a weighting network) are frequency-dependent.

The A-scale weighting network approximates the frequency response of the average young ear when listening to ordinary sounds. When people make judgments about the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special situations (e.g., B-scale, C-scale, D-scale), but these scales are rarely used in conjunction with most environmental noise evaluations. Noise levels are typically reported in terms of A-weighted sound levels. All sound levels discussed in this report are A-weighted decibels (dBA). Examples of typical noise levels for common indoor and outdoor activities are depicted in Table 1.

Table 1. Typical Sound Levels in the Environment and Industry

Common Outdoor Activities	Noise Level (dB)	Common Indoor Activities
Diesel truck at 15 meters (50 feet), at 80 kilometers per hour (50 miles per hour)	80	Food blender at 1 meter (3 feet); garbage disposal at 1 meter (3 feet)
Noisy urban area, daytime; gas lawn mower at 30 meters (100 feet)	70	Vacuum cleaner at 3 meters (10 feet)
Commercial area; heavy traffic at 90 meters (300 feet)	60	Normal speech at 1 meter (3 feet)
Quiet urban, daytime	50	Large business office; dishwasher next room
Quiet urban, nighttime	40	Theater; large conference room (background)
Quiet suburban, nighttime	30	Library
Quiet rural, nighttime	20	Bedroom at night; concert hall (background)
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Source: Caltrans 2013.
Note: dB = decibels.

1.4.4 Human Response to Changes in Noise Levels

Under controlled conditions in an acoustics laboratory, the trained, healthy human ear is able to discern changes in sound levels of 1 dBA when exposed to steady, single-frequency signals in the mid-frequency range. But for outdoor conditions, a change of 3 dB is considered “barely perceptible” (Caltrans 2013). Since a doubling of sound energy results in a 3 dB increase in sound, this means that a doubling of sound energy (e.g., doubling the volume of traffic on a road) would result in a barely perceptible change in sound level. A change of 5 dBA is readily perceptible, and a change of 10 dBA is perceived as twice (if a gain) or half (if a loss) as loud (Caltrans 2013).

1.4.5 Noise Descriptors

Units of measure have been developed to evaluate the long-term characteristics of sound. The energy-equivalent sound level (L_{eq}) is also referred to as the time-average sound level. It is the equivalent steady-state or constant sound level that in a stated period of time would contain the same acoustical energy as the time-varying sound level during the same time period. For instance, the 1-hour A-weighted L_{eq} is the energy average of the A-weighted sound levels occurring during a 1-hour period.

People are generally more sensitive to and thus potentially more annoyed by noise occurring during the evening and nighttime hours. Hence, another noise descriptor used in community noise assessments—the community noise equivalent level (CNEL)—represents a time-weighted, 24-hour average noise level based on the A-weighted sound level. However, unlike an unmodified 24-hour L_{eq} value, the CNEL descriptor accounts for increased noise sensitivity during the evening (7:00 p.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) by adding 5 dBA and 10 dBA, respectively, to the average sound levels occurring during these defined hours within a 24-hour period.

1.4.6 Sound Propagation

Sound propagation (i.e., the traversal of sound from a noise emission source position to a receiver location) is influenced by multiple factors that include geometric spreading, ground absorption, atmospheric effects, and occlusion by natural terrain and/or features of the built environment.

Sound levels attenuate (or diminish) geometrically at a rate of approximately 6 dBA per doubling of distance from an outdoor point-type source due to the spherical spreading of sound energy with increasing distance traveled. The effects of atmospheric conditions such as humidity, temperature, and wind gradients are typically distance-dependent and can also temporarily either increase or decrease sound levels measured or perceived at a receptor location. In general, the greater the distance the receiver is from the source of sound emission, the greater the potential for variation in sound levels at the receptor due to these atmospheric effects. Additional attenuation can result from sound path occlusion and diffraction due to intervention of natural (ridgelines, dense forests, etc.) and built features (such as solid walls, buildings and other structures).

1.4.7 Ground-Borne Vibration Fundamentals

Ground-borne vibration is fluctuating or oscillatory motion transmitted through the ground mass (i.e., soils, clays, and rock strata). The strength of ground-borne vibration attenuates rapidly over distance. Some soil types transmit vibration quite efficiently; other types (primarily sandy soils) do not. Several basic measurement units are commonly used to describe the intensity of ground vibration. The descriptors used by the Federal Transit Administration (FTA) include peak particle velocity (PPV) that is in units of inches per second (ips). The calculation to determine PPV at a given distance is as follows:

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

Where:

$PPV_{distance}$ = the peak particle velocity in inches per second of the equipment adjusted for distance

PPV_{ref} = the reference vibration velocity in inches per second at 25 feet

D = the distance from the equipment to the receiver (in feet)

2 Regulatory Setting

The following subsections summarize relevant laws, ordinances, regulations, policies, standards, and guidance that establish noise and vibration impact significance assessment criteria for the Proposed Project.

2.1 Federal

Federal Transit Administration

In its Transit Noise and Vibration Impact Assessment guidance manual, the FTA recommends a daytime construction noise level threshold of 80 dBA L_{eq} over an 8-hour period (FTA 2018), when detailed construction noise assessments are performed to evaluate potential impacts to community residences surrounding a project. Although this FTA guidance is not a regulation, it can serve as a quantified standard in the absence of such noise limits at the state and local jurisdictional levels.

With respect to vibration, Table 2 presents FTA guidance thresholds for assessing building damage risk and human annoyance. Similar to the guidance for construction noise, the values in Table 2 represent recommended assessment guidance when local regulations lack such standards.

Table 2. Federal Transit Administration Vibration Threshold Guidance

Vibration Receptor	Vibration Assessment Metric	
	Peak Particle Velocity (PPV, ips)	Approximate Root Mean Square VdB*
Potential Damage to Structures by Building/Structural Category		
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90
Residential Building Occupant Human Response		
Frequent events *(more than 70 events per day)*		72
Occasional events *(30–70 events per day)*		75
Infrequent events *(fewer than 30 events per day)*		80
Institutional Land Use (Primarily Daytime Use) Occupant Human Response		
Frequent events *(more than 70 events per day)*		75
Occasional events *(30–70 events per day)*		78
Infrequent events *(fewer than 30 events per day)*		83

Source: FTA 2018.
Notes: PPV = peak particle velocity; ips = inches per second; VdB = vibration decibels.
* Root mean square VdB is calculated from the PPV using a crest factor of 4 and is with respect to 1 micro-inch per second.

2.2 State

2.2.1 California Department of Transportation – Vibration

In its Transportation and Construction Vibration Guidance Manual (Caltrans 2020), Caltrans recommends 0.5 ips PPV as a threshold for the avoidance of structural damage to typical newer residential buildings exposed to continuous or frequent intermittent sources of ground-borne vibration. For transient vibration events, such as blasting, the damage risk threshold would be 1.0 ips PPV (Caltrans 2020) at the same type of newer residential structures. For older structures, these guidance thresholds would be more stringent: 0.3 ips PPV for continuous/intermittent vibration sources, and 0.5 ips PPV for transient vibration events. With respect to human annoyance, Caltrans guidance indicates that building occupants exposed to continuous ground-borne vibration in the range of 0.1 ips PPV ("strongly perceptible") to 0.4 ips PPV ("severe") would find it "annoying" at 0.2 ips PPV and "unpleasant" at the 0.4 ips PPV value. Although these Caltrans guidance thresholds are not regulations, they can serve as quantified standards in the absence of such limits at the local jurisdictional level.

2.3 Local/Regional

The noise limits outlined in Table 3 reflect generally applicable standards for sound levels in the region. While the Project is not required to adhere to local or regional standards, the guidelines presented in Table 3 are used in the analysis because they provide the most relevant guidelines for evaluating noise impacts. The limits specify that the 1-hour average sound level should not exceed the values indicated in the table at any location on or beyond the boundaries of the property where the noise is generated.

Table 3. Noise Guidelines

Land Use	Time of Day	One-Hour A-weighted Average Sound Level (dBA)
Single-family residential	7:00 a.m. to 7:00 p.m.	50
	7:00 p.m. to 10:00 p.m.	45
	10:00 p.m. to 7:00 a.m.	40
Multifamily residential (up to a maximum density of 1/2,000)	7:00 a.m. to 7:00 p.m.	55
	7:00 p.m. to 10:00 p.m.	50
	10:00 p.m. to 7:00 a.m.	45
All other residential	7:00 a.m. to 7:00 p.m.	60
	7:00 p.m. to 10:00 p.m.	55
	10:00 p.m. to 7:00 a.m.	50
Commercial	7:00 a.m. to 7:00 p.m.	65
	7:00 p.m. to 10:00 p.m.	60
	10:00 p.m. to 7:00 a.m.	60
Industrial or agricultural	Any time	75

Note: dBA = A-weighted decibels.

As to construction noise, absent a special permit, it is generally held throughout the state that construction activities that generate noise be limited to the hours between 7:00 a.m. and 7:00 p.m., Monday through Saturday, and excluding legal holidays. During the permissible hours, noise levels at or beyond the property lines of any property zoned residential should not exceed an average sound level greater than 75 dBA during the 12-hour period from 7:00 a.m. to 7:00 p.m.

3 Existing Conditions

Field measurements of SPL were conducted near the Proposed Project site on August 27, 2024, to quantify and characterize the existing outdoor ambient sound levels. Table 4 provides the location, date, and time period at which these baseline sound level measurements were performed by an attending Dudek field investigator using a Rion-branded Model NL-62 sound level meter equipped with a 0.5-inch, pre-polarized condenser microphone with pre-amplifier. The sound level meter meets the current American National Standards Institute standard for a Type 1 (Precision Grade) sound level meter. The accuracy of the sound level meter was verified using a field calibrator before and after the measurements, and the measurements were conducted with the microphone positioned approximately 5 feet above the ground.

Four short-term (ST) sound level measurement locations (ST1–ST4) that represent existing noise-sensitive receivers were selected on and near the Proposed Project site. These locations, depicted as receivers ST1–ST4 on Figure 3, Noise Measurement and Modeling Locations, were selected to characterize the baseline outdoor ambient sound levels for City residential noise-sensitive receptors and the traffic noise exposure from Project adjacent roadways (see Figure 3). The measured L_{eq} and maximum sound levels are provided in Table 4. The primary sound sources at the sites identified in Table 4 consisted of traffic along adjacent roadways and conversations/yelling. As shown in Table 4, the measured SPL ranged from approximately 57.8 dBA L_{eq} at ST4 to 69.8 dBA L_{eq} at ST3. Beyond the summarized information presented in Table 4, detailed sound measurement data is included in Appendix A, Baseline Noise Measurement Field Data.

Table 4. Measured Baseline Outdoor Ambient Noise Levels

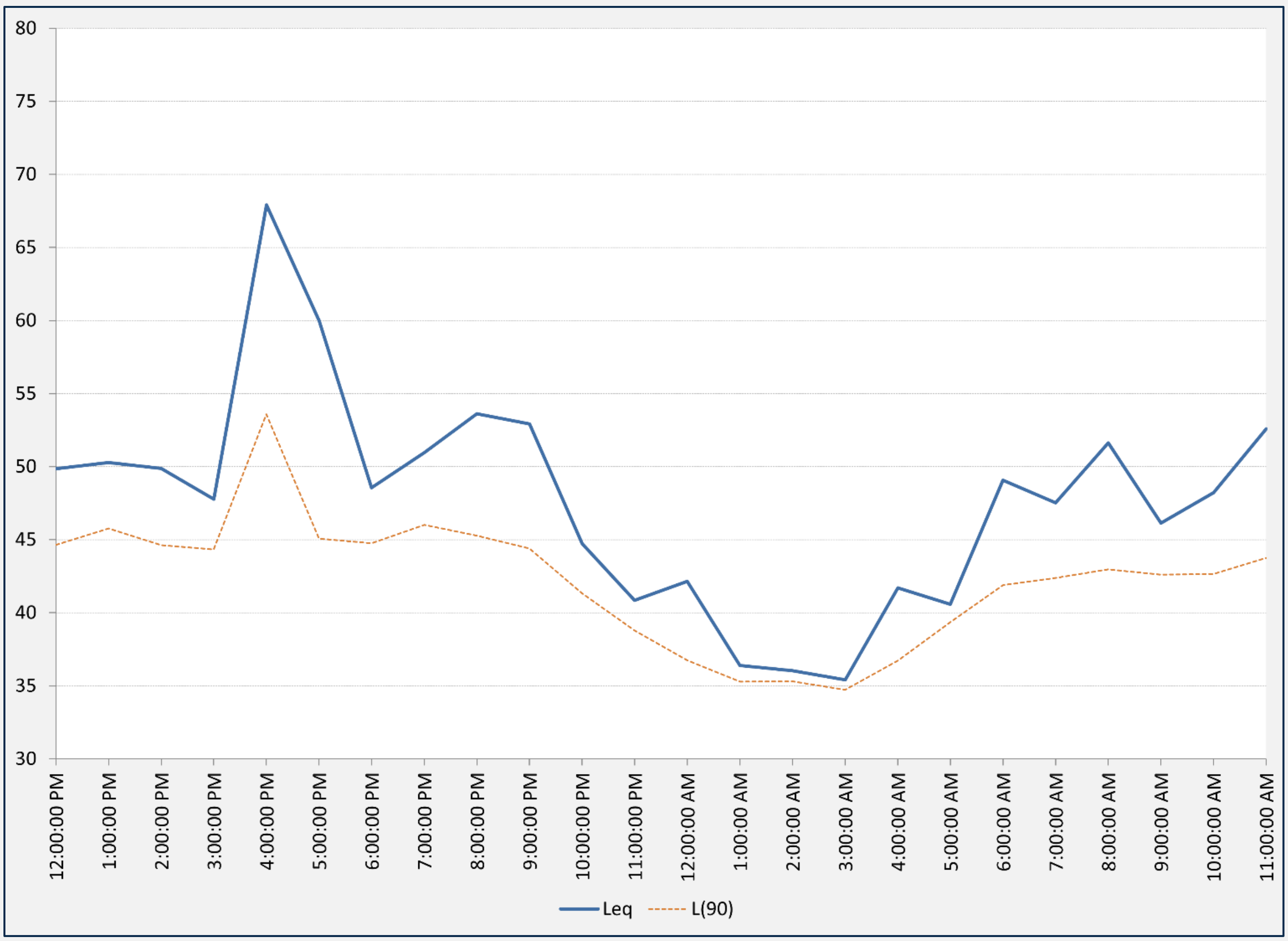
Site	Location/Address	Date/Time	L_{eq} (dBA)	L_{max} (dBA)
ST1	South of the Peninsula Component at the intersection of Remington Rd and 55th St	2024-08-27, 02:24 PM to 02:39 PM	60.7	70.6
ST2	Northwest of the University Towers East Component, at the intersection of Montezuma Rd and 55th St	2024-08-27, 01:54 PM to 02:09 PM	65.6	71.4
ST3	Northern boundary of the University Towers East Component along Montezuma Rd	2024-08-27, 01:32 PM to 01:47 PM	69.8	83.6
ST4	East of the University Towers East Component along Campanile Dr	2024-08-27, 01:07 PM to 01:22 PM	57.8	64.7

Source: Appendix A.
Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); dBA = A-weighted decibels; L_{max} = maximum sound level during the measurement interval; ST = short-term sound measurement locations.

Generally, the measured samples of daytime L_{eq} agree with expectations: at ST2 and ST3, L_{eq} values are above 65 dBA due largely to being close to a heavily trafficked roadway (Montezuma Road), whereas ST1 and ST4 were near smaller, local roadways (Remington Road and Campanile Drive) and further from Montezuma Road.

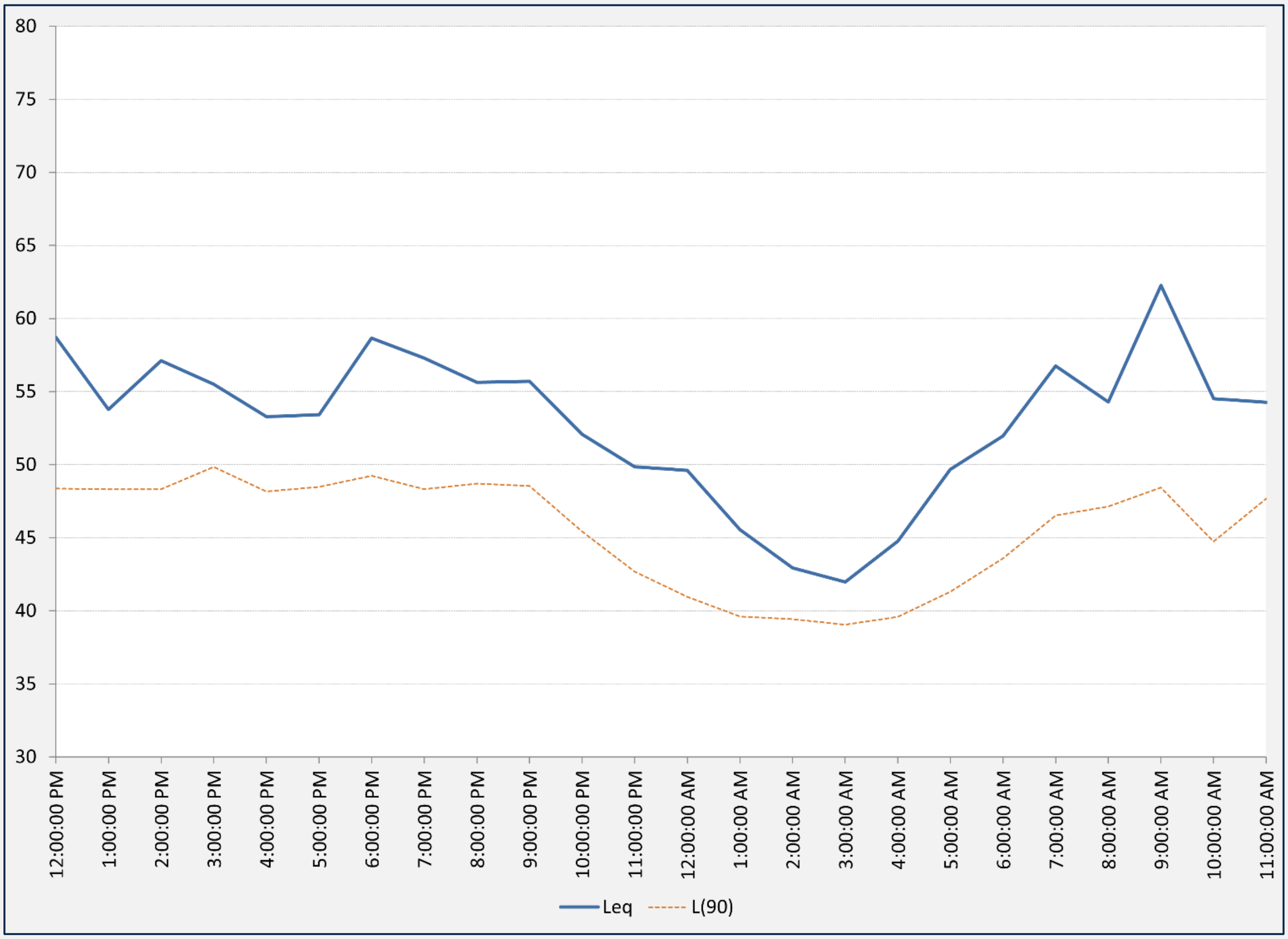
Two long-term (LT) sound level measurement locations (LT1 and LT2) that represent existing noise-sensitive receivers were also selected near the Proposed Project site. Measurement location LT1 was selected to characterize the daytime, evening, and nighttime baseline outdoor ambient sound levels at the nearest residential noise-sensitive receptors to the west of the Peninsula Component. Measurement location LT2 was selected to characterize the daytime, evening, and nighttime baseline outdoor ambient sound levels at the nearest residential noise-sensitive receptors to the east and south of the University Towers East Component. The long-term sound measurements at locations LT1 and LT2 spanned a full 24-hour cycle, totaling 1440 consecutive minutes in duration. Both L_{eq} and 90% statistical sound level (L_{90}) metrics were measured. While L_{eq} provides insight into the overall sound exposure level detected by a sound level meter, as introduced in Appendix A, the L_{90} value (the level exceeded 90% of the measurement time) is a good indicator of the background sound environment, offering a perspective clear of short-lived disturbances. Exhibit A shows the L_{eq} vs. L_{90} plot derived from the LT1 measurement data and Exhibit B shows the L_{eq} vs. L_{90} plot derived from the LT2 measurement data.

Exhibit A. LT1 L_{eq} vs. L_{90} Measurement Results (Hourly dBA)



Notes: Measurement location LT1 represents the nearest residential noise-sensitive receptors to the west of the Peninsula Component.

Exhibit B. LT2 L_{eq} vs. L_{90} Measurement Results (Hourly dBA)



Notes: Measurement location LT2 represents the nearest residential noise-sensitive receptors to the east and south of the University Towers East Component.

Throughout the day, the general ambient outdoor sound environment at LT1, located at the neighborhood west of the Peninsula Component, shows higher L_{90} sound levels that trend with anticipated traditional “rush hour” roadway traffic in the early morning and late afternoon period and lower L_{90} levels during nighttime hours (10:00 p.m. to 7:00 a.m.). This becomes evident when observing the A-weighted L_{eq} values that are often elevated by brief, but relatively high contributions. Such noise patterns are consistent with transient roadway vehicle noise. LT2, located at the southeast corner of the University Towers East Component Project boundary, was in proximity of a major roadway with a consistent heavy traffic flow (Montezuma Road), which would explain L_{90} levels remaining generally consistent during daytime hours.

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4 Thresholds of Significance

The following significance criteria are based on Appendix G of the CEQA Guidelines (14 CCR 15000 et seq.) and are used to determine the significance of potential noise impacts. Impacts to noise would be significant if the Proposed Project would result in the following:

A. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
B. Generation of excessive ground-borne vibration or ground-borne noise levels.
C. Expose people residing or working in the project area to excessive 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).

In light of the above significance criteria, this analysis uses the following standards to evaluate potential noise and vibration impacts:

- **Construction noise** - Temporary construction noise that exceeds 75 dBA L_{eq} during the 12-hour period between 7:00 a.m. and 7:00 p.m. at a sensitive receptor would be considered a significant impact. In particular, construction noise levels measured at or beyond the property lines of any property zoned residential shall not exceed an average sound level greater than 75 dB L_{eq} during the 12-hour period from 7:00 a.m. to 7:00 p.m. Additionally, where temporary construction noise would substantially interfere with normal business communication or affect sensitive receptors, such as educational facilities, a significant noise impact may be identified.
- **Construction vibration** – Guidance from Caltrans indicates that a vibration velocity of 0.2 ips PPV received at a structure would be considered annoying by occupants within it (Caltrans 2020). As for the receiving structure itself, aforementioned Caltrans guidance from Section 2 recommends that a vibration level of 0.3 ips PPV would represent the threshold for building damage risk of older residential structures exposed to continuous or frequently intermittent sources of ground-borne vibration.
- **Project-attributed stationary source noise emission to the community** – Project-attributed stationary source noise must adhere to the maximum exterior L_{eq} for single-family residential land uses of 50 dBA hourly L_{eq} during daytime hours (7:00 a.m. to 7:00 p.m.), 45 dBA hourly L_{eq} during evening hours (7:00 p.m. to 10:00 p.m.), and 40 dBA hourly L_{eq} during nighttime hours (10:00 p.m. to 7:00 a.m.) .
- **Off-site Project-attributed transportation noise** – For purposes of this analysis, a direct roadway noise impact would be considered significant if increases in roadway traffic noise levels attributed to the Proposed Project were greater than 3 dBA CNEL at an existing noise-sensitive land use.
- **Exterior to interior traffic noise intrusion** – For purposes of this analysis, traffic noise intrusion to the Proposed Project would be considered significant if interior noise levels exceed 45 dBA.
- **Exposure of project workers or visitors to excessive aviation noise** - Typically, Project areas where outdoor workers or visitors may be present that intersect the 65 dBA CNEL aviation noise contour of a public or private airport would be considered a potentially significant noise impact.

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5 Impacts Analysis

The following noise and vibration impact assessment for the Proposed Project is arranged in the same order of the three Appendix G significance criteria (a, b, c) for noise as listed in Chapter 4, Thresholds of Significance.

a) ***Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?***

5.1 Short-Term Construction Noise

Construction noise and vibration are temporary phenomena, with emission levels varying from hour to hour and day to day, depending on the equipment in use, the operations performed, and the distance between the source and receptor. Equipment that would be in use during construction would include, in part, graders, backhoes, rubber-tired dozers, loaders, cranes, forklifts, pavers, rollers, and air compressors. The typical maximum noise levels at a distance of 50 feet from various pieces of construction equipment and activities anticipated for use on the Proposed Project site are presented in Table 5. The equipment noise levels presented in Table 5 are maximum noise levels. Usually, construction equipment operates in alternating cycles of full power and low power, producing average noise levels over time that are less than the maximum noise level. The average sound level of construction activity also depends on the amount of time that the equipment operates and the intensity of construction activities during that time.

Table 5. Typical Construction Equipment Maximum Noise Levels

Equipment Type	Typical Equipment (L_{max}, dBA at 50 Feet)
All Other Equipment > 5 HP	85
Backhoe	78
Compressor (air)	78
Crane	81
Dozer	82
Excavator	81
Flat Bed Truck	74
Front End Loader	79
Generator	72
Grader	85
Man Lift	75
Paver	77
Roller	80
Welder/Torch	73

Source: DOT 2006.
Note: HP = horsepower; L_{max} = maximum sound level; dBA = A-weighted decibels.

Aggregate noise emission from Proposed Project construction activities, broken down by sequential phase, was calculated from the nearest position of the construction site boundary for each component to the nearest existing noise-sensitive receptor. Table 6 summarizes the distances from the boundary of each phase of building construction (Phase 1–6) to the closest noise-sensitive receptor (east of the University Towers East Component for Phase 1b; west of the Peninsula Component for Phases 1a and 2–6) during each of the six sequential construction phases. At the site boundaries, the analysis assumes that each piece of equipment of each listed type per phase would be involved in the construction activity for a 6- to 8-hour period at the nearest distance.

Table 6. Estimated Distances between Construction Activities and the Nearest Noise-Sensitive Receptors

Construction Phase (and Equipment Types Involved)	Distance from Nearest Noise-Sensitive Receptor to Construction Site Boundary (Feet)						
	Peninsula Component						University Towers East Component
	Phase 1a	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 1b
Demolition (excavator, tractor)	1,000	880	790	510	N/A	N/A	45
Site preparation (dozer, tractor)	1,000	880	790	510	510	575	45
Grading (grader, excavator, dozer)	1,000	880	790	510	510	575	45
Trenching (excavator)	1,000	880	790	510	510	575	45
Building construction (crane, man-lifts, generator, tractor, aerial lifts, concrete pump, welder/torch, auger drill rig)	1,000	880	790	510	510	575	45
Paving (paver, paving equipment, roller)	1,000	880	790	510	510	575	45
Architectural coating (air compressor)	1,000	880	790	510	510	575	45

Note: N/A = not applicable.

A Microsoft Excel–based noise prediction model emulating and using reference data from the Federal Highway Administration Roadway Construction Noise Model (FHWA 2008) was used to estimate construction noise levels at the nearest occupied noise-sensitive land use. Input variables for the predictive modeling consist of the equipment type and number of each (e.g., two dozers, three excavators, a backhoe), the duty cycle for each piece of equipment (i.e., percentage of time within a specific time period, such as an hour, when the equipment is expected to operate at full power or capacity and thus make noise at a level comparable to what is presented in Table 5), and the distance from the noise-sensitive receiver. The predictive model also considers how many hours that equipment may be on site and operating (or idling) within an established work shift. Conservatively, no topographical shielding was assumed in the modeling. The Roadway Construction Noise Model has default duty-cycle values for the various pieces of equipment, which were derived from an extensive study of typical construction activity patterns. Those default duty-cycle values were used for this noise analysis, which is detailed in Appendix B, Construction Noise Modeling Input and Output, and would result in the predicted noise levels displayed in Table 7.

Table 7. Predicted Construction Noise Levels per Activity Phase

Construction Phase (and Equipment Types Involved)	12-Hour L_{eq} at Nearest Noise-Sensitive Receptor to Construction Site Boundary (dBA)						
	Peninsula Component						University Towers East Component
	Phase 1a	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 1b
Demolition (excavator, tractor)	51	52	53	58	N/A	N/A	83
Site preparation (dozer, tractor)	51	52	53	58	58	57	83
Grading (grader, excavator, dozer)	51	53	53	61	61	60	83
Trenching (excavator)	46	48	49	54	54	53	79
Building construction (crane, man-lifts, generator, tractor, aerial lifts, concrete pump, welder/torch, auger drill rig)	49	50	51	56	56	56	81
Paving (paver, paving equipment, roller)	44	46	47	52	52	51	76
Architectural coating (air compressor)	40	41	42	46	46	45	72
Threshold Exceedance?	*No*	*No*	*No*	*No*	*No*	*No*	*Yes*

Notes: L_{eq} = equivalent noise level; dBA = A-weighted decibels; N/A = not applicable.

As presented in Table 7, during Phases 1a and 2–6, representing the construction of the Peninsula Component where distances from the Project site boundary to the nearest existing residences to the west range from 500 feet to 1,000 feet, construction noise levels would be up to 15 dBA higher than the measured ambient noise levels (see Exhibit A) at the nearest existing residences to the west and are estimated to range from approximately 40 dBA L_{eq} to 61 dBA L_{eq}, which is less than the 75 dBA L_{eq} 12-hour threshold.

During Phase 1b, representing the construction of the University Towers East Component, the estimated construction noise levels are predicted to be as high as 83 dBA L_{eq} over a 12-hour period and would be up to 30 dBA higher than the measured ambient noise levels (see Exhibit B) at the nearest existing residences (as close as 45 feet away) when grading activities take place near the eastern Project boundary of the University Towers East Component. While construction of Phase 1b is estimated to take approximately 68 weeks, this analysis assumes that, for those phases that would result in an exceedance of the acceptable noise levels, construction equipment would be operating at the closest distance to the nearest noise-sensitive receptor for 8 hours per day throughout the construction of Phase 1b. However, this is a worst-case scenario, and it is likely that construction activities would occur for less than 8 hours per day (or sporadically) for no more than 6 days at a time, and more likely that construction equipment would be operating further from the closest distance to the nearest noise-sensitive receptor (i.e., further than 45 feet).

To mitigate the identified potentially significant impact, when operation of construction equipment is estimated to potentially cause activity noise levels to exceed 75 dBA L_{eq} during Phase 1b of Project construction, **Mitigation Measure (MM) NOI-1** is recommended, which would require the CSU/SDSU, or its designee, to implement certain noise reduction measures as site conditions warrant. Proper implementation of **MM-NOI-1** would reduce noise levels by up to 8 dB if a 9-foot-tall temporary construction noise barrier is implemented during Phase 1b construction, which would correspondingly reduce the highest predicted estimated non-mitigated construction noise level from 83 to 75 dBA L_{eq} during the grading phase, which would be within the applicable 75 dBA threshold. Appendix B includes a construction noise prediction worksheet that illustrates a sample scenario of what the anticipated and quantifiable noise reduction effect would be of adding a temporary 9-foot-tall noise barrier to reduce construction noise exposure at the nearest sensitive receptor.

In summary, Phase 1b construction activities during allowable daytime hours (between 7:00 a.m. and 7:00 p.m.) have the potential for noise to exceed the 75 dBA L_{eq} 12-hour threshold on occasion at the nearest residential receiver to the University Towers East Component. Therefore, incorporation of **MM-NOI-1** is recommended to reduce construction noise exposure levels to acceptable levels. Thus, under such conditions, temporary construction-related noise impacts would be considered **less than significant with mitigation incorporated.**

5.2 Long-Term Off-Site Traffic Noise Exposure

The Traffic Impact Assessment prepared for the proposed Project by Linscott, Law, & Greenspan, Engineers determined that the Proposed Project would result in a net reduction of Project-attributed average daily traffic volumes on both regional and local arterial roadways (i.e., Interstate 8, Remington Road, 55th Street, Montezuma Road, and Campanile Drive) of approximately 2,948 average daily trips (LLG 2024). While the Proposed Project would result in a net increase of 4,468 student housing beds and, correspondingly, 4,468 students living on campus, parking at the Peninsula Component site would be extremely limited and, therefore, those students that do bring cars to campus would need to park in parking structures and lots to the east of the Peninsula Component site on the main campus. These lots and structures generally cannot be readily accessed via the local roads and, instead, would be accessed largely via 55th Street, Montezuma Road, and College Avenue. While non-freshmen students living on campus would have the opportunity to bring their vehicle to campus, the Project is expected to result in an overall decrease in parking demand due to the large decrease in commuter students no longer driving and parking.

Therefore, the Project would result in a reduced number of SDSU students commuting and parking a vehicle while on campus. While the analysis recognizes that some students may park in the surrounding residential neighborhoods, such parking violates City of San Diego parking restrictions and would represent a relatively small number of the students living on the Peninsula Component site. Thus, by increasing on-campus student housing and enabling 4,468 more SDSU students to live on campus, the Proposed Project would result in fewer students driving to campus and an overall reduction in average daily trips relative to existing levels, thereby reducing traffic volumes and related traffic noise levels. Notwithstanding, even if there were increased average daily traffic volumes attributed to the Project, the increase would not be sufficient to increase traffic noise levels by greater than 3 dBA CNEL over existing levels at adjacent noise-sensitive land uses, which is the threshold for significant impacts. Therefore, impacts associated with traffic noise would be **less than significant.**

5.3 Long-Term Operational Noise Exposure

Stationary Noise Sources

Using DataKustik's CadnaA software, which models three-dimensional outdoor sound propagation based on International Organization for Standardization 9613-2 algorithms (ISO 1996) and relevant reference data, an operational scenario of the Proposed Project was modeled for purposes of this analysis. The modeled scenario included operating assumptions for the anticipated noise sources, specifically, heating, ventilation and air conditioning (HVAC) units representative of combined SPL data for air-cooled chillers and air-handling units, placed on the rooftops of the eight modeled buildings. HVAC units associated with the building are expected to operate at any time up to 24 hours a day, 365 days a year. There are no other stationary noise sources associated with Project operation.

For purposes of this analysis, the overall A-weighted decibel levels appearing in Table 8 were used to define the individual Project sound sources.

Table 8. Sound Power Levels for the Modeled Individual Sources of Outdoor Noise Emission

Source	A-Weighted Sound Power Level per Octave Band Center Frequency (Hertz)								Overall Sound Power Level (dBA)
	63	125	250	500	1k	2k	4k	8k	
135-Ton Air-Cooled Chillers (9-Story Building)	74	82	84	91	89	95	84	81	98
135-Ton Air-Cooled Chillers (13-Story Building)	75	82	85	93	90	94	84	81	98
2,200 MBH Air Source Heat Pumps	97	91	94	93	94	87	85	78	97
Air-Cooled Chillers (Amenity Building)[a]	91	85	88	86	82	81	79	72	89
Air-Handling Units (Amenity Building)[b]	64	76	77	78	75	68	62	57	83

Notes: dBA = A-weighted decibels; k = thousand; MBH = 1000 British thermal units per hour.

[a] Reference SPL data shown herein based upon "lo" value per Loren Cook Company 1999, pp. 59–60.

[b] Based on data from 1- to 5-minute range for "factories (general)" per Loren Cook Company 1999, p. 41.

The reference sound power levels in Table 8 were used to define area sources of sound emission in the CadnaA computer model with respect to the placement of the rendered Peninsula Component and University Towers East Component. In addition to the above sound source inputs, the following parameters are included in this CadnaA-supported stationary noise source assessment:

- Ground effect acoustical absorption coefficient equal to 1 for the rendered Peninsula Component, which represents acoustically absorptive “soft” vegetated ground cover, loose soils, and granular aggregate, and an absorption coefficient equal to 0.25 for the rendered University Towers East Component, which represents the acoustically reflective roadway surfaces surrounding the site
- Reflection order of 1, which allows for a single reflection of sound paths on encountered structural surfaces
- Inclusion of georeferenced topography: the Project site, the canyon to the west, and the grade of the nearest residential community to the west reflect their true elevations above sea level
- Calm meteorological conditions (i.e., no wind) with 68°F and 50% relative humidity
- Eight total rendered buildings: the proposed Apartment Buildings 1–5, Flex Building, and Amenity Building (Peninsula Component), as well as University Towers East

Predicted noise exposure levels attributable to concurrent operation of the Proposed Project on-site stationary sources (i.e., HVAC systems) as modeled appear in Table 9. As shown in the table, the predicted levels at the studied noise-sensitive receptor locations would not exceed the exterior noise level threshold for single-family residential land uses of 50 dBA hourly L_{eq} during daytime hours (7:00 a.m. to 7:00 p.m.), 45 dBA hourly L_{eq} during evening hours (7:00 p.m. to 10:00 p.m.), or 40 dBA hourly L_{eq} during nighttime hours (10:00 p.m. to 7:00 a.m.); therefore, potential noise impacts associated with project operation would be **less than significant.**

Table 9. Project Operation Noise Prediction Model Results Summary

Modeled Receptor	Modeled Receptor Distance from Project Boundary	Predicted Operation Noise (dBA hourly L_{eq}) at Indicated Modeled Receptor
Peninsula Component		
R1	480 feet west	40
R2	470 feet west	40
R3	550 feet west	39
R4	680 feet southwest	39
University Towers East Component		
R5	45 feet east	40
R6	55 feet south	39
R7	45 feet south	39
R8	80 feet southwest	40

Notes: dBA = A-weighted decibels; L_{eq} = equivalent noise level.
See Figure 3 for modeled “R#” receptor locations.

Figure 4 and Figure 5 correspondingly illustrate the predicted Project stationary equipment operation sound levels—for the Peninsula Component and University Towers East Component, respectively—across a horizontal plane approximately 5 feet above grade (i.e., a first-floor or pedestrian listening elevation) over the Project site and beyond into the surrounding vicinity.

Details of the CadnaA modeling input parameters (e.g., modeled sources) can be found in Appendix C, Operation Noise Prediction Model Inputs. As illustrated, the model results show that the Proposed Project would be consistent with required noise level limits. Therefore, potential noise impacts associated with the operation of the Proposed Project would be **less than significant.**

b) ***Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels?***

5.4 Construction Vibration

Construction activities may expose persons to excessive ground-borne vibration or ground-borne noise, causing a potentially significant impact. Caltrans has collected ground-borne vibration information related to construction activities (Caltrans 2020). Information from Caltrans indicates that continuous vibrations with a PPV of approximately 0.2 ips are considered annoying. For context, heavier pieces of construction equipment, such as a bulldozer that may be expected on the Project site, have peak particle velocities of approximately 0.089 ips or less at a reference distance of 25 feet (DOT 2006).

Ground-borne vibration attenuates rapidly, even over short distances. The attenuation of ground-borne vibration as it propagates from source to receptor through intervening soils and rock strata can be estimated with expressions found in FTA and Caltrans guidance. For example, for a roller operating on site and as close as the eastern Project boundary of the University Towers East Component to the nearest occupied property (i.e., 45 feet) the estimated vibration velocity would be 0.09 ips per the equation as follows (FTA 2018):

$$PPV_{rcvr} = PPV_{ref} \times (25/D)^{1.5} = 0.09 = 0.21 \times (25/45)^{1.5}$$

In the above equation, PPV_{rcvr} is the predicted vibration velocity at the receiver position, PPV_{ref} is the reference value at 25 feet from the vibration source (the roller), and D is the actual horizontal distance to the receiver. Therefore, at this predicted PPV, the impact of vibration-induced annoyance to occupants of nearby existing homes would be **less than significant.** The nearest occupied property to the Peninsula Component is 510 feet.

Construction vibration at sufficiently high levels can also present a building damage risk. However, anticipated construction vibration associated with the Proposed Project would yield levels of 0.04 ips PPV, which would not surpass the guidance limit of 0.3 ips PPV for building damage risk to older residential structures under Caltrans guidelines (Caltrans 2020). Because the predicted vibration level at 45 feet is less than this guidance limit, the risk of vibration damage to nearby structures is considered less than significant.

Once operational, the Proposed Project would not feature major producers of ground-borne vibration. Anticipated mechanical systems like HVAC units are designed and manufactured to feature rotating (fans, motors) and reciprocating (compressors) components that are well-balanced with isolated vibration within or external to the equipment casings. On this basis, potential vibration impacts due to Proposed Project operation would be **less than significant.**

c) Would the project expose people to excessive aviation noise levels?

The San Diego International Airport is located approximately 6.6 miles from the Project site, and Montgomery Field is located approximately 3.86 miles northwest of the Project site. The Project site is outside of the 60 dBA CNEL contour shown in the San Diego International Airport Land Use Compatibility Plan (SDCRAA 2014). The Project is not located within designated noise or safety impact areas defined by the Montgomery Field Airport Land Use Compatibility Plan (SDCRAA 2010). Therefore, construction workers and post-construction project operational or maintenance staff on site would not be exposed to excessive noise levels, and there would be a **less-than-significant impact** associated with aviation noise levels.

6 Mitigation Measures

The following mitigation measure would apply during construction activities for the University Towers East Component (Phase 1b).

MM-NOI-1 Temporary Construction Noise Reduction (University Towers East Component). The California State University or San Diego State University, or its designee, shall implement one or more of the following measures, as necessary, in order to achieve on-site noise control and sound abatement that, in the aggregate, would result in a minimum construction noise reduction of approximately 8 A-weighted decibels (dBA) at the closest noise-sensitive receptor during each phase of the construction of Phase 1b:

- ***Administrative controls*** (e.g., reduce operating time of equipment and/or prohibit usage of equipment type[s] within certain distances to a nearest receiving occupied off-site property).
- ***Engineering controls*** (change equipment operating parameters [speed, capacity, etc.], or install features or elements that otherwise reduce equipment noise emission [e.g., upgrade engine exhaust mufflers]).
- ***Install noise abatement*** on the site boundary fencing (or within, as practical and appropriate) in the form of sound blankets or comparable temporary solid barriers of at least 9 feet tall to occlude construction noise emission between the site (or specific equipment operation as the situation may define) and the noise-sensitive receptor(s) of concern.
  - For example, suspended sound blankets, field-erected plywood sheeting, or comparable temporary solid (or flexible but sufficiently massive) barriers (of minimum sound transmission class rating of 25, which per California Department of Transportation guidance indicates would permit up to 8 dBA of expected barrier insertion loss) would occlude construction noise emission between the site (or specific equipment operation as the situation may define) and the noise-sensitive receptor(s) of concern.
  - Temporary barriers should adhere to a minimum height standard of 9 feet to serve as an effective deterrent against noise pollution and shielding for adjoining off-site receptors.

Appendix B includes a construction noise prediction worksheet that illustrates a sample scenario of what the anticipated and quantifiable noise reduction effect would be of adding a temporary 9-foot-tall noise barrier to reduce construction noise exposure at the nearest sensitive receptors. Such a wall should be strategically located on the Proposed Project boundary (focusing on the northern, eastern, and southern boundary) so as to reduce construction noise exposure at the nearest sensitive receptors.

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7 Summary of Findings

This noise report was conducted to predictively quantify construction and operation noise and vibration attributed to the Proposed Project. The results indicate that potential construction noise impacts during site preparation and grading phases for the University Towers East Component would be significant but would be reduced to **less than significant with mitigation incorporated.** Otherwise, all potential impacts related to noise and vibration for the construction and operation of the Proposed Project would be **less than significant.**

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8 References

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DOT (U.S. Department of Transportation). 2006. *FHWA Roadway Construction Noise Model: User's Guide*. Final Report. FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. Cambridge, Massachusetts: DOT, Research and Innovative Technology Administration. August.

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Loren Cook Company. 1999. *Engineering Cookbook – A Handbook for the Mechanical Designer*. Second Edition. Springfield, MO.

SDCRAA (San Diego County Regional Airport Authority). 2014. *San Diego International Airport; Airport Land Use Compatibility Plan*. May 1, 2014. https://www.san.org/DesktopModules/Bring2mind/DMX/API/Entries/Download?EntryId=2990&Command=Core_Download&language=en-US&PortalId=0&TabId.

SDCRAA. 2010. *Montgomery Field Airport Land Use Compatibility Plan.* January 25, 2010. https://www.san.org/DesktopModules/Bring2mind/DMX/API/Entries/Download?EntryId=16148&Command=Core_Download&language=en-US&PortalId=0&TabId=807

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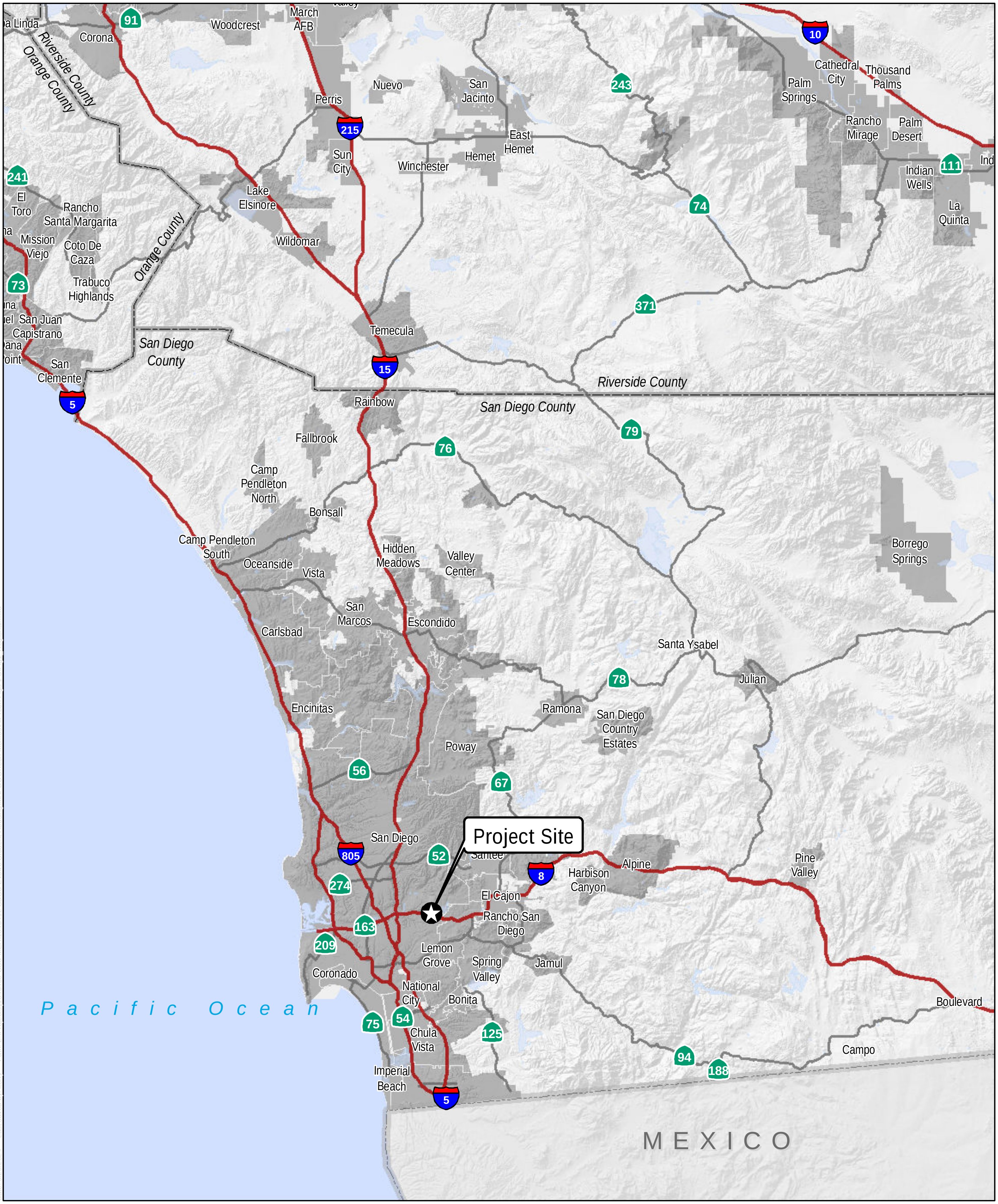

SOURCE: SOURCE: ESRI

DUDEK

FIGURE 1
Regional Map
Noise Technical Report for the SDSU Evolve Student Housing Project

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SOURCE: AERIAL - SANGIS IMAGERY 2023

FIGURE 2

Vicinity Map

Noise Technical Report for the SDSU Evolve Student Housing Project

DUDEK

0 500 1,000 Feet

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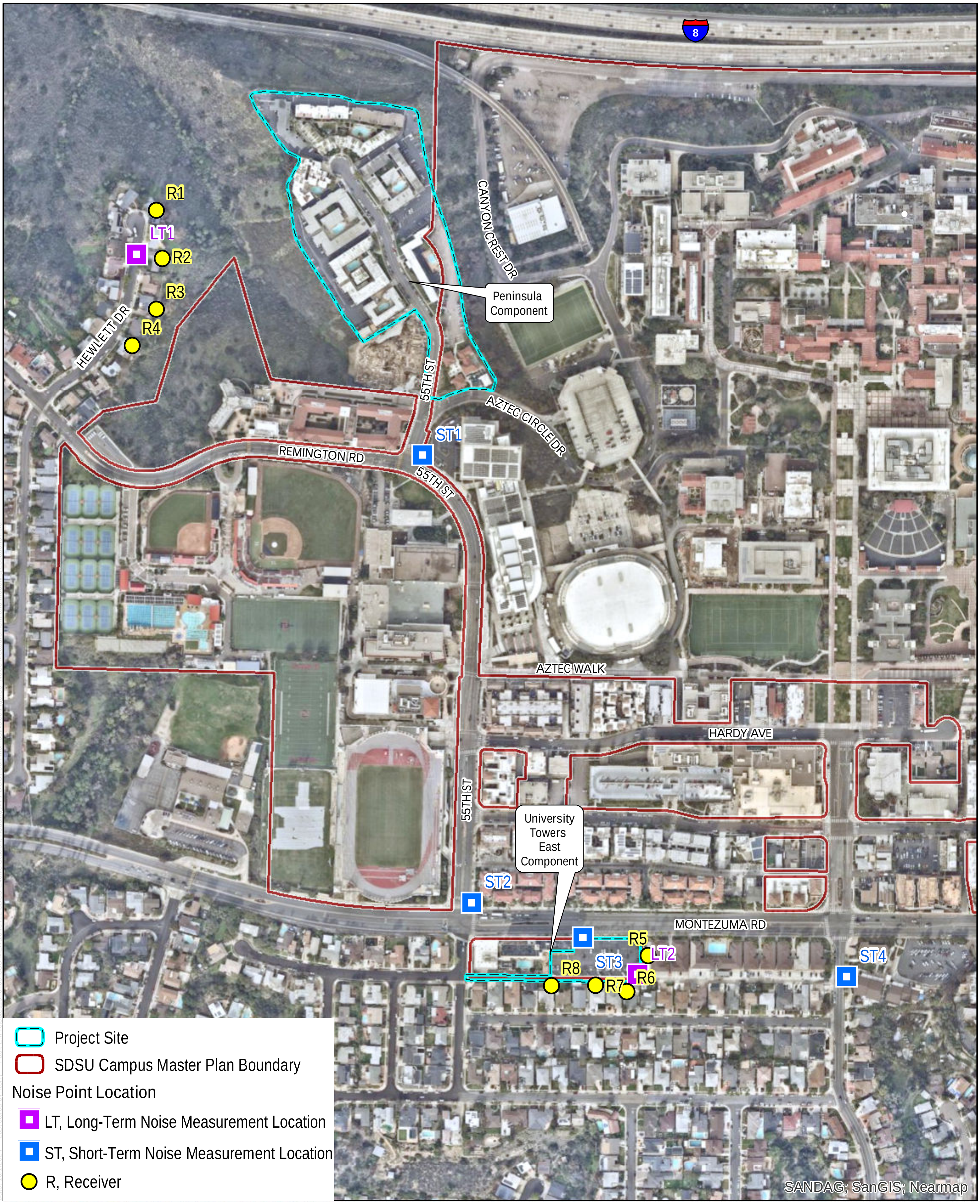

SOURCE: AERIAL-SANGIS IMAGERY 2023

DUDEK

0 225 450 Feet

FIGURE 3
Noise Measurement and Modeling Locations

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SOURCES: Google 2024; SDSU Evolve 2024; Dudek 2024

DUDEK

FIGURE 4

Predicted Stationary Source Operation Noise from Proposed Project (Peninsula Component)

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SOURCES: Google 2024; SDSU Evolve 2024; Dudek 2024

DUDEK

0 59.5 119 Feet

FIGURE 5

Predicted Stationary Source Operation Noise from Proposed Project (University Towers East Component)

Noise Technical Report for the SDSU Evolve Student Housing Project

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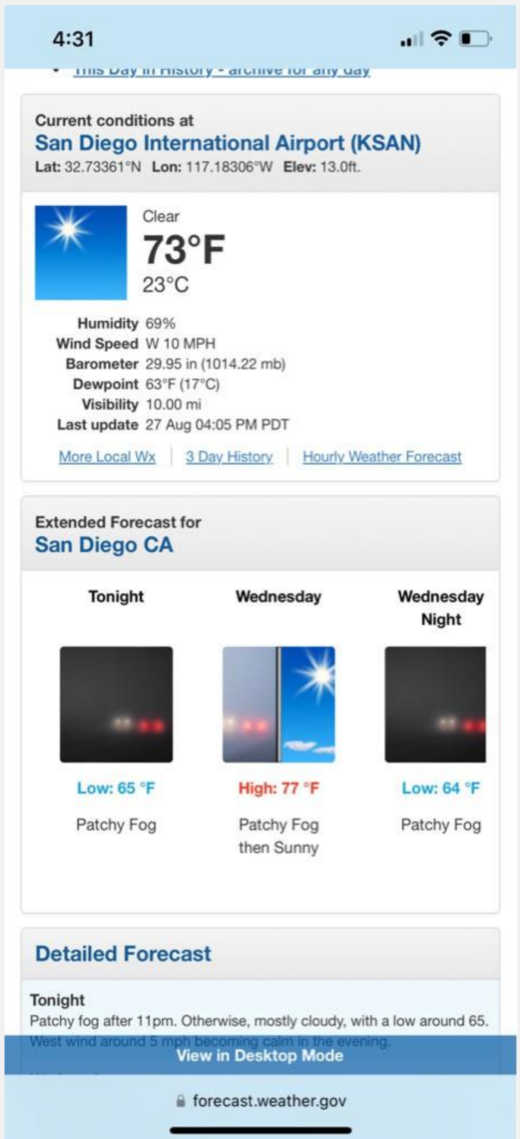
Appendix A
Baseline Noise Measurement Field Data

FORMS FIELD DATA REPORT

Field Noise Measurement Data

Record: 1971	
Project Name	*SDSU Evolve*
Project #	*15464.12*
Date	*2024-08-27*

Meteorological Conditions	
Upload NOAA Forecast	

Temp (F)	*73*
Humidity % (R.H.)	*69*
Wind	*Light*
Wind Speed (MPH)	*10*
Wind Direction	*West*
Sky	*Clear*

Instrument and Calibrator Information	
Instrument Name List	*(SAC) NL-62*
Instrument Name	*(SAC) NL-62*
Instrument Name Lookup Key	*(SAC) NL-62*
Manufacturer	*Rion*
Model	*NL-62*
Serial Number	*350815*
Calibration Date	
Calibrator Name	*(SAC) Rion NC-74*
Calibrator Name	*(SAC) Rion NC-74*
Calibrator Name Lookup Key	*(SAC) Rion NC-74*
Calibrator Manufacturer	*Rion*
Calibrator Model	*NC-74*
Calibrator Serial #	*34167529*
GPS Assistance Used	*No*
Pre-Test (dBA SPL)	*94.4*

Post-Test (dBA SPL)	94
Windscreen	Yes
Weighting?	A-WTD
Slow/Fast?	Slow

Monitoring	
Record #	1
Site ID	ST4
Site Location Lat/Long	32.770277, -117.071877
Begin (Time)	13:07:00
End (Time)	13:22:00
Leq	57.8
Lmax	64.7
Lmin	49.3
Other Lx?	L90, L50, L10
L90	51.5
L50	54.2
L10	62.9
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Distant Conversations / Yelling, Rustling Leaves
Other Noise Sources Additional Description	Moderate foot traffic passing by
Is the same instrument and calibrator being used as previously noted?	Yes

Are the meteorological conditions the same as previously noted?	*Yes*

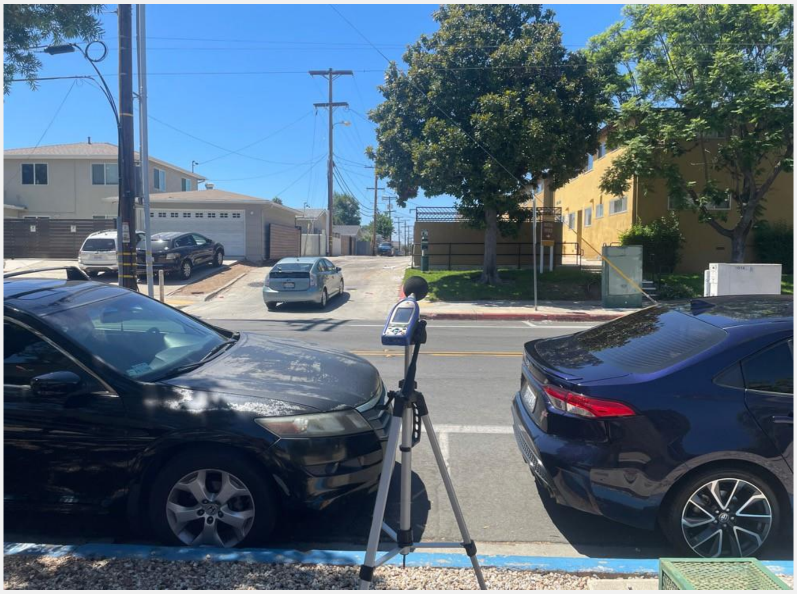
Description / Photos	
Terrain	*Hard*

Site Photos	
Photo	
Comments / Description	*Facing N*

Site Photos	
Photo	

Comments / Description	*Facing E*

Site Photos	
Photo	
Comments / Description	*Facing S*

Site Photos	
Photo	

Comments / Description	Facing W

Monitoring	
Record #	2
Site ID	ST3
Site Location Lat/Long	32.770632, -117.074844
Begin (Time)	13:32:00
End (Time)	13:47:00
Leq	69.8
Lmax	83.6
Lmin	49.2
Other Lx?	L90, L50, L10
L90	51.0
L50	65.4
L10	71.3
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Distant Conversations / Yelling
Other Noise Sources Additional Description	Heavy foot traffic, motorcycle backfiring, buses
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos	
Terrain	*Hard*

Site Photos	
Photo	
Comments / Description	*Facing N*

Site Photos	
Photo	

Comments / Description	*Facing E*

Site Photos	
Photo	
Comments / Description	*Facing S*

Site Photos	
Photo	

FORMS FIELD DATA REPORT

Comments / Description	*Facing W*

Monitoring	
Record #	*3*
Site ID	*ST2*
Site Location Lat/Long	*32.770919, -117.076085*
Begin (Time)	*13:54:00*
End (Time)	*14:09:00*
Leq	*65.6*
Lmax	*71.4*
Lmin	*60.2*
Other Lx?	*L90, L50, L10*
L90	*61.4*
L50	*64.0*
L10	*69.4*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Distant Conversations / Yelling*
Other Noise Sources Additional Description	*Very heavy foot traffic*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Terrain	*Hard*

Site Photos

Photo	
Comments / Description	*Facing N*

Site Photos

Photo	

Comments / Description	*Facing E*

Site Photos	
Photo	
Comments / Description	*Facing S*

Site Photos	
Photo	

FORMS FIELD DATA REPORT

Comments / Description	*Facing W*

Monitoring	
Record #	*4*
Site ID	*ST1*
Site Location Lat/Long	*32.775282, -117.077000*
Begin (Time)	*14:24:00*
End (Time)	*14:39:00*
Leq	*60.7*
Lmax	*70.6*
Lmin	*52.9*
Other Lx?	*L90, L50, L10*
L90	*53.6*
L50	*55.8*
L10	*64.5*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Distant Conversations / Yelling*
Other Noise Sources Additional Description	*Very high foot traffic*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

FORMS FIELD DATA REPORT

Source Info and Traffic Counts	
Number of Lanes	*2*
Lane Width (feet)	*10*
Roadway Width (feet)	*20*
Roadway Width (m)	*6.1*
Distance to Roadway (feet)	*0*
Distance to Roadway (m)	*0*
Distance Measured to Centerline or Edge of Pavement?	*Edge of Pavement*
Roadway Type	*Street*
Estimated Vehicle Speed (MPH)	*15*

Traffic Counts	
Vehicle Count Summary	*A 54, MT 1, HT 0, B 0, MC 0*
Counting Both Directions?	*Yes*
Count Duration (minutes)	*0*
Vehicle Count Tally	*55*
Select Method for Vehicle Counts	*Use Counter (+/-)*
Number of Vehicles - Autos	*54*
Number of Vehicles - Medium Trucks	*1*
Number of Vehicles - Heavy Trucks	*0*
Number of Vehicles - Buses	*0*
Number of Vehicles - Motorcyles	*0*

Description / Photos	
Terrain	*Hard*

Site Photos	
Photo	
Comments / Description	*Facing S*

Site Photos	
Photo	

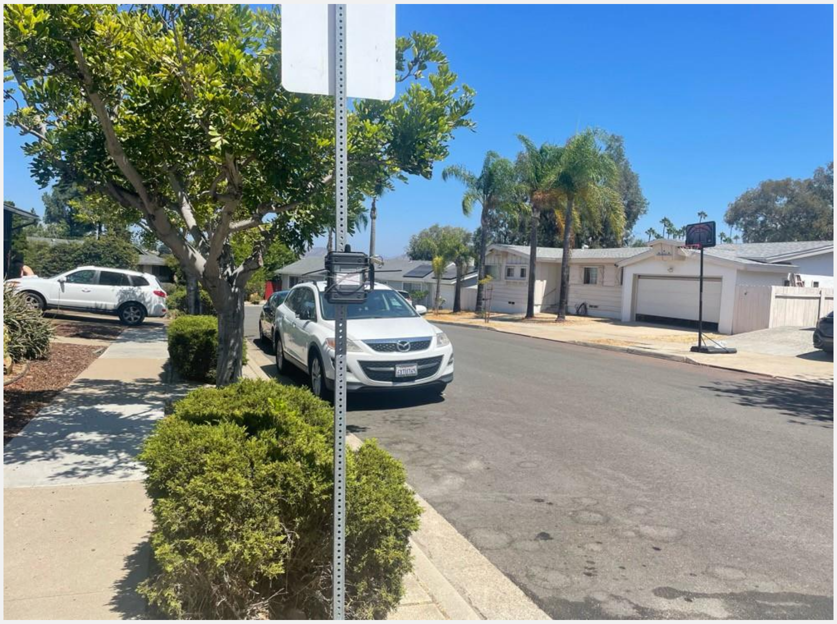
Comments / Description	*Facing W*

Site Photos	
Photo	
Comments / Description	*Facing E*

Site Photos	
Photo	

Comments / Description	*Facing N*

Description / Photos	
Terrain	*Hard*

Site Photos	
Photo	
Comments / Description	*LT1*

Site Photos	
Photo	

FORMS DUDEK FIELD DATA REPORT

Comments / Description	*LT2*

Appendix B

Construction Noise Modeling Input and Output

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, per City of San Diego = 75

allowable hours over which Leq is to be averaged, City of San Diego = 12

0 = temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		1000	0.1		49.7	8	480	49
	tractor	1	40	84		1000	0.1		52.7	8	480	47
									Total for Demolition Phase:			**51.0**
Site Preparation	dozer	1	40	82		1000	0.1		50.7	8	480	45
	tractor	2	40	84		1000	0.1		52.7	8	480	50
									Total for Site Preparation Phase:			**51.2**
Grading	grader	1	40	85		1000	0.1		53.7	7	420	47
	excavator	1	40	81		1000	0.1		49.7	8	480	44
	dozer	1	40	82		1000	0.1		50.7	8	480	45
									Total for Grading Phase:			**50.5**
Trenching	excavator	2	40	81		1000	0.1		49.7	7	420	46
									Total for Trenching Phase:			**46.4**
Building Construction	man lift	1	20	75	"forklift"	1000	0.1		43.7	8	480	35
	generator	1	50	72		1000	0.1		40.7	8	480	36
	crane	1	16	81		1000	0.1		49.7	4	240	37
	welder / torch	1	40	73		1000	0.1		41.7	8	480	36
	tractor	1	40	84		1000	0.1		52.7	7	420	46
	pumps	1	50	77		1000	0.1		45.7	8	480	41
	man lift	2	20	75	"aerial lift"	1000	0.1		43.7	8	480	38
	auger drill rig	1	20	84		1000	0.1		52.7	2	120	38
									Total for Building Construction Phase:			**49.3**
Paving	paver	1	50	77		1000	0.1		45.7	6	360	40
	paver	1	50	77	"paving equipment"	1000	0.1		45.7	6	360	40
	roller	1	20	80		1000	0.1		48.7	6	360	39
									Total for Paving Phase:			**44.2**
Architectural Coating	compressor (air)	1	40	78		1000	0.1		46.7	6	360	40
									Total for Architectural Coating Phase:			**39.8**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	tractor	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
Site Preparation	dozer	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	tractor	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
Grading	grader	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	excavator	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	dozer	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
Trenching	excavator	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
Building Construction	man lift	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	generator	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	crane	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	welder / torch	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	tractor	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	pumps	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	man lift	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	auger drill rig	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
Paving	paver	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	paver	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
	roller	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1
Architectural Coating	compressor (air)	30	5	0	10	990	1000	31.6	990.0	1000.3	0.00	0.1	17.5	17.5	0.4	0.4	0.1

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, per City of San Diego = 75

allowable hours over which Leq is to be averaged, City of San Diego = 12

0 = temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		880	0.1		50.9	8	480	50
	tractor	1	40	84		880	0.1		53.9	8	480	48
									Total for Demolition Phase:			**52.1**
Site Preparation	dozer	1	40	82		880	0.1		51.9	8	480	46
	tractor	2	40	84		880	0.1		53.9	8	480	51
									Total for Site Preparation Phase:			**52.3**
Grading	grader	1	40	85		880	0.1		54.9	8	480	49
	excavator	2	40	81		880	0.1		50.9	8	480	48
	dozer	1	40	82		880	0.1		51.9	8	480	46
									Total for Grading Phase:			**52.7**
Trenching	excavator	2	40	81		880	0.1		50.9	8	480	48
									Total for Trenching Phase:			**48.1**
Building Construction	man lift	1	20	75	"forklift"	880	0.1		44.9	8	480	36
	generator	1	50	72		880	0.1		41.9	8	480	37
	crane	1	16	81		880	0.1		50.9	7	420	41
	welder / torch	1	40	73		880	0.1		42.9	8	480	37
	tractor	1	40	84		880	0.1		53.9	7	420	48
	pumps	1	50	77		880	0.1		46.9	8	480	42
	man lift	2	20	75	"aerial lift"	880	0.1		44.9	8	480	39
									Total for Building Construction Phase:			**50.3**
Paving	paver	1	50	77		880	0.1		46.9	6	360	41
	paver	1	50	77	"paving equipment"	880	0.1		46.9	6	360	41
	roller	2	20	80		880	0.1		49.9	6	360	43
									Total for Paving Phase:			**46.4**
Architectural Coating	compressor (air)	1	40	78		880	0.1		47.9	6	360	41
									Total for Architectural Coating Phase:			**40.9**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Site Preparation	dozer	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Grading	grader	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	excavator	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	dozer	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Trenching	excavator	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Building Construction	man lift	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	generator	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	crane	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	welder / torch	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	pumps	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	man lift	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Paving	paver	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	paver	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	roller	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Architectural Coating	compressor (air)	20	5	0	10	870	880	22.4	870.0	880.1	0.00	0.1	12.5	12.5	0.5	0.5	0.1

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Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		790	0.1		51.7	8	480	51
	tractor	1	40	84		790	0.1		54.7	8	480	49
										Total for Demolition Phase:		**53.0**
Site Preparation	dozer	1	40	82		790	0.1		52.7	8	480	47
	tractor	2	40	84		790	0.1		54.7	8	480	52
										Total for Site Preparation Phase:		**53.2**
Grading	grader	1	40	85		790	0.1		55.7	7	420	49
	excavator	2	40	81		790	0.1		51.7	7	420	48
	dozer	1	40	82		790	0.1		52.7	8	480	47
										Total for Grading Phase:		**53.1**
Trenching	excavator	2	40	81		790	0.1		51.7	8	480	49
										Total for Trenching Phase:		**49.0**
Building Construction	man lift	1	20	75	"forklift"	790	0.1		45.7	8	480	37
	generator	1	50	72		790	0.1		42.7	8	480	38
	crane	1	16	81		790	0.1		51.7	7	420	41
	welder / torch	1	40	73		790	0.1		43.7	8	480	38
	tractor	1	40	84		790	0.1		54.7	7	420	48
	pumps	1	50	77		790	0.1		47.7	8	480	43
	man lift	2	20	75	"aerial lift"	790	0.1		45.7	8	480	40
										Total for Building Construction Phase:		**51.1**
Paving	paver	1	50	77		790	0.1		47.7	6	360	42
	paver	1	50	77	"paving equipment"	790	0.1		47.7	6	360	42
	roller	2	20	80		790	0.1		50.7	6	360	44
										Total for Paving Phase:		**47.3**
Architectural Coating	compressor (air)	1	40	78		790	0.1		48.7	6	360	42
										Total for Architectural Coating Phase:		**41.7**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	tractor	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Site Preparation	dozer	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	tractor	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Grading	grader	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	excavator	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	dozer	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Trenching	excavator	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Building Construction	man lift	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	generator	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	crane	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	welder / torch	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	tractor	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	pumps	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	man lift	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Paving	paver	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	paver	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	roller	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Architectural Coating	compressor (air)	10	5	0	10	780	790	14.1	780.0	790.0	0.00	0.1	7.5	7.5	0.6	0.6	0.1

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Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		510	0.1		56.4	8	480	55
	tractor	1	40	84		510	0.1		59.4	8	480	54
									Total for Demolition Phase:			**57.6**
Site Preparation	dozer	1	40	82		510	0.1		57.4	8	480	52
	tractor	2	40	84		510	0.1		59.4	8	480	57
									Total for Site Preparation Phase:			**57.8**
Grading	grader	1	40	85		510	0.1		60.4	7	420	54
	excavator	2	40	81		510	0.1		56.4	7	420	53
	tractor	2	40	84		510	0.1		59.4	8	480	57
	dozer	2	40	82		510	0.1		57.4	8	480	55
									Total for Grading Phase:			**60.8**
Trenching	excavator	2	40	81		510	0.1		56.4	8	480	54
									Total for Trenching Phase:			**53.7**
Building Construction	man lift	1	20	75	"forklift"	510	0.1		50.4	8	480	42
	generator	1	50	72		510	0.1		47.4	8	480	43
	crane	1	16	81		510	0.1		56.4	7	420	46
	welder / torch	1	40	73		510	0.1		48.4	8	480	43
	tractor	1	40	84		510	0.1		59.4	7	420	53
	pumps	1	50	77		510	0.1		52.4	8	480	48
	man lift	2	20	75	"aerial lift"	510	0.1		50.4	8	480	45
									Total for Building Construction Phase:			**55.8**
Paving	paver	1	50	77		510	0.1		52.4	6	360	46
	paver	1	50	77	"paving equipment"	510	0.1		52.4	6	360	46
	roller	2	20	80		510	0.1		55.4	6	360	48
									Total for Paving Phase:			**51.9**
Architectural Coating	compressor (air)	1	40	78		510	0.1		53.4	6	360	46
									Total for Architectural Coating Phase:			**46.4**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Site Preparation	dozer	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Grading	grader	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	excavator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	dozer	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Trenching	excavator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Building Construction	man lift	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	generator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	crane	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	welder / torch	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	pumps	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	man lift	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Paving	paver	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	paver	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	roller	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Architectural Coating	compressor (air)	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1

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Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Site Preparation	dozer	1	40	82		510	0.1		57.4	8	480	52
	tractor	2	40	84		510	0.1		59.4	8	480	57
									Total for Site Preparation Phase:			**57.8**
Grading	grader	1	40	85		510	0.1		60.4	8	480	55
	excavator	4	40	81		510	0.1		56.4	8	480	57
	dozer	1	40	82		510	0.1		57.4	8	480	52
	tractor	2	40	84		510	0.1		59.4	8	480	57
									Total for Grading Phase:			**61.3**
Trenching	excavator	2	40	81		510	0.1		56.4	8	480	54
									Total for Trenching Phase:			**53.7**
Building Construction	man lift	1	20	75	"forklift"	510	0.1		50.4	8	480	42
	generator	1	50	72		510	0.1		47.4	8	480	43
	crane	1	16	81		510	0.1		56.4	7	420	46
	welder / torch	1	40	73		510	0.1		48.4	8	480	43
	tractor	1	40	84		510	0.1		59.4	7	420	53
	pumps	1	50	77		510	0.1		52.4	8	480	48
	man lift	2	20	75	"aerial lift"	510	0.1		50.4	8	480	45
									Total for Building Construction Phase:			**55.8**
Paving	paver	1	50	77		510	0.1		52.4	6	360	46
	paver	1	50	77	"paving equipment"	510	0.1		52.4	6	360	46
	roller	2	20	80		510	0.1		55.4	6	360	48
									Total for Paving Phase:			**51.9**
Architectural Coating	compressor (air)	1	40	78		510	0.1		53.4	6	360	46
									Total for Architectural Coating Phase:			**46.4**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Site Preparation	dozer	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Grading	grader	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	excavator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	dozer	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Trenching	excavator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Building Construction	man lift	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	generator	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	crane	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	welder / torch	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	tractor	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	pumps	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	man lift	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Paving	paver	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	paver	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
	roller	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1
Architectural Coating	compressor (air)	20	5	0	10	500	510	22.4	500.0	510.2	0.00	0.1	12.5	12.5	0.5	0.5	0.1

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, per City of San Diego = 75

allowable hours over which Leq is to be averaged, City of San Diego = 12

0 = temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Site Preparation	dozer	1	40	82		575	0.1		56.3	8	480	51
	tractor	2	40	84		575	0.1		58.3	8	480	56
									Total for Site Preparation Phase:			**56.8**
Grading	grader	1	40	85		575	0.1		59.3	8	480	54
	excavator	4	40	81		575	0.1		55.3	8	480	56
	dozer	1	40	82		575	0.1		56.3	8	480	51
	tractor	2	40	84		575	0.1		58.3	8	480	56
									Total for Grading Phase:			**60.3**
Trenching	excavator	2	40	81		575	0.1		55.3	8	480	53
									Total for Trenching Phase:			**52.6**
Building Construction	man lift	1	20	75	"forklift"	575	0.1		49.3	8	480	41
	generator	1	50	72		575	0.1		46.3	8	480	42
	crane	1	16	81		575	0.1		55.3	7	420	45
	welder / torch	1	40	73		575	0.1		47.3	8	480	42
	tractor	1	40	84		575	0.1		58.3	7	420	52
	pumps	1	50	77		575	0.1		51.3	8	480	47
	man lift	2	20	75	"aerial lift"	575	0.1		49.3	8	480	44
	auger drill rig	1	20	84		575	0.1		58.3	8	480	50
									Total for Building Construction Phase:			**55.9**
Paving	paver	1	50	77		575	0.1		51.3	6	360	45
	paver	1	50	77	"paving equipment"	575	0.1		51.3	6	360	45
	roller	2	20	80		575	0.1		54.3	6	360	47
									Total for Paving Phase:			**50.9**
Architectural Coating	compressor (air)	1	40	78		575	0.1		52.3	6	360	45
									Total for Architectural Coating Phase:			**45.3**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Site Preparation	dozer	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	tractor	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
Grading	grader	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	excavator	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	dozer	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	tractor	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
Trenching	excavator	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
Building Construction	man lift	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	generator	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	crane	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	welder / torch	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	tractor	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	pumps	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	man lift	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	auger drill rig	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
Paving	paver	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	paver	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
	roller	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1
Architectural Coating	compressor (air)	25	5	0	10	565	575	26.9	565.0	575.3	0.00	0.1	15.0	15.0	0.5	0.5	0.1

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, per City of San Diego = 75

allowable hours over which Leq is to be averaged, City of San Diego = 12

0 = temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		45	0.1		81.8	8	480	81
	tractor	1	40	84		45	0.1		84.8	8	480	79
									Total for Demolition Phase:			83.1
Site Preparation	dozer	1	40	82		45	0.1		82.8	8	480	77
	tractor	2	40	84		45	0.1		84.8	8	480	82
									Total for Site Preparation Phase:			83.3
Grading	grader	1	40	85		45	0.1		85.8	7	420	79
	excavator	1	40	81		45	0.1		81.8	8	480	76
	dozer	1	40	82		45	0.1		82.8	8	480	77
									Total for Grading Phase:			82.6
Trenching	excavator	2	40	81		45	0.1		81.8	7	420	78
									Total for Trenching Phase:			78.5
Building Construction	man lift	1	20	75	"forklift"	45	0.1		75.8	8	480	67
	generator	1	50	72		45	0.1		72.8	8	480	68
	crane	1	16	81		45	0.1		81.8	4	240	69
	welder / torch	1	40	73		45	0.1		73.8	8	480	68
	tractor	1	40	84		45	0.1		84.8	7	420	78
	pumps	1	50	77		45	0.1		77.8	8	480	73
	man lift	2	20	75	"aerial lift"	45	0.1		75.8	8	480	70
	auger drill rig	1	20	84		45	0.1		84.8	2	120	70
									Total for Building Construction Phase:			81.4
Paving	paver	1	50	77		45	0.1		77.8	6	360	72
	paver	1	50	77	"paving equipment"	45	0.1		77.8	6	360	72
	roller	1	20	80		45	0.1		80.8	6	360	71
									Total for Paving Phase:			76.3
Architectural Coating	compressor (air)	1	40	78		45	0.1		78.8	6	360	72
									Total for Architectural Coating Phase:			71.8

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	tractor	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
Site Preparation	dozer	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	tractor	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
Grading	grader	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	excavator	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	dozer	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
Trenching	excavator	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
Building Construction	man lift	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	generator	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	crane	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	welder / torch	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	tractor	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	pumps	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	man lift	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	auger drill rig	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
Paving	paver	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	paver	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
	roller	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1
Architectural Coating	compressor (air)	5	13	0	10	35	45	11.2	37.3	45.7	0.00	0.1	9.0	9.0	0.6	0.6	0.1

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, per City of San Diego = **75**

allowable hours over which Leq is to be averaged, City of San Diego = 12

9 = temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		45	7.9		74.0	8	480	73
	tractor	1	40	84		45	7.9		77.0	8	480	71
									Total for Demolition Phase:			**75.2**
Site Preparation	dozer	1	40	82		45	7.9		75.0	8	480	69
	tractor	2	40	84		45	7.9		77.0	8	480	74
									Total for Site Preparation Phase:			**75.5**
Grading	grader	1	40	85		45	7.9		78.0	7	420	72
	excavator	1	40	81		45	7.9		74.0	8	480	68
	dozer	1	40	82		45	7.9		75.0	8	480	69
									Total for Grading Phase:			**74.8**
Trenching	excavator	2	40	81		45	7.9		74.0	7	420	71
									Total for Trenching Phase:			**70.7**
Building Construction	man lift	1	20	75	"forklift"	45	7.9		68.0	8	480	59
	generator	1	50	72		45	7.9		65.0	8	480	60
	crane	1	16	81		45	7.9		74.0	4	240	61
	welder / torch	1	40	73		45	7.9		66.0	8	480	60
	tractor	1	40	84		45	7.9		77.0	7	420	71
	pumps	1	50	77		45	7.9		70.0	8	480	65
	man lift	2	20	75	"aerial lift"	45	7.9		68.0	8	480	62
	auger drill rig	1	20	84		45	7.9		77.0	2	120	62
									Total for Building Construction Phase:			**73.6**
Paving	paver	1	50	77		45	7.9		70.0	6	360	64
	paver	1	50	77	"paving equipment"	45	7.9		70.0	6	360	64
	roller	1	20	80		45	7.9		73.0	6	360	63
									Total for Paving Phase:			**68.4**
Architectural Coating	compressor (air)	1	40	78		45	7.9		71.0	6	360	64
									Total for Architectural Coating Phase:			**64.0**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	tractor	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
Site Preparation	dozer	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	tractor	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
Grading	grader	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	excavator	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	dozer	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
Trenching	excavator	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
Building Construction	man lift	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	generator	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	crane	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	welder / torch	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	tractor	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	pumps	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	man lift	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	auger drill rig	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
Paving	paver	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	paver	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
	roller	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9
Architectural Coating	compressor (air)	5	13	9	10	35	45	10.8	35.2	45.7	0.29	7.8	18.0	9.0	0.4	0.6	7.9

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Lesser of or available Lmax	Spec. 721 Lmax	Measured L_{max} @50ft (dBA, slow)
All Other Equipment > 5 HP	No	50	85	85	-- N/A --
Auger Drill Rig	No	20	84	85	84
Backhoe	No	40	78	80	78
Bar Bender	No	20	80	80	-- N/A --
Blasting	Yes	-- N/A --	94	94	-- N/A --
Boring Jack Power Unit	No	50	80	80	83
Chain Saw	No	20	84	85	84
Clam Shovel (dropping)	Yes	20	87	93	87
Compactor (ground)	No	20	80	80	83
Compressor (air)	No	40	78	80	78
Concrete Batch Plant	No	15	83	83	-- N/A --
Concrete Mixer Truck	No	40	79	85	79
Concrete Pump Truck	No	20	81	82	81
Concrete Saw	No	20	90	90	90
Crane	No	16	81	85	81
Dozer	No	40	82	85	82
Drill Rig Truck	No	20	79	84	79
Drum Mixer	No	50	80	80	80
Dump Truck	No	40	76	84	76
Excavator	No	40	81	85	81
Flat Bed Truck	No	40	74	84	74
Front End Loader	No	40	79	80	79
Generator	No	50	72	72	81
Generator (<25KVA, VMS signs)	No	50	70	70	73
Gradall	No	40	83	85	83
Grader	No	40	85	85	-- N/A --
Grapple (on backhoe)	No	40	85	85	87
Horizontal Boring Hydr. Jack	No	25	80	80	82
Hydra Break Ram	Yes	10	90	90	-- N/A --
Impact Pile Driver	Yes	20	95	95	101
Jackhammer	Yes	20	85	85	89
Man Lift	No	20	75	85	75
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	90
Pavement Scarafier	No	20	85	85	90
Paver	No	50	77	85	77
Pickup Truck	No	40	55	55	75
Pneumatic Tools	No	50	85	85	85
Pumps	No	50	77	77	81
Refrigerator Unit	No	100	73	82	73
Rivit Buster/chipping gun	Yes	20	79	85	79
Rock Drill	No	20	81	85	81
Roller	No	20	80	85	80
Sand Blasting (Single Nozzle)	No	20	85	85	96
Scraper	No	40	84	85	84
Shears (on backhoe)	No	40	85	85	96
Slurry Plant	No	100	78	78	78
Slurry Trenching Machine	No	50	80	82	80
Soil Mix Drill Rig	No	50	80	80	-- N/A --
Tractor	No	40	84	84	-- N/A --
Vacuum Excavator (Vac-truck)	No	40	85	85	85
Vacuum Street Sweeper	No	10	80	80	82
Ventilation Fan	No	100	79	85	79
Vibrating Hopper	No	50	85	85	87
Vibratory Concrete Mixer	No	20	80	80	80
Vibratory Pile Driver	No	20	95	95	101
Warning Horn	No	5	83	85	83
Welder / Torch	No	40	73	73	74

Appendix C
Operation Noise Prediction Model Inputs

Area Sources

Name	Sel.	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Correction			Sound Reduction		Attenuatio	Operating Time			K0	Freq.	Direct.
				Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Evening	Night	R	Area		Day	Special	Night			
				(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	dB(A)	dB(A)	dB(A)		(ft²)		(min)	(min)	(min)	(dB)	(Hz)	
Apt Bldg 4 Rooftop ACC			ACC4	97.6	97.6	97.6	85.9	85.9	85.9	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 4 Rooftop ACC			ACC4	97	97	97	85.4	85.4	85.4	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 4 Rooftop ASHP			ASHP4	97	97	97	80	80	80	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 4 Rooftop ASHP			ASHP4	97	97	97	79.9	79.9	79.9	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 3 Rooftop ACC			ACC3	97.6	97.6	97.6	85.7	85.7	85.7	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 3 Rooftop ASHP			ASHP3	97	97	97	79.9	79.9	79.9	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 3 Rooftop ASHP			ASHP3	97	97	97	80	80	80	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 3 Rooftop ACC			ACC3	97.6	97.6	97.6	85.6	85.6	85.6	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 2 Rooftop ACC			ACC2	97.6	97.6	97.6	85.8	85.8	85.8	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 2 Rooftop ASHP			ASHP2	97	97	97	79.8	79.8	79.8	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 2 Rooftop ACC			ACC2	97.6	97.6	97.6	85.8	85.8	85.8	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 2 Rooftop ASHP			ASHP2	97	97	97	80.1	80.1	80.1	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 1 Rooftop ACC			ACC1	97.6	97.6	97.6	85.8	85.8	85.8	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 1 Rooftop ASHP			ASHP1	97	97	97	79.9	79.9	79.9	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 1 Rooftop ACC			ACC1	97.6	97.6	97.6	85.7	85.7	85.7	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 1 Rooftop ASHP			ASHP1	97	97	97	79.8	79.8	79.8	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 5 Rooftop ASHP			ASHP5	97	97	97	79.9	79.9	79.9	Lw	ASHP11		0	0	0							0		(none)
Apt Bldg 5 Rooftop ACC			ACC5	97.6	97.6	97.6	85.7	85.7	85.7	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 5 Rooftop ACC			ACC5	97.6	97.6	97.6	85.8	85.8	85.8	Lw	ACC11		0	0	0							0		(none)
Apt Bldg 5 Rooftop ASHP			ASHP	97	97	97	79.7	79.7	79.7	Lw	ASHP11		0	0	0							0		(none)
Flex Bldg Rooftop ASHP			ASHPFlex	97	97	97	79.9	79.9	79.9	Lw	ASHP9		0	0	0							0		(none)
Flex Bldg Rooftop ACC			ACCFlex	97.8	97.8	97.8	86	86	86	Lw	ACC9		0	0	0							0		(none)
Flex Bldg Rooftop ASHP			ASHPFlex	97	97	97	79.7	79.7	79.7	Lw	ASHP9		0	0	0							0		(none)
Flex Bldg Rooftop ACC			ACCFlex	97.8	97.8	97.8	85.8	85.8	85.8	Lw	ACC9		0	0	0							0		(none)
AmenityBldg Rooftop ASHP			ASHPAmei	82.9	82.9	82.9	66	66	66	Lw	AAHU		0	0	0							0		(none)
AmenityBldg Rooftop ACC			ACCAmeni	88.6	88.6	88.6	76.7	76.7	76.7	Lw	AACC		0	0	0							0		(none)
UTE Rooftop HVAC			UTEHVAC	100.4	100.4	100.4	77.4	77.4	77.4	Lw	ASHP9++ACC9		0	0	0							0		(none)
UTE Rooftop HVAC			UTEHVAC	100.4	100.4	100.4	77.4	77.4	77.4	Lw	ASHP9++ACC9		0	0	0							0		(none)

Barriers

Name	Sel.	M.	ID	Absorption		Z-Ext.	Cantilever		Height	
				left	right		horz.	vert.	Begin	
						(ft)	(ft)	(ft)	(ft)	
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g
Parapet			PRPT	0.4	0.4	14.5			15	g

Buildings

Name	Sel.	M.	ID	RB	Residents	Absorption	Height Begin (ft)	
Campus Building			CBLDG	x	0	0.2	314.81	a
Residence West			WNSR	x	0	0.2	397.75	a
Residence West			WNSR	x	0	0.2	429.75	a
Residence West			WNSR	x	0	0.2	417.99	a
Residence West			WNSR	x	0	0.2	411.2	a
Residence West			WNSR	x	0	0.2	405.08	a
Residence West			WNSR	x	0	0.2	399.28	a
Residence West			WNSR	x	0	0.2	391.16	a
Residence West			WNSR	x	0	0.2	394.14	a
Residence West			WNSR	x	0	0.2	397.99	a
Residence West			WNSR	x	0	0.2	398.82	a
Residence West			WNSR	x	0	0.2	404.65	a
Residence West			WNSR	x	0	0.2	398.97	a
Residence West			WNSR	x	0	0.2	405.75	a
Chapultepec Hall			DORM	x	0	0.2	545.59	a
Residence West			WNSR	x	0	0.2	397.07	a
Residence West			WNSR	x	0	0.2	391.84	a
Residence West			WNSR	x	0	0.2	396.66	a
Campus Building			CBLDG	x	0	0.2	464.38	a
Residence West			WNSR	x	0	0.2	464.38	a
Flex Building		+	FLEX	x	0	0.2	90	r
Apartment Building 1		+	Apt1	x	0	0.2	110	r
Apartment Building 2		+	Apt2	x	0	0.2	110	r
Apartment Building 3		+	Apt3	x	0	0.2	110	r
Apartment Building 4		+	Apt4	x	0	0.2	110	r
Apartment Building 5		+	Apt5	x	0	0.2	110	r
Amenity Building		+	AMTY	x	0	0.2	25	r
Huaxyacac Hall			DORM	x	0	0.2	40	r
Huaxyacac Hall			DORM	x	0	0.2	40	r
Huaxyacac Hall			DORM	x	0	0.2	40	r
University Towers East			UTE	x	0	0.2	90	r

Sound Levels (local)

Name	ID	Type	1/3 Oktave Spectrum (dB)											Source
			Weight.	63	125	250	500	1000	2000	4000	8000	A	lin	
11 Story Building Two 135-Ton ACC	ACC11	Lw		75	82	85	93	90	94	84	81	97.6	98.1	SDSU provided rooftop mechanical data
11 Story Building Two 2,200 MBH Air Source Heat P	ASHP11	Lw		97	91	94	93	94	87	85	78	97	101.5	SDSU provided rooftop mechanical data
9 Story Building Two 135-Ton ACC	ACC9	Lw		74	82	84	91	89	95	84	81	97.8	97.8	SDSU provided rooftop mechanical data
9 Story Building Two 2,200 MBH Air Source Heat Pu	ASHP9	Lw		97	91	94	93	94	87	85	78	97	101.5	SDSU provided rooftop mechanical data
Amenity Building ACC	AACC	Lw		91	85	88	86	82	81	79	72	88.6	94.7	SDSU provided rooftop mechanical info
Amenity Building AHU	AAHU	Lw	A	64	76	77	78	75	68	62	57	82.9	95.1	SDSU provided rooftop mechanical info

AHUs (plenum-type return fan only, no condenser units [see separate worksheet]):

Building Minimum Ventilation

		63	125	250	500	1000	2000	4000	8000
	A-weighting adjustments	26	13	9	3	0	-1	-1	1
average of values for the two fan diameter ranges, per Guyer (Table 12)	plug	40	40	38	34	29	23	19	16
average of values for the two fan diameter ranges, per Guyer (Table 12)	tube	47	44	46	47	44	45	38	35
per Guyer (Table 12, presumed based on Bies & Hansen ENC)	prop	46	48	55	53	52	48	43	38

percent GSF actually occupied (and need ventilation): 90

Tag	Building	GSF	Avail. SF	Height (ft)	Avg. minutes to change air*	Volume (ft3)	CFM	m^2	comparable facility function	Pressure (iwg)	Pressure (Pa)	Q (m^3/s)	fantype = plug, tube, or prop	A-weighted PWL (for CadnaA inputs) 63	125	250	500	1000	2000	4000	8000	OA dB
return air fans in building rooftop AHUs:																						
2 Floor	Amenity Bldg	30000	27000	10	3	270000	90000	2510	residences	2	500	42	plug	64	76	77	78	75	68	62	57	**83**
fan or AHU cabinet liner/interior attenuation (excludes inlet/outlet PWL split, already in calcs above:														2	3	4	5	6	8	10	10	

*from 2-5 minute range for "residences" per Loren Cook's "Engineering Cookbook", 1999 edition, p. 41

ACCs (air-cooled chillers on rooftops):

Building Interior Comfort

with or without sound insulation? (enter Y/N): y

unweighted PWL (dB) per OCBF (Hz) at full load (100%)

	tons	LWA	63	125	250	500	1000	2000	4000	8000
Bryant BH16-018 (no sound blanket)	1.5	67	66.2	66.2	63.9	63.8	62.3	58.4	56.4	50.3
Bryant BH16-024 (no sound blanket)	2	71	65	65	63.7	63.4	68.5	64.7	58.7	52.8
Bryant BH16-036 (no sound blanket)	3	71	68.2	68.2	66.4	67.5	68.4	59.6	58.2	52.4
Bryant BH16-048 (no sound blanket)	4	71	68.4	68.4	67.7	69.7	67.6	59.4	56.4	50
Bryant BH16-060 (no sound blanket)	5	69	63.7	63.7	65.4	67.3	64.9	58.3	56.2	51.9
Daikin AGZ-E 30 (w/out sound insulation)	30	85	84	84	83	84	77	75	74	70
Daikin AGZ-E 40 (w/out sound insulation)	40	85	84	84	83	84	77	75	74	70
Daikin AGZ-E 50 (w/out sound insulation)	50	87	85	85	85	86	80	77	75	70
Daikin AGZ-E 60 (w/out sound insulation)	60	87	85	85	85	86	80	77	75	70
Daikin AGZ-E 70 (w/out sound insulation)	70	87	85	85	85	86	80	77	75	70
Daikin AGZ-E 80 (w/out sound insulation)	80	88	88	85	87	86	81	81	77	71
Daikin AGZ-E 90 (w/out sound insulation)	90	88	88	87	87	86	83	80	77	71
Daikin AGZ-E 120 (w/out sound insulation)	120	89	91	85	88	86	82	81	79	72
Daikin AGZ-E 240 (w/out sound insulation)	241	94	94	88	91	90	91	84	82	75

data for models "without sound insulation" or no "sound blankets"

	LWA	63	125	250	500	1000	2000	4000	8000
Bryant BH16-018 (no sound blanket)	68	*66.2*	66.2	63.8	64.1	64.6	59.9	57.7	53.6
Bryant BH16-024 (no sound blanket)	72	*63.4*	63.4	63.3	63.3	70.4	64.5	59.3	55.5
Bryant BH16-036 (no sound blanket)	72	*67.7*	67.7	66.8	68.1	69.9	62.8	60.3	55.2
Bryant BH16-048 (no sound blanket)	73	*67.5*	67.5	67.8	70.1	70.6	63.1	58.5	53.3
Bryant BH16-060 (no sound blanket)	70	*61.7*	61.7	65.6	68.1	65.8	59.8	58.4	56.1
Daikin AGZ-E 30 (w/out sound insulation)	88	92	91	88	87	83	78	73	68
Daikin AGZ-E 40 (w/out sound insulation)	89	92	91	90	88	84	79	74	69
Daikin AGZ-E 50 (w/out sound insulation)	90	93	93	91	89	85	79	74	69
Daikin AGZ-E 60 (w/out sound insulation)	91	94	93	94	89	86	81	76	71
Daikin AGZ-E 70 (w/out sound insulation)	92	95	95	94	89	87	81	76	71
Daikin AGZ-E 80 (w/out sound insulation)	92	95	95	95	89	87	81	76	71
Daikin AGZ-E 90 (w/out sound insulation)	93	94	95	92	91	89	83	81	81
Daikin AGZ-E 120 (w/out sound insulation)	95	93	96	92	92	90	84	84	82
Daikin AGZ-E 240 (w/out sound insulation)	100	98	98	98	95	96	90	90	86

data for models "with sound insulation" or "sound blankets"

	LWA	63	125	250	500	1000	2000	4000	8000
Bryant BH16-018 (no sound blanket)	67	*66.2*	66.2	63.9	63.8	62.3	58.4	56.4	50.3
Bryant BH16-024 (no sound blanket)	71	*65*	65	63.7	63.4	68.5	64.7	58.7	52.8
Bryant BH16-036 (no sound blanket)	71	*68.2*	68.2	66.4	67.5	68.4	59.6	58.2	52.4
Bryant BH16-048 (no sound blanket)	71	*68.4*	68.4	67.7	69.7	67.6	59.4	56.4	50
Bryant BH16-060 (no sound blanket)	69	*63.7*	63.7	65.4	67.3	64.9	58.3	56.2	51.9
Daikin AGZ-E 30 (w/out sound insulation)	85	84	84	83	84	77	75	74	70
Daikin AGZ-E 40 (w/out sound insulation)	85	84	84	83	84	77	75	74	70
Daikin AGZ-E 50 (w/out sound insulation)	87	85	85	85	86	80	77	75	70
Daikin AGZ-E 60 (w/out sound insulation)	87	85	85	85	86	80	77	75	70
Daikin AGZ-E 70 (w/out sound insulation)	87	85	85	85	86	80	77	75	70
Daikin AGZ-E 80 (w/out sound insulation)	88	88	85	87	86	81	81	77	71
Daikin AGZ-E 90 (w/out sound insulation)	88	88	87	87	86	83	80	77	71
Daikin AGZ-E 120 (w/out sound insulation)	89	91	85	88	86	82	81	79	72
Daikin AGZ-E 240 (w/out sound insulation)	94	94	88	91	90	91	84	82	75

actual percent of GSF occupied: 90

Phase	Building Tag	GSF	Avail. SF	comparable facility function	Avg. GSF per ton*	tons of refrig.	Approx. Qty. of ACCs	tons per ACC	Approx. Total PWL (dBA)
11 Floor	Apt. Bldg. 1-5	174240	156816	Residential (large)	183	856.9	2	428	**97**
9 Floor	University Towers East	133200	119880	Residential (large)	183	655.1	2	328	**97**
9 Floor	Flex Bldg	144000	129600	Residential (large)	183	708.2	2	354	**97**
2 Floor	Amenity Bldg	30000	27000	Residential (large)	183	147.5	1	148	**89**

unweighted PWL (dB) per OCBF (Hz) at full load (100%)

Building Tag	63	125	250	500	1000	2000	4000	8000
Apt. Bldg. 1-5	97	91	94	93	94	87	85	78
University Towers East	97	91	94	93	94	87	85	78
Flex Bldg	97	91	94	93	94	87	85	78
Amenity Bldg	91	85	88	86	82	81	79	72

*based upon "lo" for "residential (large) value per Loren Cook's "Engineering Cookbook", 1999 edition, pp. 59-60